

An Investigation of Participants' Perspectives About a Learning Assistant Program and Their Thinking about Becoming a Mathematics Teacher

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Abstract: A Learning Assistant program that recruits strong STEM undergraduates to become mathematics teachers was explored through a qualitative study. Three program participants were purposely selected and interviewed. The program reaffirmed one participant's choice to become a teacher and clarified for one that it might be a career for him.

According to the Trends in International Mathematics and Science Study (USDOE, 2008), students' scores in mathematics in the United States are behind that of U.S. competitors: Singapore, Hong Kong, and England. In order for students in the United States to become academically competitive in mathematics with other countries, their mathematics teachers must be qualified. This situation indicates that there is a distinct need for recruitment of teachers who are highly qualified in mathematics. All of the literature reviewed identified low levels of Science, Technology, Engineering, and Mathematics (STEM) education recruitment as a problem but few offered solutions. One solution mentioned repeatedly across the body of literature was the offer of programs and grants as incentives to pursue careers in STEM education. One program designed to improve recruitment and preparation of STEM teachers is the learning assistant (LA) program, originally established at the University of Colorado.

The LA program at the University of Colorado has (a) increased the pool of well-qualified K-12 physics teachers by a factor of 3 or more, (b) engaged scientists significantly in the recruiting and preparation of future teachers, and (c) improved the introductory physics sequence so that students' learning gains typically double the traditional average (Otero, Pollock, & Finkelstein, 2010). Because the model is fairly young, there is very limited research on its effectiveness. Students chosen for the LA program are among the top performers in their respective mathematics and science classes. The LA program requires learning assistants (LAs) to take a semester long seminar focused on the learning and teaching of both science and mathematics. LAs are also taught useful strategies for tutoring other college students in lower division mathematics, physics, and chemistry. LAs are paid a stipend for working 10 hours per week assisting faculty in classes, leading group recitation sessions, and tutoring in the labs. LAs who commit to a STEM education major are given a \$20,000 Noyce scholarship in exchange for 4 years of service teaching in K-12 schools. In recent years, other universities have begun to adopt LA programs. A lack of research exists on ways that LA programs and other programs for recruiting STEM majors into teaching careers influence student views about careers in teaching. Thus, it is of value to investigate participants' perspectives about such programs and in what ways these programs are helping them develop their thinking about mathematics teaching as a career.

Studies have shown that students choose to become teachers because they enjoy helping others, sharing information, and interacting socially (Barker & Reyes, 2001). Most research on motivation to become a teacher (i.e., Kyriacou & Coulthard, 2000; Kyriacou, Hultgren, & Stephens, 1999; Papanastasiou & Papanastasiou, 1998; Saban, 2003) suggests that reasons for

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becoming a teacher fall into three categories: intrinsic, extrinsic, and altruistic. Intrinsic reasons for choosing to become a teacher are related to aspects of the job itself and its inherent satisfaction such as enjoying the subject matter, liking the activity of classroom teaching, and a sense of having a personality suited for teaching. Extrinsic reasons for teaching include aspects of the job that are not inherent to the work itself and produce some separable consequences or outcomes such as long vacations, social status, lead to other jobs, and job security. Altruistic reasons for teaching include aspects of the job that are seen as giving back or contributing to the common good such as helping to improve society, believing the subject is important for students to learn, and teaching is a noble profession. Altruistic reasons are considered by some, and in the present study, as an extension of intrinsic reasons (e.g., Covington & Mueller, 2001; Kasser & Ryan, 2001).

Reasons for choosing to teach are interrelated to an individual's goal of becoming a teacher (Schutz, Crowder, & White, 2001). According to Schutz and colleagues (2001), "goals are subjective representations of what one would like to happen and what one would like to avoid in the future" (p. 229). In their investigation of pre-service teachers' development of the goal to become a teacher, Schutz et al. (2001) found four main sources that were predominant in their participants' goal history of becoming a teacher: (a) family influences, (b) teacher influences, (c) peer-influences, and (d) teaching experience. Their research supports the supposition of experiences and external factors influencing individuals' goal development of becoming a teacher.

Purpose of the Study

The purpose of this study was to investigate from the points of view of mathematics LAs: (a) their thinking about their LA program, and (b) how the LA seminar and related LA experiences have influenced their thinking about becoming a mathematics teacher. This study's overarching goal is to inform the role that an LA program can play in attracting STEM undergraduate students to a career in teaching mathematics. More specifically, the following research question guided this investigation: *What do mathematics undergraduate students participating in an LA program at a southeastern urban, public university think about the program and the choice of mathematics teaching as a career?*

Setting and Participants

This study was conducted within the LA program on the main campus of a large southeastern urban public university during the Fall 2011 semester. Over 46,000 students, approximately 20,240 men and 25,760 women, were enrolled at the university across its two campuses and internationally (Florida International University, 2011). On the main campus, 15% of the students were White non-Hispanic, 61% were Hispanic, 13% were Black Non-Hispanic or African American, 4% were Asian/Pacific Islander, and 7% were part of other minority groups.

At the university, 51 STEM undergraduates were joining the LA program and completing the LA seminar for the first time in Fall 2011. The main goal of the LA program is to increase recruitment and retention of STEM undergraduates choosing to become STEM teachers in order to meet recent initiatives such as the 100kin10 Challenge that focused on recruiting, preparing, retaining, and supporting 100,000 excellent STEM teachers over the coming 10 years. The LA program consists of two main components: (a) an LA seminar completed by LAs their first semester in the program, and (b) LA teaching/tutoring experiences. The LA seminar is focused on issues of learning and teaching of mathematics that provide the participants with initial knowledge that supports their work in their LA teaching/tutoring experiences. The LA

teaching/tutoring experiences provide the LAs with opportunities to teach/tutor (10 hours per week) undergraduates in STEM courses that the LA has successfully completed and meet for planning and reflection sessions with faculty and/or other LAs.

The participants of the study were mathematics undergraduate students at the university that were participating for the first time in the LA program, were enrolled in the LA seminar, and had expressed a genuine interest in tutoring their peers and working with faculty. Early in the Fall 2011 semester, STEM LAs were given a survey to gather demographic data, background information, and participants' thinking about becoming a teacher. One part of the survey included Likert-type items pertaining to reasons for becoming a teacher. Thirteen mathematics LAs completed the survey. Of these, three were selected for interviews using purposeful sampling in order to select a sample from which the most can be learned (Merriam, 2001). The three participants that were selected (reported here by pseudonym) varied in their thinking about becoming a mathematics teacher: Kate, who was definitely interested in becoming a mathematics teacher; Kory, who was not interested; and Kyle, who was not sure.

Research Methods

This section describes the methods used to collect the data and analyze the data. The research design of this study was qualitative with naturalistic inquiry.

Data Collection

The research design was qualitative and involved the development of case studies. The data collected for the investigation included surveys, interviews, and field observation notes. The students enrolled in the LA seminar class completed a survey a month at the start of their LA program which was into the semester and their start of the LA program. The survey, developed by the authors drawing in part from the work of Pop (2010), was used to gather demographic data, background information, and participants' thinking about becoming a teacher. The gathered surveys were separated into three groups based on participant responses: (a) interest in pursuing a career in teaching, (b) disinterest in pursuing a career in teaching, and (c) undecided in regards to pursuing a career in teaching. Nine of 13 mathematics LAs (three from each group) were selected to be contacted for an interview. Of those nine, three responded to an e-mail invitation to be interviewed, each with a different perspective on becoming a mathematics teacher (i.e., definitely interested, unsure, and currently not interested). Throughout the semester, the first author conducted weekly field observations in the LA seminar class. The persistent engagement and persistent observation allowed the researchers to develop trust and learn the culture of this class (Glesne, 2006). The field observations allowed the researchers to see what activities and instructions were given to the LAs related to STEM education and in preparation for their LA teaching/tutoring experiences. The field observation notes gave the researchers insight on the environment of the LA seminar, which was found to be rich in project-based learning activities. Toward the end of the semester, the three selected LAs were interviewed. These interviews were conducted following an interview protocol. Interviews were semi-structured and flexible, allowing new questions to be posed as a result of what the interviewee said.

Data Analysis

The surveys and transcribed interviews for each of the three selected participants were coded and analyzed in order to build a case pertaining to each participant. The data sources were coded and analyzed separately and triangulated to better inform each case. The codes were reduced to major themes. These themes represent the repetitive patterns that were indicated by the data and were identified across the data (Merriam, 2001).

The data were analyzed and interpreted in two stages. During the *early* data analysis stages, the survey data were categorized and interpreted. During the *later* data analysis stage, coding was incorporated across the surveys and interview transcripts. All data sources were coded using the coding methods as described by Merriam (2001) where “coding occurs at two levels – identifying information about the data and interpretive constructs related to analysis” (p. 164). The first level of coding involved the assigning of phrases, single words, numbers, and/or letters to various facets of the data and led to the second level where common themes or patterns found across the data were identified and categorized (Merriam, 2001).

Findings

The data analysis provided for the development of three cases, one for each participant: Kate, Kyle, and Kory. These cases help to understand participant’s conceptions about the LA program and their thinking about becoming a mathematics teacher.

Kate

Kate was a junior mathematics major with an education focus, who at the start of the semester definitely intended on pursuing a career in teaching. Analysis of Kate’s survey responses revealed the high level of importance she placed on intrinsic (including altruistic) reasons for considering a career in teaching. For her, the extremely important reasons included wanting to help students succeed, the belief that teaching is a noble profession and teachers can help improve society, liking classroom teaching, and having a personality suited for the job. With respect to extrinsic reasons, she rated highly other’s people’s influence and previous jobs as important reasons. On the survey, she indicated that she has tutored privately. She responded that she is interested in a career in teaching because she “always had a passion about helping other students learn and teaching them in order to watch them succeed,” and she has “also been strongly and positively affected by my own teachers.” Kate felt that she was making a difference in the lives of others, which may have greatly impacted her decision to pursue a career in teaching.

As part of her LA experience, Kate worked as a tutor for 5 hours in a mathematics open lab and 5 hours in an algebra lab. As part of working in the algebra lab, Kate attended a weekly meeting with other algebra LAs and faculty teaching algebra to discuss what the students are learning and where they may be having difficulty. For Kate, the algebra related work is helping her to “relearn things that I forgot in algebra” and the open lab preparing her for answering “tough questions that I sometimes might not know the answer right then and there so I either have to figure it or I have to find it out for them.”

During the interview at the end of the semester, Kate revealed her continued excitement and passion for teaching. Prior to joining the LA program, she had decided to become a mathematics teacher and the LA program continued to support that for her. Growing up, Kate had great experiences with her teachers and her teachers acknowledged her mathematics strengths.

I remember in my fifth grade class that was a huge thing because my teacher was older and we were going through, I forgot the topic, but we are going through a topic that she had learned in a different way than students were able to learn it now. So I remember it was a huge frustration so I remember in one of the classes me I think as a 5th grader, which I was super honored. One of the classes she actually had me stand up to be able to help her relate it because I have the ability, and I think it’s a blessing, to understand math from different point of view and from different umm generations.

Kate often utilized her talent to decipher her teacher's lessons and translate the content to her peers, particularly while tutoring them prior to the tests. Their successes reinforced positive feelings for her about teaching. Kate's mom also implicitly supported her growing interest in teaching by cooking big dinners when Kate was having the tutoring sessions with her friends. Kate's goal to pursue a career in teaching can be traced back to the four main sources for setting a goal to become a teacher discussed by Schutz (2001): (a) family influences, (b) teacher influences, (c) peer-influences, and (d) teaching experience. Although each person's story is unique, the types of influences on those choosing to pursue a career in education are similar across stories. For Kate, the LA program helped reaffirm her desire to become a teacher, particularly through the further opportunities to teach that it provided and the positive peer-influences.

Kyle

Kyle was a senior with a triple major, one of which was mathematics. At the start of the semester, he did not intend on pursuing a career in teaching. Analysis of Kyle's survey responses revealed that he had low levels of intrinsic motivation when considering a career in education. Different from Kate, he rated reasons of teaching being a noble profession, liking classroom teaching, and having a personality suited for the job as not very important for deciding to be a teacher. On the other hand, he thought extrinsic reasons, such as long vacations and job security, were important for person choosing to be teachers. In the survey, Kyle also indicated that he taught others as a private tutor and that he did not like teaching enough to do it for the rest of his life.

For his LA experience, Kyle was placed as an LA with a calculus professor in a calculus class. During his 10 hours as an LA, he attended the calculus class, assisted the professor as needed, and tutored the calculus students. He typically did not meet outside of class with the calculus professor he assisted. Kyle's main reason for becoming an LA was to help him have a stronger curriculum vita (CV) or resume. Although he tutored privately, he thought being officially selected to be an LA by a mathematics department at a university would provide recognition for him.

Kyle's interview at the end of the semester revealed that his interest and "passion" for becoming a financial analyst was very high and he lacked interest in becoming a teacher. When Kyle was asked if he would consider pursuing a degree in education he replied as follows:

No . . . I don't . . . I don't intend to . . . umm first of all as I mentioned before I don't think anyone can just, uhh, hop into education you really have to prepare yourself academically and I wouldn't get a degree in education because that is not what interests me most. I am more interested in mathematics, economics, finance, so it is not something I like.

Kyle indicated that prior to joining the LA program, he had been tutoring privately for only about one year. Thus, he did not have much teaching experience in his history. He felt comfortable tutoring because he knew the material very well. However, with respect to becoming a teacher, he felt that his family and friends may have influenced him subliminally:

It's just that parents, family, friends they influence everything obviously the environment we live in so maybe at some point it's like a lot of other probably fields. Someone has maybe told me, 'Oh with teaching salary it's not gonna . . .' Well, maybe that has been in the back of my mind . . . that coupled with the fact that I'm not passionate about it.

With respect to the LA program, he indicated that he enjoyed his LA experience and it has helped him hold teachers at a much higher regard because he understands better what their work entails. However, although Kyle's experiences were found to be enriching, they were not

enough to attract him to education. Unlike Kate, he did not have a history of experiences within Schutz's (2001) four main sources that encouraged him to become a teacher. Kyle was not positively reinforced by his family and teacher influences, while Kate was received positive reinforcement from all four sources.

Kory

Kory was a junior mathematics major with an education focus, who at the start of the semester was unsure about teaching in the future. Analysis of Kory's survey responses revealed that he, like Kate, rated highly intrinsic (including altruistic) motivations for becoming a teacher when considering a career in education. For him, the extremely important reasons included wanting to help students succeed, the belief that teaching is a noble profession and teachers can help improve society, having a personality suited for the job, and liking classroom teaching. However, unlike Kate and more like Kyle, he rated as not very important the following extrinsic reasons: other's people's influence and previous jobs. Also, like Kyle, Kory rated job security as a fairly important reason for someone to become a teacher. Through the survey, Kory also expressed that he was interested in politics or becoming an astronaut. He said that his main reason for becoming an LA was to "see if I want to become an educator." Prior to the LA program, Kory did not have much experience tutoring or teaching others.

As part of his LA experience, Kory worked for 10 hours both in an algebra class and with the algebra students working in the algebra lab. As part of working with the algebra class, Kory attended weekly meetings with faculty teaching the Algebra course and with other algebra LAs. In those meetings, they discussed what the students were learning at the time and areas in which they might have or were having difficulties. Kory felt his experience as an LA "was a good learning experience" and he was "definitely satisfied and happy and fulfilled that I helped other students get through difficult courses."

During Kory's interview at the end of the semester, he said that the most crucial influence in his decision to become a mathematics teacher or not was the LA program:

I would say the LA experience has been the most decisive. I mean, I had always thought about it but it wasn't until I had been participating in my LA class and seminar that I really enjoyed teaching and saw that it is something that I could see myself doing then. Prior to the LA program experiences, Kory did not have much teaching/tutoring experience, positive peer influences toward teaching, or positive teacher influences, three of the main sources supporting individuals for choosing to become teachers outlined by Schutz (2001). Prior to the LA program, Kory did not have experience tutoring and, unlike Kate, Kory did not discuss any individuals who significantly impacted his decision to pursue a career in education. The LA program seemed to begin to provide some of these influences through the experiencing teaching/tutoring the algebra students, working with other LAs, and working with algebra faculty. When asked what Kory thought would be most rewarding to him as a teacher, he responded:

The most rewarding experiences would be being this student that actually appreciated me as much as I appreciated them I would try to make a good connection with every student but the ones that make the effort to make a connection back with me and come back to me to visit afterwards and say that I really did affect them along the way in their education and in their life, not just the subject that I had taught them.

Although at the start of the semester, Kory was unsure about choosing to become a mathematics teacher, the high importance he placed on intrinsic reasons for becoming a mathematics teacher

and his positive experiences as an LA make him more susceptible to being recruited as a mathematics teacher.

Discussion

The three cases of Kate, Kyle and Kory reveal some similarities and differences that can inform the implementation of programs, like the LA program, to recruit mathematics teachers. Both Kate and Kory were juniors. They rated intrinsic reasons as extremely important for individuals' choices to become a teacher. Additionally, for Kate, sources in her history for setting the goal to become a mathematics teacher were directly aligned with Schutz's (2001) four main sources: (a) family influences, (b) teacher influences, (c) peer-influences and, (d) teaching experience. Thus, Kate had decided to become a teacher when she enrolled in the LA program and the program confirmed her decision. Kory, however, was not sure if he wanted to pursue a career in teaching and did not have a history aligned with Shutz's main sources for becoming a teacher to support such a decision. For Kory, the LA program seemed to be building a history for him of these main sources. He felt the LA program was helping him to decide to become a teacher. He reported that through the LA program he recognized that "I really enjoyed teaching and saw that it is something that I could see myself doing them."

Kyle, a senior, on the other hand, did (a) not rate intrinsic decisions highly for influencing individuals' choices to be a teacher, and (b) rate some extrinsic reasons highly, such as long vacations and job security. With respect to Shutz's main sources for choosing to become a teacher, Kyle had only been tutoring for a year so he did not have much teaching experience. Additionally, he felt that his family and friends may have made comments about becoming a teacher that may have swayed him away from pursuing teaching as a career. Important for Kyle was that he had a passion for being a financial analyst that he did not have for teaching. Kyle stated that he enjoyed the LA seminar and the LA experience; but when he was asked to what extent it affected his decision to pursue a career in education, he stated, that he had other considerations such as wanting to be a financial analyst and knowing that to become a teacher required a great deal of preparations.

The LA program seems valuable to some extent for recruiting and retaining strong STEM undergraduates to become mathematics teachers. For individuals, like Kate, with a positive history of the four main sources (a) family influences, (b) teacher influences, (c) peer-influences, and (d) teaching experience for becoming a teacher (Shutz, 2001), the LA program may confirm that teaching is the career for them and may help to retain them in the major. For individuals, like Kory, who are not sure and do not have a history of positive or negative influences to become a teacher and have positive intrinsic motivations to be a teacher, the LA program can begin to provide a positive history of influences to make the decision to become a teacher. Last, for individuals such as Kyle, a senior with a passion for another career, who do not rate highly intrinsic motivations for becoming a teacher, and who have little positive main sources for becoming a teacher such limited experience teaching/tutoring and some negative influences (family and friends) discouraging teaching as a career, the LA program may not be a good recruitment tool to become a teacher. However, it did help clarify his thinking about what it takes to be a teacher, and it did help him value the work of teachers more.

Implications

Further study of the LA program would be valuable because the program is fairly new and has the potential to increase recruitment of STEM educators (Otero, Pollock, & Finkelstein, 2010). In the future, the researchers in this study will survey the students in the beginning of the semester and at the end of the semester in order to detect change in their career decisions and

possible reasons for those changes. With future data, the researchers plan to develop a linear model that will help predict a student's probability of choosing to pursue a career in teaching prior to joining the LA program.

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