Mathematics Instructors' Perspectives on the Affordances of LA Implementations in the Undergraduate Classroom

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This study explores undergraduate mathematics instructors' perspectives on the benefits of Learning Assistant (LA) programs. Interviews with seven faculty members highlight LAs' roles in providing student support, enhancing instruction, and promoting student-centered learning. Instructors also noted that LAs gain valuable teaching experience, build relationships with faculty, and grow in confidence. These findings align with the established LA program goals of improving undergraduate education and preparing future teachers. However, the LA program goals of engaging faculty with educational research and institutional change were less evident. Future research will examine how LA use aligns with or diverges from established program objectives.

Keywords: Learning Assistants, Student Support, Faculty Perspectives

Learning Assistants (LAs) are typically undergraduate students who have successfully completed a course and support students currently enrolled in the same class (Talbot et al., 2015). Since its development in 2003, the LA model has become commonplace in higher education. This paper presents a preliminary analysis of interviews with mathematics faculty who have worked with LAs within the past five years (since Fall 2019). This study aims to identify the key benefits that faculty perceive LA programs offer to students, LAs, mathematics programs, and institutions of higher education.

Literature Review

The LA model was developed at the University of Colorado Boulder (CU Boulder) and the University of Colorado Denver with four key goals: (1) transform undergraduate STEM education, (2) recruit and prepare future teachers, (3) engage faculty in discipline-based educational research, and (4) change departmental and institutional culture (Otero, 2015). Talbot, Hartley, Marzetta, and Wee (2015) exhibit similar, directly related goals of improving student learning in undergraduate science courses, supporting reform efforts, and giving high-performing students opportunities to be exposed to science teaching as a career choice.

In addition, Talbot et al. (2015) describe three "foundations" of any LA program – content, pedagogy, and practice. Firstly, content (or preparation) refers to LAs meeting regularly to discuss course content, plan upcoming classes, reflect on past activities, and provide input from students' perspectives to the instructor. Second, LAs participate in a regular pedagogy to discuss learning theory, teaching strategies, formative assessment, and student conceptions in the context of their work. Thirdly, LAs primarily serve to interact with students to guide them in students' own learning process.

Barrasso and Spilios (2021) conducted a scoping review of 39 research papers to assess the effectiveness of Learning Assistant (LA) programs in achieving the four goals outlined by Otero (2015). First, their review highlights evidence that LA programs can lead to increased student satisfaction, reduced DFW rates, greater learning gains, and enhanced student comfort in interacting with peers and faculty—factors that contribute to a stronger STEM identity. Second,

although there is limited evidence regarding improved teacher preparation, the LA program at CU Boulder has seen a rise in student enrollment in its teaching certification program since its implementation (Otero et al., 2006). Third, several studies suggest that the LA model can influence faculty teaching practices (Van Dusen et al., 2015; Caravez et al, 2017). Finally, evidence of departmental and institutional changes can be found in case studies of multi-institutional partnerships utilizing LAs (Cochran et al., 2016; De Leone et al., 2019).

Recent research by Karch, Mashhour, Koss, and Caspari-Gnann (2024) with instructors and LAs demonstrates the ways instructors implement the LA model can vary across institutions and classes and are influenced by their perspectives on learning and curricular goals. Moreover, these differences result in distinct roles for LAs, which impact how LAs learn and interact with students. Thus, the way an LA model is implemented (and its success) depends on how instructors define and implement the role of LAs in the classroom.

This study is a preliminary exploration of how instructors position LAs in their classrooms and why they do so. Specifically, it investigates the extent to which instructors from institutions of varying sizes align their use of LAs with the established goals of the LA model. The research questions guiding this study are:

1. What goals or benefits of utilizing LAs do instructors describe for both classroom environments and departmental culture?
2. In what ways do instructors' descriptions of their work with LAs embody the goals of the LA model?

Methods

Participants

Participants were recruited through a screening survey sent by email from a RUME listserv. A total of 15 participants were chosen based on the following criteria. First, all participants had experience teaching undergraduate courses with one or more LAs within the past five years. Second, participants represented, as best as possible, a range of institution sizes. For this preliminary report, we further reduced our sample to seven participants as outlined in the Analysis section below.

Table 1. Distribution of participants by institution size

Institution Size	Count
1,000 - 4,999 students	1
5,000 - 9,999 students	3
10,000 - 19,999 students	4
20,000 students or more	7
Total Participants	15

Data Collection

Each participant engaged in a one-hour semi-structured interview following the same basic sequence of questions. First, five questions explored the structure and format of course(s) taught with LAs. Second, seven questions explored the ways the student and participant (instructor)

interacted with the LA. A third sequence of questions explored which aspects of learning the LAs provided the most support. Finally, participants were asked for advice for someone training or working with LAs for the first time. Each interview was conducted online by one of the authors using video conferencing software. Interview recordings and computer-generated transcriptions were used for subsequent analysis. Additionally, a post-interview survey was sent to participants to collect additional demographic, educational, and institutional information along with any comments they thought of after the conclusion of the interview.

Analysis

An individual interview was used as the unit of analysis. For this preliminary analysis, one participant's interview was chosen for trial coding based on the clarity of the examples provided during that interview. Both authors individually coded this interview for instructor evidence of work and teaching with LAs in ways that aligned with the goals of the LA model, as described by Otero (2015), along with the subgoals developed in Barrasso and Spilios' (2021) review of the LA literature.

Both authors then met to compare their coding, agreeing on a set of codes that best captured the range of affordances of LAs described in the interviews. These codes are shown in Table 2. The resulting coding scheme closely aligns with the provisional coding method described by Saldaña (2013), as codes were based on existing research frameworks but expanded to better reflect the range of affordances of LAs as described by instructors.

For instance, under the goal of "recruiting and preparing future STEM teachers," the subcodes "giving LAs first-hand leadership experience" and "providing LAs with practice in supporting student questions" were added, as distinct from "engaging LAs in learning about learning" (which we further defined as second-hand study of learning and pedagogy).

At the time of this report, the authors selected six additional participants (for a total of 7 out of 15) to represent the range of institution sizes in the data corpus; the remaining interviews will be analyzed in the completed analysis. One author coded each participant's interview using the coding scheme mentioned earlier. Lastly the codes were aggregated for analysis as described in the next section.

Results

Table 2 displays the coding scheme used in the preliminary analysis of interviews of seven of the 15 participants in our study. Subcodes are listed under primary codes and are indented. A column is provided for each of the seven coded interviews, with the interview heading showing the size of the participant's home institution, as detailed in the key at the bottom of Table 2. Each cell is marked with a "1" if the code was present in that participant's interview, and a "0" if it was not. Additionally, the total number of occurrences of each code across the seven participants is shown on the right, indicating the relative frequency of each code representation across the seven interviews.

Primary code 1 and its associated subcodes relate to the benefits LAs provide to students. In 100% of the interviews analyzed thus far, participants made observations related to subcodes 1a, 1b, and 1c. Code 1a indicates these seven instructors have observed students receiving direct support from LAs in the form of LAs answering their questions about mathematics or institutional knowledge or LAs providing affective support or encouragement. Codes 1b and 1c are closely related; this result indicates that all seven instructors feel that having LAs in their

classroom both improves the overall instruction students receive as well as the amount of student-centered instruction students provide. One participant captured a sentiment shared by several others: "[LAs] can feel the pulse of the room much more than [I can]." Four participants also spoke about code 1d, which relates to improving student retention and filling a need for remediation.

Table 2. Coding scheme and codes present for each participant's interview

Codes and Subcodes **Institution Size***	**A**	**B**	**C**	**C**	**C**	**D**	**D**	**Total**
1. Transforming undergraduate STEM education								
1a. Direct student support	1	1	1	1	1	1	1	**7/7**
1b. Improving instruction in general	1	1	1	1	1	1	1	**7/7**
1c. Developing student-centered instruction	1	1	1	1	1	1	1	**7/7**
1d. Supporting reform efforts	0	0	1	1	1	0	1	**4/7**
2. Recruiting and preparing future STEM teachers								
2a. Building mentorships with faculty	1	1	1	0	0	1	1	**5/7**
2b. Engaging LAs in learning about learning	1	0	1	1	1	1	1	**6/7**
2c. Promoting positive STEM identities in LAs	1	0	0	0	0	1	1	**3/7**
2d. Giving LAs classroom leadership experience	0	1	0	0	0	1	0	**2/7**
3. Engaging faculty in discipline-based educational research literature	0	0	0	0	0	0	0	**0/7**
4. Changing departmental instructional culture to value evidence-based teaching	0	0	0	0	0	1	0	**1/7**

** Institution size: **A** = 1-5k students; **B** = 5-10k; **C** = 10-20k; **D** = above 20k students*

Primary Code 2 and its subcodes describe the benefits LAs receive through their participation in the LA program at their institution. While these benefits concern preparing LAs as future STEM teachers, many of the LAs described by our participants were neither pre-service teachers nor enrolled in teacher education programs. The most frequently mentioned subcode of Primary Code 2, cited by our seven participants, is 2b, which relates to teacher professional development. Most often, participants indicated that LAs met at least once per week either the instructor of the course in which they assisted, the course coordinator, and/or the LA program coordinator at their institution. Some participants also indicated that LAs were required to take a pedagogy course, where they discussed classroom challenges and topics related to metacognition.

Five participants mentioned that LAs built relationships with the instructors they assisted, providing LAs with a faculty mentor they could come to for advice or letters of recommendation. Subcode 2c was referenced by three participants, who observed LAs gaining confidence in their mathematical and teaching abilities. Subcode 2d was mentioned twice, indicating that at two of the participants' institutions, LAs had the opportunity to lead a classroom, either through leading recitations or hosting review sessions.

Lastly, the authors note that it is not surprising that the interviews analyzed contained so few instances of participants mentioning primary codes 3 or 4, as these were not directly referenced in our interview protocol. However, several open-ended questions allowed participants opportunities to mention these topics if they felt them relevant. The one reference to changing

departmental culture to value evidence-based teaching was from a senior faculty that also served as coordinator for the course.

Future Work

Based on this preliminary work, instructors' perspectives of their work with LAs appear focused and aligned on the first two goals of the LA model – transforming undergraduate STEM education and recruiting and preparing future STEM teachers. The degree to which instructors are aware of and motivated by goals three and four (engagement with discipline-based educational research and change in departmental culture to value evidence-based teaching) falls outside the scope of the methods of this current study. Thus, we plan to expand our analysis to better understand: (1) how instructors and departments position LAs in active learning classrooms, (2) the reasons instructors assign LAs to these roles, and (3) how LAs are supported or trained to develop these roles. In this way, we hope to better understand ways the productive use of LAs may align and diverge from the goals outlined in current LA program research.

Acknowledgments

We sincerely thank the 15 faculty members who participated in our interviews. Your insights have contributed much to our understanding and appreciation of LAs and the value they bring to the undergraduate mathematics education community.

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