

# Effects of the Learning Assistant Experience on In-Service Teachers' Practices

Kara E. Gray, David C. Webb, and Valerie K. Otero

*School of Education, University of Colorado – Boulder, 249 UCB, Boulder, CO 80309*

**Abstract.** The Colorado Learning Assistant (LA) Program serves as a content-specific supplement to standard teacher preparation programs. In addition to transforming undergraduate STEM courses, it recruits and prepares math and science majors for teaching careers by involving university STEM faculty. The research reported here compares the teaching practices of in-service teachers who participated in the LA experience as undergraduates to a comparison group of teachers who did not participate in the LA program as undergraduates but were certified to teach through the same program. We report on teachers' views of assessments and differences in their teaching practices. This analysis is based on interviews with approximately 30 teachers and observations of their classrooms throughout their induction years of teaching. This work considers how the LA program may help improve current teacher preparation models.

**Keywords:** Learning Assistants, teacher preparation, formative assessment, teacher observations

**PACS:**01.40.Fk, 01.40.G-, 01.40.jc,

## INTRODUCTION

Most American high school students are not being adequately prepared in physics. This is a result of the critically low number of teachers qualified to teach physics and the weak preparation of those teaching physics [1]. This lack of preparation extends beyond physics knowledge. It also includes physics knowledge applied to teaching, also known as pedagogical content knowledge (PCK), and knowledge of pedagogy, such as formative assessment. Formative assessment is taught in teacher education programs, yet it is rare in classrooms [2]. This is possibly because formative assessment is not embedded in content specific learning environments during teachers' preparation. For those who decide to become teachers, the Colorado Learning Assistant (LA) Program [3] serves as a supplement to traditional teacher preparation programs with a heavy emphasis on the content specificity of research-based instructional strategies, particularly formative assessment.

Formative Assessment is defined as assessing students for the purpose of gathering information to change the instruction or to inform students how they can improve their learning [4]. While formative assessment is often described as a teaching strategy, it can also characterize a teaching philosophy. This philosophy views teaching as focused on helping students build their understanding by starting from where the student is in their understanding, and leveraging multiple representations and cooperative learning to help all students succeed.

The Colorado LA Program was designed to recruit STEM majors into teaching careers and provide

assistance to university faculty who want to reform their STEM courses. The program hires undergraduates to work in STEM courses that they have successfully completed. These undergraduates, referred to as Learning Assistants (LAs), assist course instructors in making the reformed courses more interactive and student-centered by leading learning teams of students in discussions during lectures and/or in recitation sections. During their first semester as LAs, they take an introductory pedagogy course. This course covers topics such as questioning and drawing on students' prior knowledge. The term formative assessment was not used in the course but the concept was present in the course readings and discussions throughout the semester as it is present throughout the PER literature.

The Colorado LA Program is not a teacher certification program. LAs who decide to pursue a career in K-12 teaching enter the university's teacher preparation program to earn their certification. Previous research has shown that the Colorado LA Program has more than doubled the number of physics majors completing teacher certification at CU-Boulder and LAs greatly outperform their peers in content assessments [3].

This paper will discuss two aspects of a much larger study designed to test our hypothesis that teachers who participated in the Colorado LA program are more prepared than their colleagues. This paper will address the following two research questions: (1) Are former participants of the Colorado LA Program using more reformed teaching practices than their fellow beginning teachers and (2) Do former participants of the Colorado LA Program have views

of the purpose of assessment that are more aligned with a formative assessment teaching philosophy than other beginning teachers.

## METHODOLOGY

To study the influence of the LA program, we recruited two groups of teachers. Because of the small numbers of physics teachers we did not have a sample large enough for our study. We therefore chose to recruit samples of STEM teachers with the expectation that we will later be able to extend these findings to physics teachers more specifically. The first group of teachers was made up of secondary math and science teachers who participated as LAs for at least one semester during their time as undergraduates. The second group of teachers completed the same teacher certification program but did not serve as LAs. These two groups were matched based on their years of teaching experience, degree area (math, physical science, or biological science), teacher preparation program (licensure only or licensure with masters), and school context such as ethnic diversity, and school location (urban, rural, or suburban). Table 1 shows the number of teachers in each group.

**TABLE 1.** Count of Teachers Participating in the Study (Total N = 29).

Status	Math	Science
LA	7	8
NonLA	7	7
All	14	15

In order to consider whether teachers who participate in the LA program as undergraduates use more research-based teaching practices and have different views of assessment than their fellow beginning teachers, we collected two sources of data: observations and interviews.

### Observations

The participating teachers were observed two to three times over the course of the school year. Teachers were observed for one to five years during the beginning of their teaching careers. The number of observations and the years of teaching experience were approximately equal across the groups of the study. Over the course of the study 178 observations were completed. The observations were done by a member of the research team with at least two members observing each teacher over the course of a school year. Each observation was scheduled with the teacher and then documented using the Reformed Teaching Observation Protocol (RTOP) [5]. The RTOP consists

of 25 statements that describe the classroom environment and the lesson. Researchers rate the observed class from zero to four for each statement based on how descriptive the statement is of that class. Members of the research team met several times each year to establish consistency across researchers. In these sessions the research team independently scored videotaped teachers, who were not in the study, using the RTOP. The scores for all researchers were within five points of each other and did not differ by more than a single point on any statement.

### Interviews

The second source of data was teacher interviews. At the beginning of the school year teachers were interviewed about their experiences, views, and students. The interviews usually lasted around half an hour. This paper reports on teachers' responses to the question "Why do you assess your students?" Five of the teachers were not asked about their purpose for assessing students, so the sample for this part of the study included 24 teachers (12 LAs and 12 nonLAs).

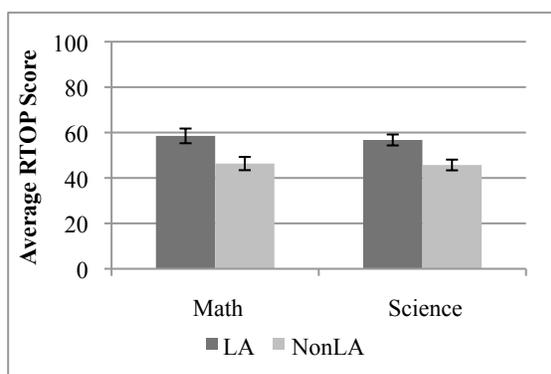
The transcripts of these interviews were then read to find the central purpose for assessing students given by each teacher. All of the teachers' responses were represented by the four categories shown in Table 2 and described more completely in the following section. While, many of the teachers mentioned using assessments to evaluate students, teachers were only coded as "evaluation" if no other purpose was given.

## RESULTS

Figure 1 shows the total RTOP scores for all teachers observed during the study [6]. Based on these results, there is a statistically significant difference between the scores of the former LAs and their colleagues in both math ( $p = 0.005$ ) and science ( $p = 0.001$ ) as measured by the RTOP. A more extensive analysis of the RTOP results can be found in Ref. [7].

While the data above demonstrate that teachers who participated in the LA program tend to use more reformed teaching practices, the substance of these differences is not revealed with this measure. In order to delve into the substance of teachers' practices we considered the interview data from the perspective of formative assessment. The analysis will focus on the views of first year teachers in order to remove confounding influences of the teachers' teaching experiences.

Based on the analysis of the teachers' reasons for assessing students, the following four categories were created. The codes are followed by a definition and an example quote from the responses in that category.



**FIGURE 1.** Average RTOP scores broken down by teachers' experience and subject taught [6].

Teachers' responses were only coded under evaluation if they gave no other purpose for their assessments.

*Play Along* – the teacher assesses students so that they will participate in class and learn the material. The teacher thinks that without assessments, students will not pay attention to the material.

Just making sure that the kids are playing along, and, you know, doing what they're supposed to, and at least attempting, the progress (CathyB, Fa06-Sp07).

*Evaluation* – the teacher assesses students to evaluate whether they learned the material. This information is often used to assign a grade.

Well, to find out if they learned anything. [laughs] That's what we're doing. We're trying to teach people things. That's the purpose. (PattieD, Fa08-Sp09).

*Inform students* – the teacher assesses students to let the students know how they are doing. The assessments provide the student with feedback about their understanding.

So without any assessment, my students do not know if they're learning. They might say, "I'm doing all the homework, I'm getting the answers, so I must be learning." They need feedback (GlennM, Fa07-Sp08).

*Inform instruction* – the teacher assesses students to gather information that she will use to inform her decisions about what or how to teach next.

To know where they are. I have to know where they are in order to help them go to where I'm trying to get them. In order for them to hit the target, I have to know what direction they're pointing, to help them hone in on the bull's eye (WendyL, Fa08-Sp09).

Each teacher's response was coded into only one of the above categories. While there are many reasons to assess students, the categories described above were broad enough to capture the responses of these teachers. Most of the teachers within the "inform instruction" category listed several reasons for assessing students but all fell within this code. Table 2 shows the number of teachers whose responses were included in each category. Based on this analysis, only the nonLAs talked about assessing their students strictly for evaluative purposes (i.e. assigning a grade). The former LAs tended to talk about assessing their students in order to gather information that is either shared with the students or used to inform instruction (11 of 12 LAs compared to 7 of 12 NonLAs). These results do not mean that former LAs do not talk about evaluating students. However, if former LAs talked about assessing students to evaluate them, they also went on to talk about using assessments for feedback.

These results are not surprising in light of the RTOP results. Research-based teaching practices are based on concepts such as building on students' prior knowledge and engaging students as partners in their own learning. Therefore, formative assessment is one facet of research-based teaching practices.

**TABLE 2.** Reasons to Assess Students.

	Play Along	Evaluation	Inform Students	Inform Instruction
LAs	1		2	9
NonLAs	1	4		7

## IMPLICATIONS AND CONCLUSIONS

Based on the analysis presented above, former LAs tend to use more reformed teaching practices than their fellow beginning teachers as measured by the RTOP. An analysis of these teachers' interviews suggests LAs and nonLAs view assessment differently, which may help to explain why their practices look different. The former LAs tend to focus on using assessments to inform students or their instruction; what the literature refers to as formative assessment [8]. Unlike LAs, some NonLAs focus on assessment only for evaluative purposes, often referred to as summative assessments [8]. These results do not suggest that NonLAs don't change their instruction based on information from students. Instead, they may only engage in this practice implicitly, or they may not view it as related to assessment. One possible reason for the differences in the two groups of teachers may be the learning opportunities created by the Colorado LA program.

While the term formative assessment is not taught in the Colorado LA pedagogy courses, the course does focus on the importance of listening to students' ideas

and building off these ideas, as does the PER literature. LAs are likely to experience the importance of tailoring explanations to students' current understanding during their interactions with students. These interactions are grounded in content, allowing the LAs to also develop their PCK. These experiences allow the LAs to assimilate the concept of formative assessment into their view of effective teaching when it is introduced in their teacher preparation courses. The LAs may come to see the dual purpose of assessment through these experiences.

The teacher certification courses, taken by both groups of teachers, focus extensively on formative assessment. They also discuss the importance of listening to and valuing students' ideas. NonLAs may enter these courses without having substantive and extended experiences that demonstrate the importance of building on students' ideas about specific topics. Without these experiences, NonLAs may not be able to understand the value of formative assessment, recognize the role it plays in their teaching, or connect it to their existing knowledge and experiences.

The reason for the differences between the two groups of teachers may be because of the learning environment created by the Colorado LA Program and its deep connection to the content. The Colorado LA program creates a situated learning environment for the LAs. A situated learning experience provides opportunities for the LAs to unite teaching experiences in their content areas with new formal information on teaching. In this type of experience, the teaching is not simply an opportunity to apply new information previously learned in the course. Instead, the teaching experience motivates and drives the course experience, and at the same time, the course drives the growth in the teaching experience. This type of learning gives LAs an opportunity to form a robust understanding of effective teaching. Vygotsky [9] refers to this process as a mediation between a person's experiences and the formal language and concepts presented through formal schooling.

The Situated Learning perspective, based on the work of Dewey and Vygotsky, has been frequently discussed in research on teacher professional development [10]. Yet, this perspective is rare in research on teacher preparation. This is likely due to the fact that traditional teacher preparation programs do not provide future teachers with extended opportunities to work with students in experiences that are closely tied to their program of study (e.g. physics, chemistry) and the topics in their pedagogy courses [11]. Frequently, this type of experience comes after all course work has been completed, such as in student teaching. In the Colorado LA program this type of experience is concurrent with an introduction to

pedagogy, closely tied to the STEM content, and prior to teacher preparation course work.

The Colorado LA program provides an opportunity for STEM majors to become interested in teaching and seems to improve the outcomes of teacher certification programs. It is a content specific supplement to traditional teacher certification programs. Though, it is not yet clear which aspects of the Colorado LA program may be responsible for the results presented here. It is also still unclear whether the LA program is recruiting people who become better teachers or if it is helping people become better teachers than they would have been following a traditional program. Either way, we want former LAs in our classrooms. The Colorado LA program has the potential to increase the number and quality of physics teachers.

## ACKNOWLEDGMENTS

The authors wish to thank the members of the LATEST K-12 research team. This work was partially funded by NSF grant #ESI-0554616.

## REFERENCES

1. T. Hodapp, J. Hehn, and W. Hein. "Preparing high school physics teachers," *Phys. Today*, 62 (2), pp. 40-45, (2009); National Task Force for Teacher Education in Physics, Report Synopsis (February, 2010).
2. V.J. Shute, *Review of Educational Research* **78**, 153 - 189 (2008).
3. V.K. Otero, S.J. Pollock, and N.D. Finkelstein, *Am. J. Phys.* **78**, 1218 (2010).
4. P. Black and D. Wiliam, *Assessment in Education* **5**, 7-74 (1998).
5. D. Sawada, M.D. Piburn, E. Judson, J. Turley, K. Falconer, R. Benford, and I. Bloom, *School Science and Mathematics* **102**, 245-253 (2002).
6. Means for the data shown in Figure 1 with standard deviations in parentheses: Math LAs – 58.5 (19.9), Math NonLAs – 46.3 (18.7), Science LAs – 56.7 (18.2), Science NonLAs – 45.7 (15.3).
7. K.E. Gray and D.C. Webb, Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 8 – 12, 2011).
8. National Research Council, *How People Learn: Brain, Mind, Experience, and School* (National Academy Press, Washington DC, 2000).
9. L.S. Vygotsky, *Thought and Language - Revised Edition*, Revised (The MIT Press, 1986).
10. R.T. Putnam and H. Borko, *Educational Researcher* **29**, 4-15 (2000).
11. S. Wilson, R. Floden, and J. Ferrini-Mundy, *Teacher Preparation Research: Current Knowledge, Gaps and Recommendations (document R-01-3)* (Center for the Study of Teaching and Policy/University of Washington, 2001).