



Learning Assistants and Course Success

The purpose of this report is to explore the association between student course-level success and the use of undergraduate peer learning assistants (LAs). LAs serve as peer educators by 1.) supporting instructor implementation of active learning during class sessions in high-enrollment courses and 2.) facilitating study sessions outside class time. In these roles, LA engage students in high-impact practices (HIPs) such as collaborative work, problem-solving, and the development of study skills that promote mastery of content and skills knowledge.

Executive Summary

This report shows no statistically significant difference in course grade averages between students in CSU courses staffed with LAs and those in courses without LAs. In contrast, when implemented with all four key components at other institutions, the LA model has produced such improvements. In an effort to garner wider instructor participation during the pilot stage at CSU, the model was implemented only with those components each individual instructor chose to use. Therefore, the suggested next steps listed at the end of this report propose moving toward a more targeted three-year pilot including one to two large-enrollment courses in which all four key components are fully implemented.

National Context: Learning Assistant Models

The LA model was developed 17 years ago, beginning with physics courses in 2001, then expanding across Science, Technology, Engineering, and Mathematics (STEM) courses, with more recent adoption in social sciences and humanities courses. Implementation at CU-Boulder significantly improved key student success metrics, with increases in the proportion of students earning a C or better, and a disproportionately higher positive impact for students from groups historically under-represented both in post-secondary institutions and in STEM fields, as well as cultivation of science identities for students and capacity to implement active learning effectively for faculty. These successes have prompted the adoption of the LA model across 70 institutions in the U.S. The [Learning Assistants Alliance](#), a clearinghouse for sharing information, resources, and experiences relevant to the implementation of the LA model, provides a repository for national and international data documenting the impact of using LAs on students' academic achievement. Key findings include decreased DFW rates and increased graduation rates in LA supported courses.

The [LA model adopted at CU-Boulder](#) and other institutions entails four key components:

1. Redesigning courses to integrate high-impact practices and active learning, supported by the use of LAs, who facilitate collaborative problem-solving during class time.
2. Training LAs in pedagogical, learning science, and peer education approaches.
3. Preparing faculty to guide LAs' facilitation by holding well-structured weekly meetings with them on upcoming class sessions' content, objectives, and methods.
4. Designing and conducting assessment research that evaluates the effects of implementing the LA model in light of faculty, departmental, and institutional goals for students' academic achievement.

The LA model at CU-Boulder has been implemented with extensive support, not only from the National Science Foundation and Howard Hughes Medical Institute, but also from the Provost's Office and a number of corporate donors and national organizations. This support includes departmental coordinators in each department using LAs; a centralized staff, website, and related resources to help faculty vet, hire, train, and work with LAs; a set of resources for designing and implementing program assessments to evaluate the impact of adding LAs to a course; support for faculty in redesigning courses and learning how to use LAs to best effect; and support for communicating and collaborating with national and international disciplinary colleagues about the use of LAs nationally through the Learning Assistants Alliance.



Local Context: Learning Assistants at CSU

Some CSU faculty have been using LAs for several years, but our conversations with them suggest that they've done so without incorporating all of the CU-Boulder model's four key components. In 2015, through The Institute for Learning and Teaching (TILT), CSU initiated a pilot program intended to pilot the use of LAs in an effort to create transformative learning environments that would promote improvements in academic achievement comparable to those resulting from CU-Boulder's LA program. As part of this effort, TILT has developed the CU-Boulder model's four key components, including relevant course redesigns; preparation for instructors; an initial assessment model (with IRP&E); and LA training focused on learning science, active learning techniques, the role of peer educators, and working effectively with instructors. However, in an effort to cultivate faculty interest in the LA model, TILT cast a wide net, inviting interested faculty into the pilot and foregoing key components when faculty partners felt unable to incorporate them. Thus, while some LAs in the pilot have participated in TILT trainings, many have not. Similarly, some instructors have completed course redesigns to incorporate use of LAs effectively; worked with TILT on recruiting, hiring, and mentoring LAs; or met weekly with LAs to plan class sessions' objectives, content and activities. Few or no instructors have implemented the LA model with all four components. Most have included one or two of the four.



One instructor, Brian Jones, implemented three of the four key components and has done assessment research comparing in-course data, rather than final grades, from a semester prior to his use of LAs (Spring 2016) with data from a semester after he incorporated LAs (Spring 2017). His findings offer a more fine-grained picture than do average course grades, which dropped slightly for PH 121 and rose slightly for PH 122, neither to a statistically significant extent (see the section below titled "Course Grade Averages by LA Status"). Mr. Jones' findings show that attendance increased by roughly 2% to 20% across the weeks of the semester; attendance at optional weekly study sessions increased from a high of 15% of students enrolled in Spring 2016 to a high of 40% in Spring 2017; and while average scores on homework and test questions remained stable at 252 in Spring 2016 and 252 in Spring 2017 (despite an increase in the level of challenge in the questions), the median scores rose (252 in Spring 2016 and 260 in Spring 2017) due to a reduced number of low scores, corresponding with a decrease in the D, F, W rate from approximately 3% to less than 1%.

Study Methodology

In order to assess the association between LA usage and course success, the average of students' final course grades is compared across LA and non-LA course sections. This section describes the report's success outcomes, population criteria and demographics, and analytical methods, as well as important limitations of this methodology.

Course Success Outcomes

Course success is measured across two variables that are associated with students' final grade in the course:

-  Course success rate: percent of students at end of term who earned an A, B, or C grade among all students who received a letter grade or W drop/Incomplete
-  Average grade points: the average of the numeric value to the letter grade (e.g. A=4), excludes W and I grades



Population

Undergraduate students who enrolled in a course that utilized LAs or one of the selected comparison sections are included in this analysis. Table 1 shows the demographic characteristics of undergraduates in this sample.

Table 1.

Demographics of Students in LA and Non-LA Course Sections					
	Headcount	First Generation (%)	Racially Minoritized (%)	Pell Recipient (%)	Index (HDCT w index)
LA Sections	3,158	21.1%	20.8%	22.5%	120.3 (2691)
Non-LA Sections	3,257	22.9%	19.2%	27.8%	119.7 (2770)

There are very few differences in demographic or academic characteristics by LA status. Pell grant recipient status is the one exception. There is a 5 percentage point (PP) difference in representation of Pell Grant recipients by LA status (27.8% in non-LA sections compared to 22.5% in LA sections). Table 2 displays the student class distribution by LA status.

Table 2.

Class Level Distribution for Students in LA and Non-LA Course Sections					
	Freshman	Sophomore	Junior	Senior	
LA Sections	22.2%	20.9%	25.0%	31.9%	
Non-LA Sections	21.4%	20.8%	25.1%	32.6%	

Like demographic attributes, the class level distribution is nearly identical by LA status. These similarities are most likely due to the random nature of students enrolling in LA or non-LA sections. These similarities might change in the future if the program gains a positive reputation or becomes an intervention based on strategic student success efforts.

Study Limitations

The associations between LA and course success are measured with logistic (for the A/B/C rate outcome) and linear (for the grade point outcome) regressions. The models are run by course and control for class level (freshman, sophomore, etc.) and student demographics (first generation status, minority status, and Pell recipient status). The following are some important limitations that should be considered when reviewing the results:

- ✚ The models do not control for any other curricular changes across terms or the intensity of LA training/implementation. There is extensive variation unaccounted for ($r^2=.1$) because these models are accounting only for a small number of the factors that influence course success.
- ✚ The study outcomes are indirect measures of success and do not accurately capture the achievement of student learning outcomes.
- ✚ For about half of the courses, the instructor is not consistent across the LA/non-LA comparison. When instructors cannot be held constant, care is given to match instructors on experience level and reputation. Specific information on the course terms, class sizes and number of sections included for the LA group and the comparison group are in Appendix A.



Course Success Rates by LA Status

The LA courses' observed headcounts and rates of success (percent that earn an A, B or C grade) are displayed in Table 1. Additionally, this table shows the logistic regression odds ratios and changes in predicted probability of success by course.

Table 1.

Course Success Rates ¹ by Learning Assistant (LA) Status								
Course	Comparison Type ³	LA Student		Observed Values		Predicted Values ²		LA's Predicted PP Difference
		Count	Non-LA Student Count	LA Successful Rate	Non-LA Successful Rate	LA Odds Ratio ⁴		
BC 351	Same	129	146	76.0%	81.5%	0.70	-5.89	
CHEM245	Same	120	183	83.3%	73.8%	1.74	8.92	
ECON202	Same	87	259	82.8%	84.2%	0.90	-1.42	
LIFE210	Same	347	294	80.4%	86.1%	0.69	-4.98	
MATH157	Different	33	31	78.8%	58.1%	7.07*	36.77	
MATH159	Different	23	22	87.0%	77.3%	1.96	2.33	
MATH160	Different	257	218	67.7%	60.6%	1.38	7.29	
MATH161	Different	375	354	78.1%	82.8%	0.70	-5.49	
MECH103	Different	398	313	86.9%	88.2%	0.80	-1.75	
PH 121	Same	986	985	94.5%	95.6%	0.76	-1.11	
PH 122	Same	397	446	97.7%	97.3%	1.20	0.37	
Overall		3,152	3,251	86.5%	87.3%	0.92	-0.71	

¹ Course Success rate is the percent of students at end of term that earned an A, B, or C grade among all students that received a letter grade or W drop/Incomplete.

² Predicted values are based on a course's logistic regression model that has LA status as the primary independent variable and success rate as the dependent variable controlling for student class level, gender, first-generation status, Pell grant recipient status, and racially minoritized status. The predicted probabilities assume the average level of all the control variables.

³ Comparison type indicates if the course comparison is made across the the same or different instructors

⁴ The asterisk indicates statistical significance (the odds ratio's p-value is less than .01)

Overall, about 86.5% of students in the LA courses earned an A, B or C compared to about 87.3% of students in non-LA courses (.8 PP difference). These rates are very high (success rates in a similar study were 77%-80%). Similarly, the predicted values indicate that LA are associated with slightly lower odds of course success compared not having LA (after controlling for some extraneous variables). This difference is not statistically significant, but decreases the magnitude of the PP difference slightly (.7 compared to the .8).

Appendix B shows the results when the data is limited to students who are either a Pell grant recipient, first generation, or identify with a minoritized race/ethnicity and the conclusions are identical. This outcome indicates that LA association with course success is not different for students with at least one gap attribute.

There is wide variation in the associations between LA usage and course success, but very few of the course level models have statistically significant results (MATH157 being the exception). About 54% (6 of the 11) of the LA courses have lower rates of success rate compared to the non-LA course. The strong positive association between LA usage and



course success in MATH 157 should be interpreted with some care because of the smaller number of students and the instruction differences across LA status.

Course Grade Averages by LA Status

Table 3 shows the average grade points for each course by LA status. The table also displays predicted values based on a linear regression model. The LA coefficient is interpreted as the change in the average grade for courses with LA compared to non-LA courses, after controlling for some demographic variables and student class level.

Table 3.

Average Course Grade Points¹ by Learning Assistant (LA) Status

Course	Comparison Type ³	Observed Values		Predicted Values ²		
		LA Student Count ⁴	Non-LA Student Count ⁴	LA Course GPA	Non-LA Course GPA	LA Coefficient ⁵
BC 351	Same	124	139	2.69	2.79	-0.11
CHEM245	Same	119	175	2.43	2.37	0.03
ECON202	Same	85	256	2.56	2.58	-0.06
LIFE210	Same	323	283	2.88	2.91	0.02
MATH157	Different	32	31	2.43	1.91	0.65*
MATH159	Different	21	22	2.49	2.18	0.50
MATH160	Different	244	178	2.18	2.26	-0.09
MATH161	Different	357	341	2.46	2.77	-0.34*
MECH103	Different	396	311	2.69	2.86	-0.21*
PH 121	Same	976	979	3.00	3.02	-0.03
PH 122	Same	392	445	3.18	3.24	-0.03
Average		3,069	3,160	2.79	2.86	-0.08*

¹ Average grade points by course assigns a numeric value to the letter grade (e.g. A=4) and takes the average letter grade for students in that course. Please note that W and I grades are not included in this calculation.

² Predicted values are based on a course's linear regression model that has LA status as the primary independent variable and grade as the dependent variable controlling for student class level, gender, first-generation status, Pell grant recipient status, and racially minoritized status. The coefficient is interpreted as the predicted change in GPA for LA courses

³ Comparison type indicates if the course comparison is made across the same or different instructors

⁴ Student counts are reduced to students that earned a grade (excludes W and I grades)

⁵ The asterisk indicates statistical significance (the LA coefficient's p-value is less than .01)

On average, courses with LA have 2.79 grade point average. This is .07 grade points lower than courses without LA and is a statistically significant relationship (the model predicts a .08 decrease in grade points for LA courses relative to the non-LA course). At the course level, three of the 11 courses have statistically significant associations. Again MATH157 has a strong positive association (predicted .65 increase in grade points for LA courses), but both MATH 161 and MECH103 have relatively strong negative associations. The predicted decreases in grades points are .34 and .21 for MATH 161 and MECH 103, respectively.

Appendix C shows the analysis among students who either are a Pell grant recipient, first generation, or identify with a minoritized race/ethnicity. The results are similar. The regression coefficient for LA status is negative but no longer



statistically significant (the magnitude decreased to .06 decrease in grade points from .08). For students with a gap attribute LA usage in a course is not associated with a decrease in grade points.

Implications and Proposed Next Steps

We believe that, taken together, the course grade averages discussed above, the limitations of the study, and Mr. Jones' findings offer two implications:

- ✚ Evaluating the effects of the initial pilot may require a more fine-grained approach than comparing course grade averages. (Unfortunately, we do not have data comparable to that Mr. Jones provided for other courses that piloted the use of LAs.)
- ✚ Using all four components of the CU-Boulder LA model may be essential to achieving the improvements in academic performance that model has generated at other institutions.

Therefore, we suggest that a more targeted, fully developed pilot over three years is needed to accumulate the type and extent of data needed to evaluate the potential impact of the LA model on student success at CSU. We propose the following next steps:

- ✚ Target one to two high-enrollment courses with high D, F, W rates; significant numbers of students with gap attributes; and motivated faculty and department administrators. Consider courses in which earning a C or better correlates strongly with higher graduation rates, but prioritize faculty and departmental motivation.
- ✚ Ensure robust implementation of all four CU-Boulder components (course redesign, LA training, instructor preparation, and collaboratively designed and executed assessment). Where possible, redirect existing TILT resources to support this effort.
- ✚ Design assessments that combine traditional student success metrics (e.g. course grade averages) with other appropriate metrics developed collaboratively with instructors and with attention to the impact of LAs on the academic performance of students with gap attributes. Further, evaluate the impact of the program on both LAs themselves, examining whether their participation entails a set of HIPs, with the expected results, as well as whether it prompts LAs to continue in or add the relevant academic major, and/or shapes their career goals.
- ✚ Carry out implementation and assessment over a three-year period. Three years is typically recommended for instructors to develop sufficient expertise with a new pedagogical approach to produce improvements in student performance.
- ✚ Work with department chairs to ensure that a.) the relevant courses are taught by motivated instructors prepared to make effective use of LAs; b.) annual reviews and other evaluations include appropriate recognition of instructors' efforts (particularly important, given the high faculty effort required); and c.) key departmental entities (e.g., undergraduate committees, academic faculty) are regularly informed of the goals, progress, and evaluation results of the LA program.



Appendix A

Table A.

Description of Courses Included in the Analysis

Course (comparison type ¹)	LA sections			Non-LA Sections		
	Terms	Headcount	Section Count	Terms	Headcount	Section Count
BC 351 (same)	SP17	129	1	SP16	149	1
CHEM245 (same)	FA17	120	1	FA16	183	1
ECON202 (same)	SP17	88	1	SP17	259	1
LIFE210 (same)	FA16; FA17	348	4	FA14; FA15	294	3
MATH157 (different)	FA16	33	1	FA15	31	1
MATH159 (different)	SP17	23	1	SP16	22	1
MATH160 (different)	FA16; FA17	259	4	FA13; FA14; FA16; FA17	218	4
MATH161 (different)	SP17	376	2	SP16	354	2
MECH103 (different)	FA17; SP17;	398	3	FA15; SP16	313	2
PH 121 (same)	FA16; FA17	986	4	FA15; FA14	743	4
PH 122 (same)	SP17	398	2	SP16	447	2

¹Comparison type indicates if the course comparison is made across the same or different instructors



Appendix B

Table B.

Course Success Rates¹ by Learning Assistant (LA) Status Among First Generation, Racially Minoritized or Pell Grant Recipient Students

Course	Comparison Type ³	Observed Values		Predicted Values ²			
		LA Student Count	Non-LA Student Count	LA Successful Rate	Non-LA Successful Rate	LA Odds Ratio ⁴	LA's Predicted PP Difference
BC 351	Same	69	68	73.9%	80.9%	0.71	-5.62
CHEM245	Same	58	102	75.9%	69.6%	1.38	6.23
ECON202	Same	37	115	78.4%	81.7%	0.80	-3.58
LIFE210	Same	168	121	77.4%	81.0%	0.81	-3.38
MATH157	Different	12	12	58.3%	50.0%		
MATH159	Different	8	8	75.0%	75.0%		
MATH160	Different	106	102	61.3%	52.0%	1.62	11.71
MATH161	Different	140	151	72.9%	80.8%	0.58	-9.25
MECH103	Different	114	127	86.8%	83.5%	1.18	1.41
PH 121	Same	448	484	91.7%	94.6%	0.62	-2.70
PH 122	Same	181	218	96.1%	95.4%	1.20	0.71
Overall		1,341	1,508	83.4%	84.7%	0.90	-1.14

¹ Course Success rate is the percent of students at end of term that earned an A, B, or C grade among all students that received a letter grade or W drop/Incomplete. Data is limited to just students with at least one gap attribute and models are not run for counts less than 10.

² Predicted values are based on a course's logistic regression model that has LA status as the primary independent variable and success rate as the dependent variable controlling for student class level, gender, first-generation status, Pell grant recipient status, and racially minoritized status. The predicted probabilities assume the average level of all the control variables.

³ Comparison type indicates if the course comparison is made across the the same or different instructors

⁴ The asterisk indicates statistical significance (the odds ratio's p-value is less than .01)



Appendix C

Table C.

Average Course Grade Points¹ by Learning Assistant (LA) Status Among First Generation, Racially Minoritized or Pell Grant Recipient Students

Course	Comparison Type ³	Student Status		Observed Values		Predicted Values ²
		LA Student Count ⁴	Non-LA Student Count ⁴	LA Course GPA	Non-LA Course GPA	LA Coefficient ⁵
BC 351	Same	65	63	2.72	2.68	0.01
CHEM245	Same	57	98	2.20	2.20	0.01
ECON202	Same	36	114	2.26	2.41	-0.17
LIFE210	Same	154	115	2.81	2.72	0.15
MATH157	Different	11	12	2.03	1.72	
MATH159	Different	7	8	2.19	2.38	
MATH160	Different	98	80	1.98	2.07	-0.05
MATH161	Different	132	146	2.25	2.66	-0.44*
MECH103	Different	114	126	2.70	2.78	-0.15
PH 121	Same	439	481	2.84	2.86	-0.01
PH 122	Same	177	217	3.06	3.03	0.01
Average		1,290	1,460	2.67	2.70	-0.06

¹ Average grade points by course assigns a numeric value to the letter grade (e.g. A=4) and takes the average letter grade for students in that course. Please note that W and I grades are not included in this calculation. Data is limited to just students with at least one gap attribute and models are not run for counts less than 20.

² Predicted values are based on a course's linear regression model that has LA status as the primary independent variable and grade as the dependent variable controlling for student class level, gender, first-generation status, Pell grant recipient status, and racially minoritized status. The coefficient is interpreted as the predicted change in GPA for LA courses

³ Comparison type indicates if the course comparison is made across the same or different instructors

⁴ Student counts are reduced to students that earned a grade (excludes W and I grades)

⁵ The asterisk indicates statistical significance (the LA coefficient's p-value is less than .01)