Goals, Orientations, and Social Support Offered by a Mathematics Graduate Teaching Assistant

Brittany Johnson
University of Nebraska-Lincoln

Research suggests that support offered by an instructor can significantly impact student experiences and that there are different types of support that instructors can offer (e.g., emotional support, informational support, etc.). This case study examines the goals and beliefs of a first-year Mathematics Graduate Teaching Assistant (MGTA) in an attempt to explain their in-the-moment classroom decisions about offering different kinds of support to their students. This study found that the MGTA's beliefs about the nature of mathematics and how mathematics problems are solved were critical in understanding their tendency to offer a particular type of support. Understanding the ways that MGTAs support their students can initiate a valuable discussion surrounding novice mathematics instructors and their professional development.

Keywords: Graduate Teaching Assistants, Social Support, Goals, Beliefs, Decision-Making

In recent years, education researchers have become more concerned with teacher-student relationships and the impact these relationships can have on student experiences. Teachers are no longer considered couriers of knowledge as they have been in the past. Several studies from the past 20 years provide evidence that a positive teacher-student relationship correlates to increased engagement, motivation, effort, achievement, and overall well-being for students (Furrer & Skinner, 2003; Niehaus et al., 2012; Tennant et al., 2014). The present study is concerned with one specific facet of the teacher-student relationship: social support. *Social support* refers to any action intended to alleviate or prevent negative emotions that someone might experience (House, 1981). Numerous studies have explored social support in the classroom, including the kinds of social support that students receive, student perceptions of social support, and the effects of social support on student experiences (Federici & Skaalvik, 2013; Tennant et al., 2014). However, little research has explored social support from the perspective of the teacher, including the decision-making process behind offering different kinds of support. Tardy (1985) claims that the direction of social support (i.e., the distinction between the giver and receiver) is one of the most important characteristics of social support but acknowledges that the receiver is usually the focus of research.

Since research suggests that social support has the potential to positively benefit students and that different kinds of social support affect students in different ways, it is important to understand the elements that contribute to decisions to provide different kinds of support. While much of this decision process occurs subconsciously, research suggests that the decision-making process is determined by things that one can become aware of (Schoenfeld, 2011). An awareness of the decision-making process and the elements that it draws upon can better inform such a decision and lead to more intentional, productive support being offered.

The purpose of this study is to explore how Mathematics Graduate Teaching Assistants (MGTAs) choose the types of support they offer their students in first-year math courses by exploring their goals and orientations about teaching (*orientations* refers to one's beliefs and values) (Schoenfeld, 2011). MGTAs comprise a consequential portion of the teaching force behind undergraduate mathematics education, teaching 17% to 21% of mathematics courses at doctoral institutions (Blair et al., 2013). The long-term intent of this research is to better understand the decision-making process behind offering support, enabling MGTAs to become

more aware of the ways they offer support and in turn better serve their students. Such an understanding has the potential to contribute to professional development for all educators, not just graduate students, as making decisions about social support is a ubiquitous part of teaching (Schoenfeld, 2011).

This paper is a part of a larger, semester-long study that explored the ways that six MGTAs conceptualize the types of social support that they offer, as well as the goals and orientations that influence their decisions to offer social support in particular ways. Due to space limitations, this paper focuses on one MGTA and the findings related to the following questions:

RQ1: What goals and orientations are present when MGTAs offer social support to their students?

RQ2: How can MGTAs' goals and orientations be used to explain the types of social support that they offer their students?

Literature Review

This study was designed around two separate frameworks, the first being House's categorizations of social support (1981). House asserts that all examples of social support can be categorized as emotional, informational, instrumental, and/or appraisal support. *Emotional support* is defined as support in which the negative emotion itself is being combatted, such as a teacher providing validation to a student experiencing self-doubt. *Informational support* is that in which resources are provided to combat a negative emotion indirectly. For instance, a teacher referring a student struggling with a homework problem to a helpful example in the textbook would be considered informational support. The other two categories are not discussed in this paper, and therefore will not be addressed due to space limitations. Despite being written more than four decades ago, House's framework is still referenced today and more recent frameworks for categorizing social support are comparable to House's (Wu et al., 2020; Feeney and Collins, 2015; Federici & Skaalvik, 2014).

The second framework around which this study was designed is Schoenfeld's "resources-orientations-goals" framework for in-the-moment decision-making (henceforth referred to as the ROG framework) (2011). Orientations include one's beliefs, values, and other related concepts, while goals are "something that an individual wants to achieve, even if simply in the service of other goals" (Schoenfeld, 2011, p. 21). According to the framework, one's in-the-moment decisions are shaped by these constructs, and if you know enough about one's resources, orientations, and goals, you can understand and ultimately explain the decisions they make (Schoenfeld, 2011). The present study was conducted in a convened course in which lesson plans, student workbooks, and assessments were constant across all participants and were therefore excluded from consideration.

Methods and Procedures

Methodological Approach

This study used a qualitative case study methodology, defined as "an empirical inquiry that investigates a contemporary phenomenon… in depth and within its real-world context" (Yin, 2014, p.16). This methodology is appropriate for this study because the research questions are less focused on the general phenomenon (the decision-making process behind MGTAs offering social support) and more concerned with the individual cases. Each case is an individual MGTA teaching a calculus recitation during their first semester as a PhD student at a large Midwestern public university. A descriptive case study design gives each participant an opportunity to have

their story be told in order to "develop a complete, detailed portrayal of [the] phenomenon" (Schwandt & Gates, 2017, p. 346).

Participants

Only MGTAs teaching a recitation for either Calculus I or II were considered for this study. MGTAs were excluded if they were doing doctoral research in mathematics education or if they had significant teaching experience prior to matriculation, as they were not representative of a typical graduate student. This paper focuses on one first-year MGTA in the study, Blake (pseudonymized).

Data Collection

Data was collected in three stages. First, MGTAs were interviewed to explore their goals and orientations related to teaching. Secondly, each MGTA was observed teaching for four 75-minute class meetings; these lessons were audio-recorded while the researcher took note of examples of social support that they noticed the instructor offer. The observations were followed by a second semi-structured interview to discuss a selection of the observed examples of social support. Here, MGTAs were asked to reflect on their motivations and decision-making behind each example and asked to categorize each example within the social support categorization framework (House, 1981).

Data Analysis

A pilot study indicated that multiple coding methods would be needed to analyze the data through the lenses of the different research questions. The purpose of the first phase of coding was to address RQ1 by focusing on the goals and orientations of each participant; this phase used both structural and provisional coding to develop parent and child codes, respectively. *Structural coding* refers to the use of codes relating data to specific research questions; this method allows one to categorize excerpts related to similar topics before moving on to further coding and analysis (MacQueen et al., 2008; Saldana, 2016). In this study, parent codes were used to categorize data related to goals, orientations, and social support, allowing for simultaneous coding. In *provisional coding*, a codebook is developed prior to data collection, but can be "revised, modified, deleted, or expanded to include new codes" (Saldana, 2016, p. 168). Child codes were developed based on the literature review and experiential data (both from the pilot study and the researcher's familiarity with the data) to capture different types of goals and orientations that participants might express; child codes included things like "Goals – Student Performance" and "Orientations – Nature of Mathematics". The flexibility of provisional coding allowed the researcher to continuously add codes as new goals and orientations arose. Each interview was coded multiple times to ensure that no codes or excerpts were missed.

A second phase of coding utilized hypothesis coding. In *hypothesis coding*, codes are generated "specifically to assess a researcher-generated hypothesis" (Saldana, 2016, p. 171). The researcher developed specific theories for each participant based on the first cycle of coding, memos that were taken throughout the study thus far, and peer debriefing. An individualized codebook was then developed for each participant to assess the researcher's hypotheses, and coding was repeated until no new themes emerged.

Findings

What follows is a discussion of Blake. Of the six participants in the larger study, Blake's case exemplifies how the ROG framework (Schoenfeld, 2011) can be used to relate MGTAs' goals,

orientations, and social support actions. Blake's case ultimately forms the foundation that the rest of the cases expand upon.

A Brief Introduction to Blake

Blake is a first-year MGTA whose enthusiasm for teaching was immediately evident during data collection. When talking about their reasons for coming to a doctoral program, Blake said,

> I want to learn more about math, but then on top of that, I want to become the best math educator that I can be. So teaching for me is extremely important… I find joy in teaching these topics, leading students through problems, helping them understand, and just also in general just helping them enjoy mathematics.

Prior to graduate school, Blake sought out various opportunities to teach in informal settings (such as tutoring) and continued to seek out opportunities to improve their teaching throughout their first semester of graduate school. Blake puts a great deal of energy into their teaching, including developing rapport with their students. Throughout this study, it was evident that Blake knew and cared about their students.

During the observations, Blake gravitated towards offering informational support over the other categories of social support (House, 1981). During data analysis, two compelling themes emerged that could explain Blake's tendency towards informational support: their perspectives on what mathematics is and how math problems should be solved. What follows is a description of Blake's goals and orientations related to these themes and an explanation of how they are reflected in Blake's social support actions.

Goals and Orientations Related to the Nature of Mathematics

When reflecting on what mathematics is and what it means to solve math problems, Blake regularly made comparisons to solving a puzzle. When asked about their goals, Blake said, "I always think of it [math] as a puzzle, so hopefully I can transfer that to them [my students]. Like this is like a fun puzzle, here are the rules that you can use". They went on say that, like a puzzle, much of their enjoyment in math comes from the sense of accomplishment one gets after completing a problem:

> *I* [emphasized by speaker] enjoy doing math, like mathematics is fun to me. It's frustrating, it's annoying, sometimes it's heartbreaking… But I'm here in a PhD program because I enjoy doing and teaching and just like, being a part of mathematics. And so if I can get my students to then feel some of that same enjoyment… If they did a thousand-piece puzzle and like a really cool [math] problem, like if I can get the idea in their head that that is possible? Then I've already won. I've done most of what I want to do.

These ideas—that math is like a puzzle and that it is more enjoyable if it is challenging—are personal beliefs of Blake's that present as goals that they have for their students and are frequently reflected in their day-to-day teaching practices. For example, Blake often encouraged students to try problems that the students may find challenging. Blake suggested different problems for different groups depending on the capabilities of each group (e.g., Blake suggested challenging problems to groups who appeared to have mastered the content for that day while suggesting more standard or introductory problems to groups who seemed to need more practice before attempting the challenging problems). This suggests that Blake was not only aware of the capabilities of individual students and groups, but also that they had a sense of what degree of difficulty would be both challenging and rewarding for different students.

Goals and Orientations Related to Solving Mathematics Problems

Blake frequently referenced a metaphorical "toolbox" full of "tools" that students possess to approach different kinds of mathematical problems. For example, Blake described the process of problem solving in a calculus class as, "You took this set of tools, you applied it to a problem, and then you got to a solution". In the second interview, Blake said,

> We have our bag of tools and then a bunch of math is just figuring out in what ways we can use them, in what ways can we combine them, what are some of the limitations, but also [what] are some of the like further stuff that we can use with these tools?

This belief is reflected in Blake's teaching practices. For instance, during the observed classes, Blake wrote important theorems and definitions on the board before class started; when class began, they encouraged students to refer to these resources as they worked through problems. When asked why they chose to start class this way, Blake said,

> Few things suck and bring up as many negative feelings in math as when you don't even know where the heck to start. So to have at least the definition… You can't work with tools if you don't know what's in your toolbox. So I guess in my case, at the very least everyone has the same set of starting tools and so they can at least get started.

In fact, when helping students one-on-one in class, Blake often explicitly asked students what "tools" they had in their "toolboxes" and asked them which tools they might be able to use.

Blake's Use of Informational Support

Blake's beliefs about mathematics being like a puzzle that can be solved using "tools" from one's "toolbox" are not only present in their goals and orientations but in the social support actions that they offer in the classroom. Blake tends to use informational support more than any of the other categories proposed by House (1981). Table 1 outlines some of the examples of informational support offered by Blake during observations and offers a brief explanation of why informational support is the best categorization for them.

Table 1. Examples of Informational Support Offered by Blake

Example of Informational Support	Justification for Categorization
Before class (and as students started to work individually and in small groups), Blake wrote all the major theorems/rules/definitions that were needed for today's lesson up on the board.	Blake was providing a resource that was not inherently helpful to any particular problem that students were working on; students were responsible for identifying the tool that would be helpful and determine how to use that tool effectively.
While Blake was helping a student, the student kept flipping through their notebook searching for a rule. Blake encouraged them to make a list with all the rules they'd learned recently so that they'd all be in one place.	Advising the student to create a reference page is informational support because Blake is not providing them with something helpful but is suggesting something that would be helpful if the student were to follow through.
Blake checked in with a student who had missed two weeks of class; during that conversation, Blake reminded the student of their office hours and of the tutoring center.	Blake gave this student the tools to seek out help, but it was up to the student to get help if they needed it.

algebraic computations. When the students told Blake they'd decided to skip this problem, Blake made light of it, even going as far as to laugh along with the students when one of them jokingly crossed the entire problem out of their workbook. The researcher categorized this example as emotional support because Blake was empathizing with the students and validating their frustrations with the problem by implicitly giving them permission to skip the frustrating problem. However, Blake interpreted this action as informational support. Blake argued that by encouraging the students to skip the problem after struggling with it for a long time, they were indirectly giving the students information that they could benefit from (in particular, that this problem was not "standard" and that their frustration was probably coming from long computations and not the calculus itself). When categorizing this example, Blake said,

> I want to put it into informational support again because like… I'm not telling them to skip the problem… If you don't think that this is going to be productive use of your time, I'm going to agree with that. And then you should move on to something else. So I'm not fixing the problem… I'm validating their… intuition on like "I could be doing something more productive". Great. Yes… Maybe now think about why this question is maybe not as helpful as maybe some of the other ones are.

Overall, informational support was the most frequent category of social support that was observed, both for the researcher's initial categorizations and Blake's categorizations during the interviews. Moreover, Blake explicitly identified informational support as the category that they believe they provide the most of. The use of informational support is a repeated in-the-moment decision that Blake makes, and therefore according to the ROG framework (Schoenfeld, 2011), any such decision should reflect their goals and orientations.

Explaining Blake's Use of Informational Support

Many of Blake's social support actions are related to their beliefs about the nature of mathematics and mathematical problem solving; in fact, all the examples of informational support discussed in this paper can be attributed to these beliefs. For example, Blake writing theorems and definitions on the board before class reflects their belief about how math problems should be solved. Blake believes that the best way to approach mathematics problems is to have a "toolbox" of "tools" at one's disposal. As a result, Blake perceives it to be their job as an educator to ensure that students have the tools necessary to solve a particular problem. By writing the relevant definitions and theorems on the board at the start of each class, Blake guarantees that every student at least has the required tools to approach any problem that day.

Even the example of informational support that the researcher and Blake disagreed on the categorization of makes sense when juxtaposed with Blake's beliefs about the nature of mathematics. Blake believes that mathematics is like a puzzle and that enjoyment often comes from overcoming the challenge. In this example, the students were frustrated by the problem because it was mired with tedious computations, not with the calculus itself. Blake's argument is that the students weren't benefitting from doing those computations because that problem was not representative of the skill they were supposed to be practicing. In the context of Blake's perception of mathematics being like a puzzle, this problem was like forcing the students to do the puzzle in the dark: it would be an impressive feat to complete the puzzle, but it would not have been representative of what solving a puzzle really is. This particular problem was in contention with Blake's beliefs about what mathematics should be, so it is understandable that Blake would encourage the students to skip that problem with the hopes that the students would recognize what made the exercise futile.

On a larger scale, Blake's general tendency towards informational support over the other categories is aligned with their beliefs about mathematics and mathematical problem solving as well. Many of Blake's goals and orientations reflect their beliefs that mathematics problems are puzzles to be solved, that the puzzles are more satisfying if they are challenging, and that one needs tools to approach the puzzles in the first place. In terms of social support, these beliefs are reflected in the fact that Blake fosters an environment that values productive struggle and has a teaching philosophy in which students cultivate their own "toolbox" of theorems, rules, and definitions; such attributes are closely aligned with informational support. In fact, research has suggested that in mathematics classrooms, informational support is one of the most beneficial categories of social support for developing problem-solving skills (Cutrona & Russell, 1990). When reflecting on social support in general, Blake said, "I should be providing them hints, clues, telling them that they're doing a great job, and giving them the tools to succeed. I should not be sitting down and doing the problems with them", which is indicative of someone who values the use of informational support.

Discussion

Blake serves as an excellent starting point in understanding how Schoenfeld's ROG framework (2011) can be used to understand MGTAs' use of social support in the classroom, particularly in consideration of both the research questions. RQ1 asks, *What goals and orientations are present when MGTAs offer social support to their students?* While the goals and orientations discussed in this paper are certainly not comprehensive, they paint a vivid picture of who Blake is as an instructor. It cannot be said that every first-year MGTA will have the same goals and orientations as Blake, nor can it be said that a MGTA with the same goals and orientations as Blake would offer social support in the same ways. However, discussing Blake's goals and orientations can serve as a starting point for understanding the ways that novice mathematics instructors conceptualize math and mathematics education.

RQ2 asked, *How can MGTAs' goals and orientations be used to explain the types of social support that they offer their students?* Analysis suggested that Blake's beliefs about the nature of mathematics and how mathematics problems should be solved are not only present when they offer social support to their students, but that they are a driving factor in many of the in-the-moment, day-to-day instructional decisions that Blake makes. All the observed social support actions discussed in this paper were considered informational support and could be traced back to these orientations. While Schoenfeld's ROG framework (2011) cannot be used to predict how Blake would respond in certain situations, this does provide insight into how Blake prioritizes and ultimately makes in-the-moment instructional decisions on a day-to-day basis.

The purpose of this study was not to develop a comprehensive understanding of how MGTAs provide social support in the classroom, but to instead begin a conversation about the goals and orientations that are relevant when making in-the-moment decisions. Since the ways that MGTAs offer social support is so heavily dependent on their personal goals and orientations, the results of this paper cannot and should not be generalized. Instead, the findings may inform professional development efforts as mathematics departments aim to understand how MGTAs support undergraduate students in classrooms.

References

Blair, R., Kirkman, E.E., & Maxwell, J.W. (2013). Statistical abstract of undergraduate programs in the mathematical sciences in the United States. Fall 2010 CBMS Survey. Washington D.C.: American Mathematical Society.

Cutrona, C. E., & Russell, D. W. (1990). Type of social support and specific stress: Toward a theory of optimal matching. In B. R. Sarason, I. G. Sarason, & G. R. Pierce (Eds.), *Social support: An interactional view.* (pp. 319-366). John Wiley & Sons.

Federici, R. A., & Skaalvik, E. M. (2013). Students' perceptions of emotional and instrumental teacher support: relations with motivational and emotional responses. *International education studies, 7*(1), 21–36.

Feeney, B. C., & Collins, N. L. (2015). A new look at social support: A theoretical perspective on thriving through relationships. *Personality and social psychology review, 19*(2), 133–147.

Furrer, C., & Skinner, E. (2003). Sense of relatedness as a factor in children's academic engagement and performance. *Journal of educational psychology, 95*(1), 148–162.

House, J. S. (1981). *Work stress and social support.* Addison-Wesley Publishing Company.

MacQueen, K. M., McLellan, E., Kay, K., & Milstein, B. (1998). Codebook development for team-based qualitative analysis. *Cultural anthropology methods, 10*(2), 31–36.

Niehaus, K., Rudasill, K. M., & Rakes, C. R. (2012). A longitudinal study of school connectedness and academic outcomes across sixth grade. *Journal of school psychology*, 443–460.

Saldana, J. (2016). *The coding manual for qualitative researchers* (3rd ed.). SAGE Publications.

Schoenfeld, A. H. (2011). *How we think: A theory of goal-oriented decision making and its educational applications.* Routledge.

Schwandt, T. A., & Gates, E. F. (2017). Case study methodology. In N. K. Denzin & Y. S. Lincoln (Eds.), *The SAGE handbook of qualitative research* (5th ed., pp. 341-358). SAGE Publishing.

Tardy, C. H. (1985). Social support measurement. *American journal of community psychology, 13*, 187–202.

Tennant, J. E., Demaray, M. K., Malecki, C. K., Terry, M. N., Clary, M., & Elzinga, N. (2014). Students' ratings of teacher support and academic and social-emotional well-being. *School Psychology Quarterly.*

Wu, T.-J., Wang, L.-Y., Gao, J.-Y., & Wei, A.-P. (2020). Social support and well-being of Chinese special education teachers—An emotional labor perspective. *International journal of environmental research and public health, 17*(18), 6884. https://doi.org/10.3390/ijerph17186884.

Yin, R. K. (2014). *Case study research design and methods* (5th ed.). Thousand Oaks, CA: Sage.