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AN EVALUATION OF THE LEARNING ASSISTANT MODEL IMPLEMENTATION IN GATEWAY ENGINEERING COURSES

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Abstract

High attrition rates remain a persistent challenge in gateway engineering courses, hindering student progression and ultimately affecting middle-year retention rates within engineering programs. This study aims to assess the impact of undergraduate learning assistants on student learning in the fundamental engineering courses Statics, Dynamics, and Thermodynamics. The model, often referred to as the Learning Assistant (LA) model, has been primarily adopted in the Science disciplines such as Chemistry and Biology, and has demonstrated success in improving student learning outcomes. Although the implementation of the LA approach has been examined in the sciences, studies investigating the benefits of LA involvement in enhancing student learning in engineering, especially in courses with very high enrollments, are scarce. The authors aim to address this void through this study. The authors involved LAs to support student-centered learning both inside and outside the classroom through the following approaches: LA assisted active learning sessions during in-class lectures; LA led learning (recitation) sessions outside the regular lecture period; and LA supported hands-on project-based activities. These interventions were implemented in the courses mentioned above. All three courses are high-enrollment and challenging gateway engineering courses at the authors' institution. The effects of the LA interventions on student performance and perceptions were assessed through course grades and student surveys. Preliminary results indicate promising, positive impacts of this multi-pronged approach.

Introduction

Middle-year retention of undergraduate engineering students remains a challenge at many universities in the United States. Although universities have implemented measures to increase first-year engineering student retention, middle-year retention remains a work in progress for most [1]. Low success rates in gateway engineering courses such as Statics, Dynamics, Thermodynamics, and Solid Mechanics, typically taken by students in their middle years (2^{nd} or 3^{rd}) of college, contribute significantly to student dropout rates in engineering programs. Additionally, high student enrollment in these gateway courses can lead to large class sizes, thus creating barriers to student progression and retention. Competitive and unwelcoming environments in large classes often introduce social and psychological barriers that ultimately affect student success. Research consistently demonstrates that a sense of inclusion within educational settings can significantly impact student engagement, achievement, and long-term aspirations [2]. Peer support groups, such as undergraduate learning assistants, can significantly foster a sense of belonging and academic persistence among students.

LAs are trained undergraduate students who have successfully completed a course and can support student learning of the course materials alongside instructors by encouraging active student engagement and supporting peer discussions in lectures, recitations, or laboratory settings [3], [4]. According to Clements et al., LAs can improve students' experience in STEM courses through two pathways: reducing students' social and psychological barriers, strengthening their sense of belonging, and improving the planning and implementation of active learning strategies in the course [4]. Research has shown that active learning strategies can improve student engagement, attendance, and student attitude towards discipline [5], [6]. Despite overwhelming evidence, most instructors still use traditional teaching methods in large-enrollment courses, resulting in lower success rates.

The LA model was first introduced at the University of Colorado in 2001 and has since been adopted by many universities with positive benefits on student learning. For example, Talbot and coworkers have demonstrated increased student satisfaction and improved perceptions of engagement in large-enrollment introductory science courses using LA support [7]. Similarly, numerous studies have shown that students in LA supported science courses have performed better in exams and earned higher overall grades than students in traditional courses [8]-[12]. Another longitudinal study revealed that LA support in the first semester of introductory chemistry, calculus, or physics reduced the probability of failure in subsequent gateway STEM courses, whether LA supported or non-LA supported [13]. Although the LA model has been widely adopted in the sciences, in engineering, peer-support groups, such as peer-led team-based tutoring, have mostly been adopted for first-year engineering students [14], [15]. Literature on the implementation of the LA model in engineering is scarce, especially in gateway engineering courses that serve as bottlenecks to middle-year engineering retention [16]. LAs support engineering courses in a different way from traditional peer-tutoring programs in most engineering programs, as they work closely with course instructors to implement active learning and peer discussion strategies both inside and outside the classroom, as well as in lab-based activities. Additionally, the LAs are trained through pedagogical courses and by instructors to support student learning effectively.

After the initial success of the LA model in the sciences, the model has been adopted in fundamental engineering courses at the author's institution during the COVID-19 pandemic. However, the effect of the LA model on student learning and perceptions has not been examined before. To explore the impact of the LA model in engineering at the authors' institution, the authors designed and conducted a multi-course research study on the integration of LAs into the bottleneck gateway undergraduate engineering courses Statics, Dynamics, and Thermodynamics. All three courses are foundational subjects in the engineering curriculum and encompass complex concepts and mathematical rigor, often posing significant challenges for students [17], [18]. Success in all three courses impacts the retention of engineering students through the middle years of the program. The authors designed a multi-pronged approach to involve LAs both inside and outside the classroom in the courses, as elaborated in the next section. The effects of these interventions were assessed by analyzing course grade and survey data.

2. Methods

2a. Study Design and Research Questions

In this paper, the authors examine the integration of LAs into the foundation engineering courses of Statics, Dynamics, and Thermodynamics through a structured approach (Figure 1) and its effects on student performance and student perceptions of learning. In all three courses, the LAs helped students learn the course materials by assisting with active learning sessions during in-class lectures, conducting regular weekly learning sessions outside the in-class lecture period, and supporting students during hands-on project-based activities.

The impact of these targeted LA interventions on students' perceptions and performance was evaluated by investigating the following research questions:
1) What effect does LA involvement in classroom lectures, learning sessions, and hands-on project sessions have on student performance and retention in gateway engineering courses?
2) Does LA involvement in foundation classes enhance students' sense of belonging in engineering?
3) How do students perceive the role and value of LAs in fostering engagement and learning in gateway engineering courses?

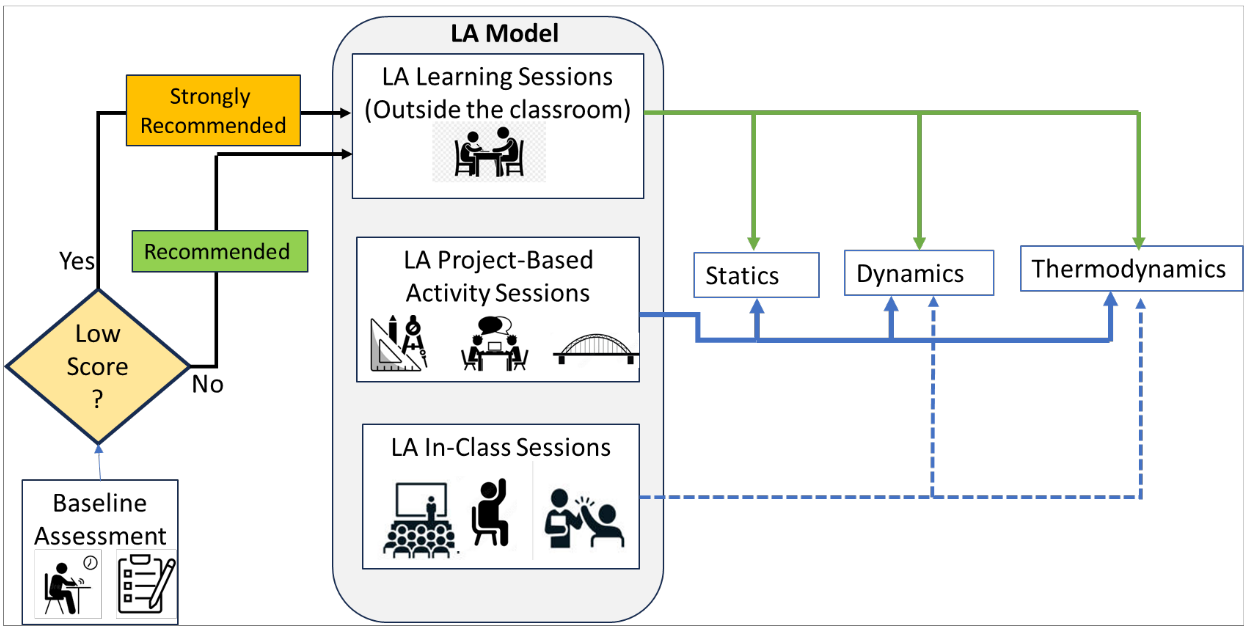


Figure 1: Overview of the LA model implementation in the engineering courses

2b. Course Descriptions

This study was conducted across three sections, one each of the Statics, Dynamics, and Thermodynamics courses offered by the College of Engineering and Computer Science at the authors' institution. All three are gateway courses required for students in the Mechanical and Aerospace Engineering program, and the first two are required for students in the Civil and Construction Engineering and Industrial Engineering programs, while the first is required for all engineering majors and thus has a significantly higher enrollment. Students in their second or third year typically take these courses sequentially.

Statics is a critical gateway course within the engineering curriculum. The course addresses essential engineering concepts such as vector analysis, force systems, equilibrium of particles and rigid bodies, free-body diagram construction, analysis of trusses, frames, and machines, distributed loading, centers of gravity, areas, moment of inertia, and internal forces, including shear and moment diagrams. The total enrollment during the semester in which the LA study was conducted was 628 students. Student demographics in the Statics course included 70% white and 30% non-white, 65% non-Hispanic and 35% Hispanic, and 75% male and 25% female. The Statics course was offered using a mixed-mode (blended) instructional model. This model intentionally reduces traditional in-class lecture time, giving the students the flexibility and responsibility to learn at their own pace. The most challenging topics were delivered as in-person weekly lectures (50min-75 min), and the easiest topics were posted as pre-recorded videos that the students were in charge of reviewing and learning from. For most topics, fundamental theory and example problem solutions were introduced via pre-recorded videos, allowing in-class time to focus on deeper conceptual engagement and application. The students' assessment for this course consisted of 8 digital homework assignments, 6 project-based active-learning assignments, five quizzes, 2 midterm exams, and a final examination. All quizzes and exams were taken by students at the proctored testing center, the Evaluation and Proficiency Center (EPC), maintained by the College of Engineering.

The Dynamics course was taught in a blended format, with reduced in-class lecture time, during the semester in which the LA study was implemented. The weekly course instruction consisted of one face-to-face 75-minute lecture and one to two pre-class lecture videos totaling approximately 70 minutes. The section enrollment for Dynamics during the implementation semester was 320. Student demographics in the Dynamics course included 76% white and 24% non-white, 68% non-Hispanic and 32% Hispanic, and 74% male and 26% female. Typically, the students are in their sophomore or junior year when taking this course and have completed the preceding Statics course. Learning topics in this course include particle kinematics, particle kinetics, energy and momentum approach, planar rigid-body kinematics, planar rigid-body kinetics, and three-dimensional rigid-body motion. Course lecture videos introduced weekly concepts to the class, with a few example problems, while the in-class lectures focused heavily on concept application through active-learning problem-solving exercises. The assessments for the Dynamics course included post-class reading and homework (HW) assignments to provide students with practice opportunities; in-class active-learning poll questions; hands-on, project-based assignments; and three exams administered digitally through the proctored testing center.

The Thermodynamics course was taught in a mixed-mode format with lecture videos and 75 minutes of in-class lecture time. The 225 students enrolled in the Thermodynamics courses completed Smart Book reading homework and watched lecture videos before class to prepare for the in-class lecture. The in-class lectures focused on concept review and problem solving. The assessments for this course included hands-on project-based assignments and three exams administered digitally through the proctored testing center. Student demographics in the Thermodynamics course included 72% white and 28% non-white, 67% non-Hispanic and 33% Hispanic, and 73% male and 27% female.

2c. LA Recruitment and Training

The LAs for the foundation courses were recruited through the LA recruitment program at the author's institution. A total of 6 LAs (two per course) were recruited for the three courses. The instructors of the respective courses reviewed applicants and recruited them from the application pool. Selection of LAs for their respective courses was primarily based on the candidate's cumulative GPA (3.8 or higher) in the program of study, performance in the foundation courses (course grades of A in the prerequisites and the course of interest), and desire to teach and help peers, as assessed from answers to curated questions in the application. During the first semester of recruitment, the LAs completed a non-credit pedagogical training course, “LA training course,” conducted by the College of Engineering and the Department of Chemistry at the authors’ institution. In this semester-long course, the LAs completed weekly asynchronous modules and five synchronous meetings covering topics such as classroom discourse, questioning, formative assessments, student misconceptions, and metacognition. The LAs also received content-specific training during weekly meetings with the course instructors to review learning session topics and in-class and project-based activities, and to discuss challenges encountered and ways to mitigate them. The learning goal for these training practices was to foster STEM communication and teaching skills, and to identify and build connections between theories of learning and practical classroom experiences in the LAs.

2d. LA Assisted In-Class Sessions

LAs participated in active learning sessions during the in-class lectures of the Dynamics and Thermodynamics courses. As mentioned in the previous section, students were introduced to weekly course concepts through one or two lecture videos before the in-class lecture. For the Dynamics course, the 75-minute in-class lecture was divided into two segments. The instructor led the first 50 minutes, focusing on concepts and problem-solving. The last 25 minutes involved LA-facilitated active learning through poll questions. Students worked with peers to solve a practice problem and respond to class polls, with LAs assisting. For the thermodynamics course, LAs assisted students with problem-solving exercises during the entire in-class period. After the class, the thermodynamics students completed a 30-minute at-home quiz instead of an in-class poll.

2e. LA Led Learning Sessions

LAs were involved outside of class lecture time in conducting learning sessions to assist students struggling with the course content in all three courses (Statics, Dynamics, and Thermodynamics). Weak or struggling students were identified through a diagnostic quiz (Baseline Quiz) based on course prerequisite knowledge (primarily Math and Physics) at the beginning of the semester. Students scoring 60% or lower on the diagnostic quiz were assigned to a weekly 75-minute LA-led Learning Session to review and practice prerequisite Math and Physics problems, as well as course-specific concepts and problems for the Dynamics and Thermodynamics courses. Attendance was recorded for students who attended these Learning sessions, and students were encouraged to participate through multiple reminders and classroom announcements throughout the semester. These sessions were open to all students in the respective classes, although they were designed with struggling students in mind. For the Statics course, instead of a fixed weekly learning session time, students were encouraged to attend LA tutoring sessions as needed and at their convenience. The LAs held several hours of Statics tutoring sessions every day of the week.

2f. LA Supported Project-Based Activity Sessions

Hands-on, project-based, active-learning assignments were assigned in all three courses during the semester of implementation. These hands-on assignments targeted critical course concepts that

students often struggle to comprehend. For example, in the Dynamics course, students were given experiments on concepts such as friction and Newton's law of rotational dynamics. Students collaborated in teams to conduct experiments, with assistance from the LAs. Typically, the LAs would run a demo in front of student teams, following which the student teams would conduct their own experimentation with LA guidance on setup and troubleshooting. Inexpensive PASCO experimental kits were used in the project-based activities for the Dynamics course.
Similarly, in the Statics course, project-based assignments included force decomposition with non-perpendicular axes; 2D particle equilibrium with springs; 3D particle equilibrium; 2D rigid-body equilibrium (crane tipping load); 3D rigid-body equilibrium; and trusses. In the Thermodynamics course, students conducted simple, safe experiments on the expansion of water at low temperatures, between 0 °C and body temperature, as part of their project-based assignments.

2g. Data Analysis

The effect of the LA intervention on student success and retention in the gateway engineering courses was determined through a comparative analysis of course grade data for student groups that used the LA support in in-class and out-of-class sessions versus those who did not. To gauge students' perceptions of the impact of LAs on engagement and learning in the courses and on overall course satisfaction, Institutional Review Board (IRB) approved surveys were administered in all three classes. The surveys included open-ended and Likert-scale questions focused on the study design, LA practices, the value of LAs, and sense of belonging. The surveys were administered through the Canvas platform (Webcourses) at the authors' institution at the end of the semester and were voluntary. However, students were incentivized to complete the survey by offering an extra credit point toward their cumulative course grade.

3. Results and Discussion

3a. Effect of LA Led Learning Sessions on Student Performance and Retention

To investigate the first research question on the impact of LAs on fostering student learning both inside and outside the classroom on student performance and retention in engineering courses, the authors analyzed and compared the final course grades of students who utilized the inside and outside classroom LA intervention sessions versus the students who did not attend or utilize these LA interventions. The use of LA resources by students was tracked through student attendance. Figure 2 shows the effect of the LA learning sessions on students' final course grades in the Dynamics and Thermodynamics courses. As mentioned in the Methods section, the LA learning sessions were explicitly designed for students struggling with prerequisite knowledge in Math and Physics for their respective courses. These students were identified through a diagnostic baseline quiz administered during the first two weeks of classes. Students scoring lower than 60% were encouraged to attend the weekly LA learning sessions. Figure 2 compares the cumulative course grades in Dynamics and Thermodynamics of two student groups: students who attended learning sessions (with 3 or more recorded attendances) and students who did not participate in or had only 1 or 2 recorded attendances. In the Dynamics course, of the 101 students assigned to LA learning sessions, only 40 attended, while in the Thermodynamics course, only 26 of the 127 assigned students attended. As observed in the figure, in both courses, the student groups who attended LA sessions received higher percentages of 'A', B', and 'C' course grades than the groups who did not participate in LA sessions. These preliminary results validate the benefits of the LA learning sessions in improving course performance in challenging gateway courses for struggling students. Another notable observation in Figure 2 is the impact of the LA learning sessions on the retention of the struggling students in challenging courses. The failure (F) and withdrawal (W) rates were notably higher for the student groups that did not attend the LA learning sessions: 10% in Dynamics and 7% in Thermodynamics. The results thereby strengthen the need for such additional learning sessions in fundamental core courses with large class sizes.

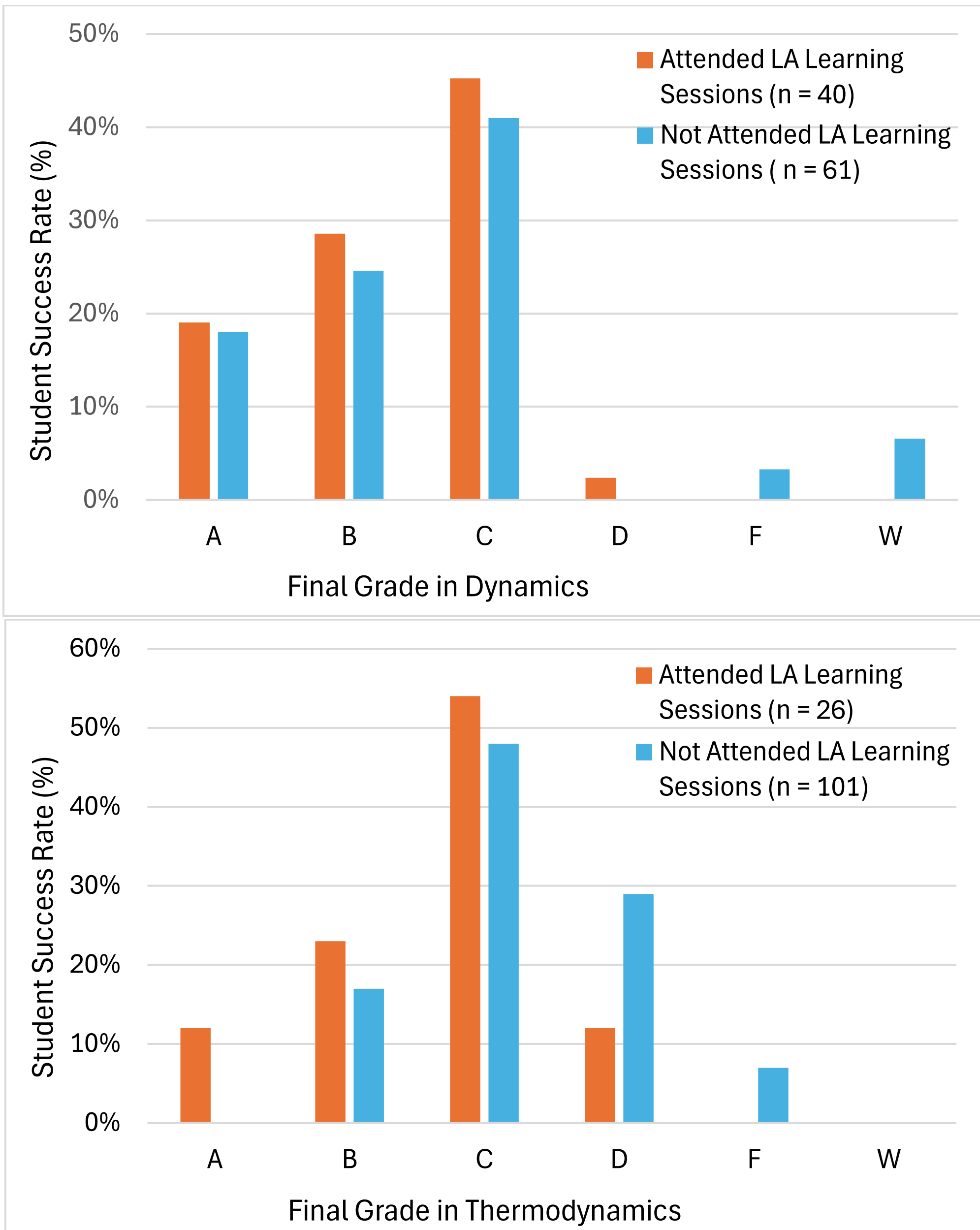


Figure 2: Effect of the LA learning sessions on students' final course grades in the (A) Dynamics and (B) Thermodynamics courses.

3b. Effect of LA Assisted In-Class Sessions on Student Performance and Retention

Figure 3 shows the effect of in-class LA interventions on student course performance and retention. The data presented here are for the Dynamics course, in which attendance and student participation were tracked through in-class poll quiz responses administered during lecture time. As mentioned in the methods section, the LAs, along with the instructor, assisted the students in in-class problem-solving activities by providing guidance on a step-by-step approach and pointing out problem-solving strategies. In the figure below, the authors compare course letter grades and pass/fail rates for students who attended 75% or more of the in-class LA sessions with those who attended fewer sessions. The cut-off for class participation was kept high because the class met only once a week for in-person lectures, and each class covered distinct concepts integral to learning the course material and performing well in the course. As shown in the figure, 100% of the student group that attended 75% or more of the in-class LA and instructor sessions passed the course, compared with the student group that attended 75% or less of these sessions. Additionally, the student group that attended the in-class sessions received significantly higher ‘A’ grades (>30%) in the Dynamics course compared to the other group. These results reinforce findings from numerous studies in the literature emphasizing the importance of class attendance and active learning activities for course performance. [5], [19] Similarly, in-class LA sessions were also conducted in the Thermodynamics course, although student participation was not tracked.

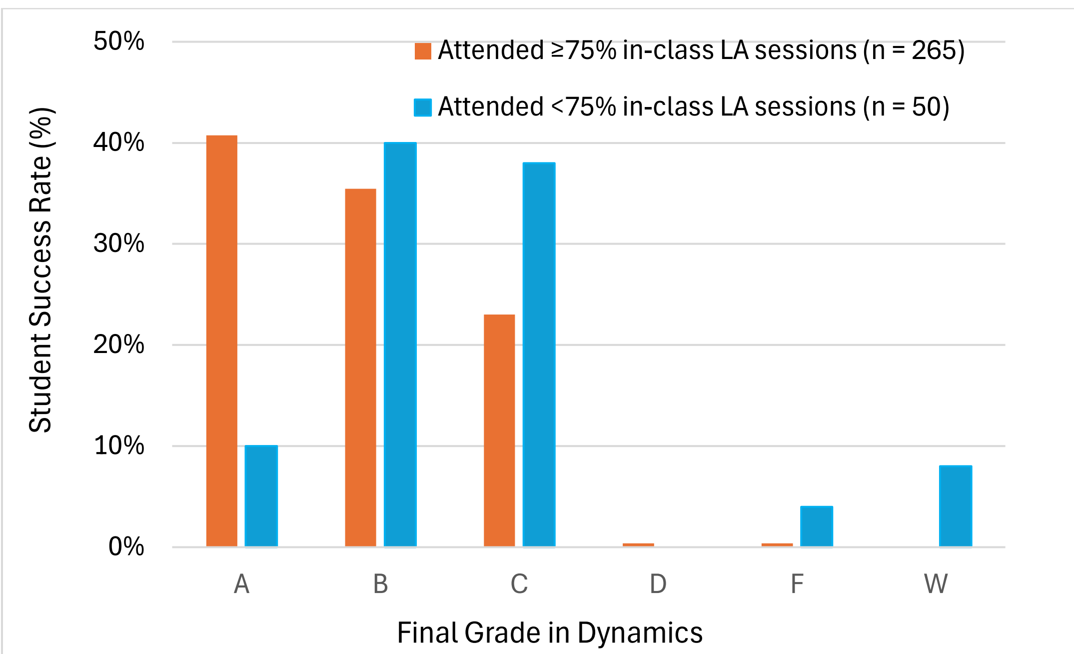


Figure 3: Effect of the in-class LA active learning sessions on student performance in the Dynamics course.

3c. Effect of LA Supported Project-Based Activity Sessions on Student Performance

Figure 4 shows the effect of LA support and involvement in project-based assignments on course grades in the Statics course. The average grades for six mini-projects are compared between students who attended the LA supported project sessions (n1 in the figure) and those who did not (n2 in the figure). Across all six project sessions, students who attended the LA supported sessions consistently performed better than their peers who did not attend. The performance gap ranged from approximately 2 to 6 percentage points, depending on the project, with the largest difference observed in the first project. Although the number of students (n1) who attended LA-supported sessions was substantially smaller than that of the non-attending group (n2) for each mini-project, the grade advantage for the LA supported cohort remained stable throughout the semester. For the third project, performance was nearly identical between both groups n1 and n2. Average grades for projects 4 and 5 are slightly lower for those seeking LA support. This decrease could be explained by a contextual factor: a substantial number of students did not submit these assignments on time and received zero grades, which significantly affected the overall averages, especially for the LA supported group. The authors believe that this pattern does not indicate reduced instructional value of LAs but could reflect the effect of mid-semester workload pressure. Overall, students who remained engaged and submitted their work continued to benefit from LA support. These findings suggest that participation in the LA supported project activities may contribute to stronger conceptual understanding and improved performance on hands-on assignments.

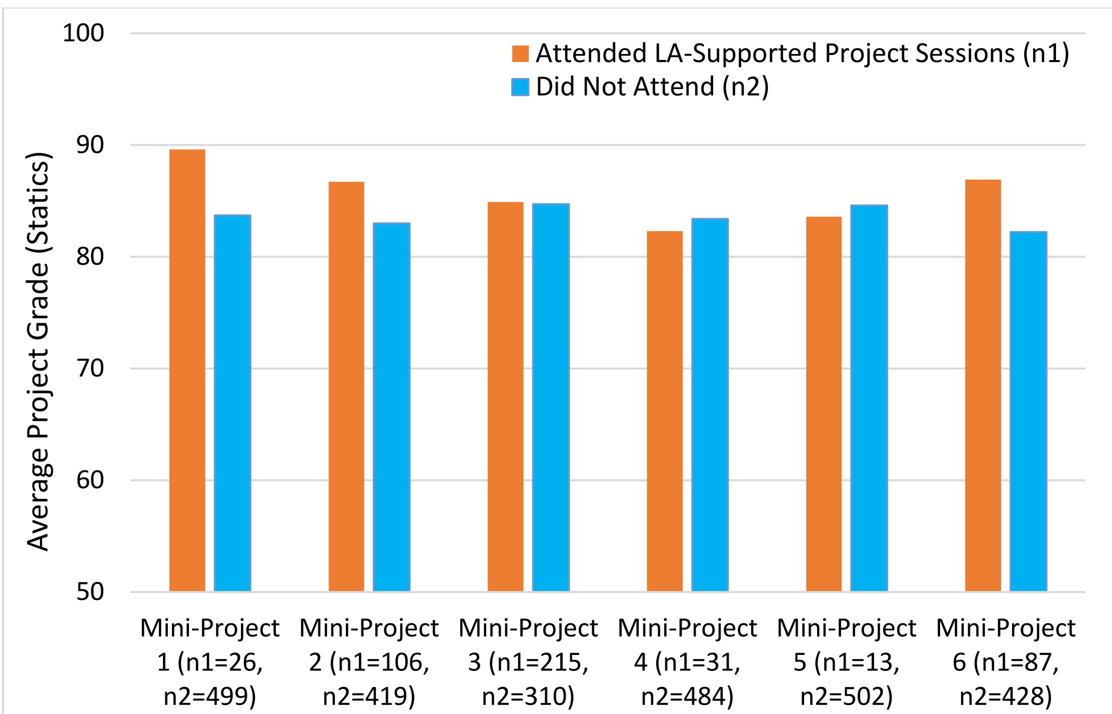


Figure 4: Effect of the outside class LA supported hands-on project sessions on project grade in the Statics course.

Figure 5 illustrates the distribution of final course grades in Dynamics for students who attended the LA supported project sessions compared with those who did not participate. The data show a clear performance distinction between the two groups. Students who attended the LA supported sessions earned a substantially higher proportion of A grades (about 44%) than those who did not attend (about 22%). Additionally, students who participated in the project-based sessions had a significantly lower DFW rate (1%) than students who did not participate (8%). Notably, no withdrawals occurred among students who did the LA supported project-based sessions. Overall, the grade distribution suggests that participation in LA supported project activities is associated with improved course performance and reduced rates of unsuccessful outcomes in this gateway Dynamics course.

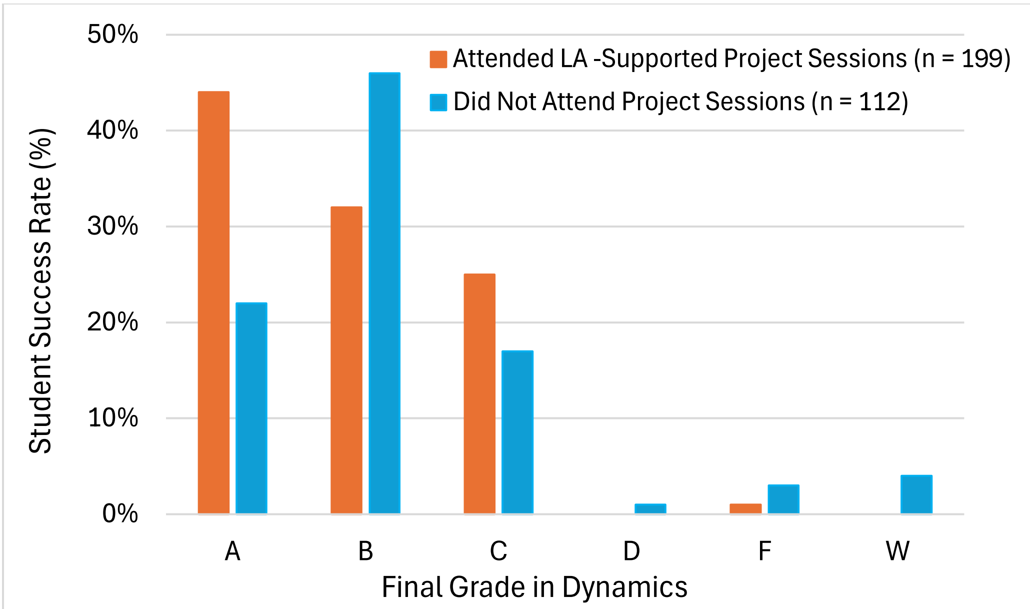


Figure 5: Effect of the outside class LA supported hands-on project sessions on overall course grade in the Dynamics course.

3d. Student Perception of Impact of LA Support on Learning

Table 1 shows the exit survey results on students' perceptions of the value of LAs in fostering learning of course content in all three courses: Statics, Dynamics, and Thermodynamics. The survey data were collected to examine the second research question, which delves into the value of LAs in supporting student learning, using students' self-reported responses. As shown in Table 1, the students provided positive feedback on the impact of LAs on their learning of the course content through LA supported in-class and out-of-class activities across all three courses. 62 to 71% of the survey respondents felt that the LA interactions helped them learn the course materials better, and 58 to 72% agreed that the LAs had adequate knowledge and preparation to support them. In the Dynamics course, 62% of students appreciated the presence of LAs and the support they provided during in-class sessions, while 60–67% of students across all three courses valued LA support in learning and tutoring sessions. LA support in mini-project sessions was most appreciated in the Statics course (72%). Feedback on questioning strategies by LAs that encourage students to think critically was slightly lower (30%) in all three courses, which calls for more training of LAs by the instructors on that aspect. In general, the majority of students (73-81%) valued the support provided by the LAs across the three fundamental engineering courses on which the study was conducted. The findings are similar to previous studies in other STEM fields, such as Physics, Chemistry and Biology, which have shown that LAs contribute to creating a supportive learning and classroom environment that also affects students' psychosocial characteristics, such as self-efficacy, belonging, and confidence [3], [4], [12], [20].

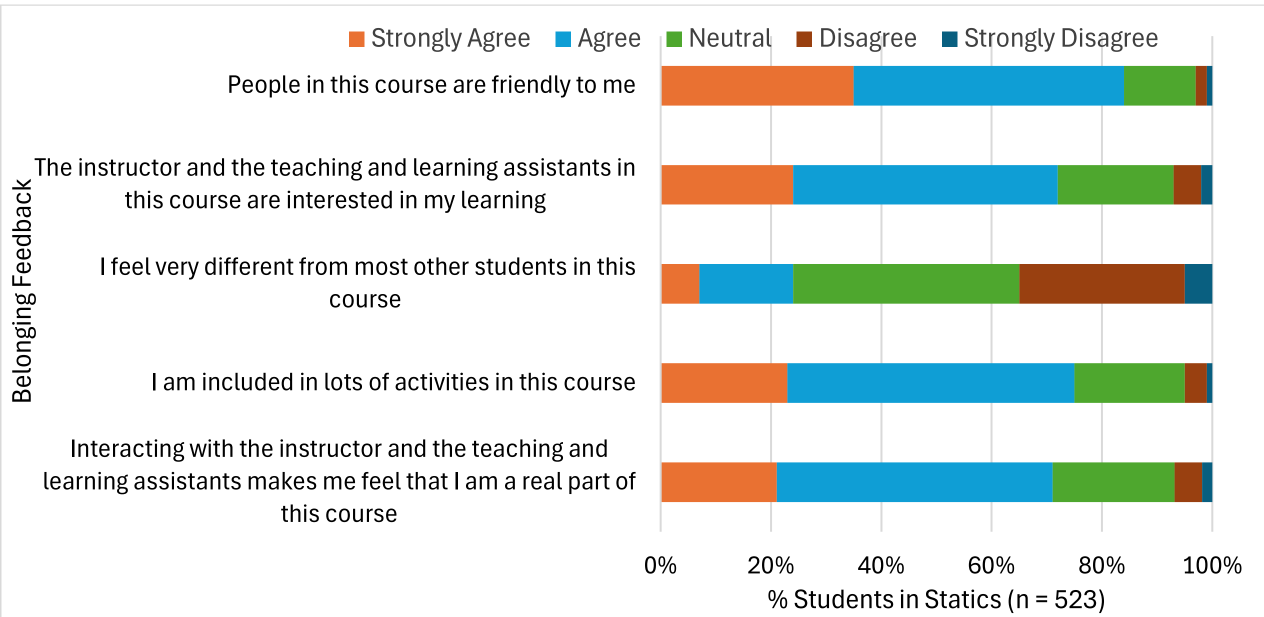
Table 1: Exit survey data on student perception of the influence of LAs on learning course content in Statics, Dynamics, and Thermodynamics

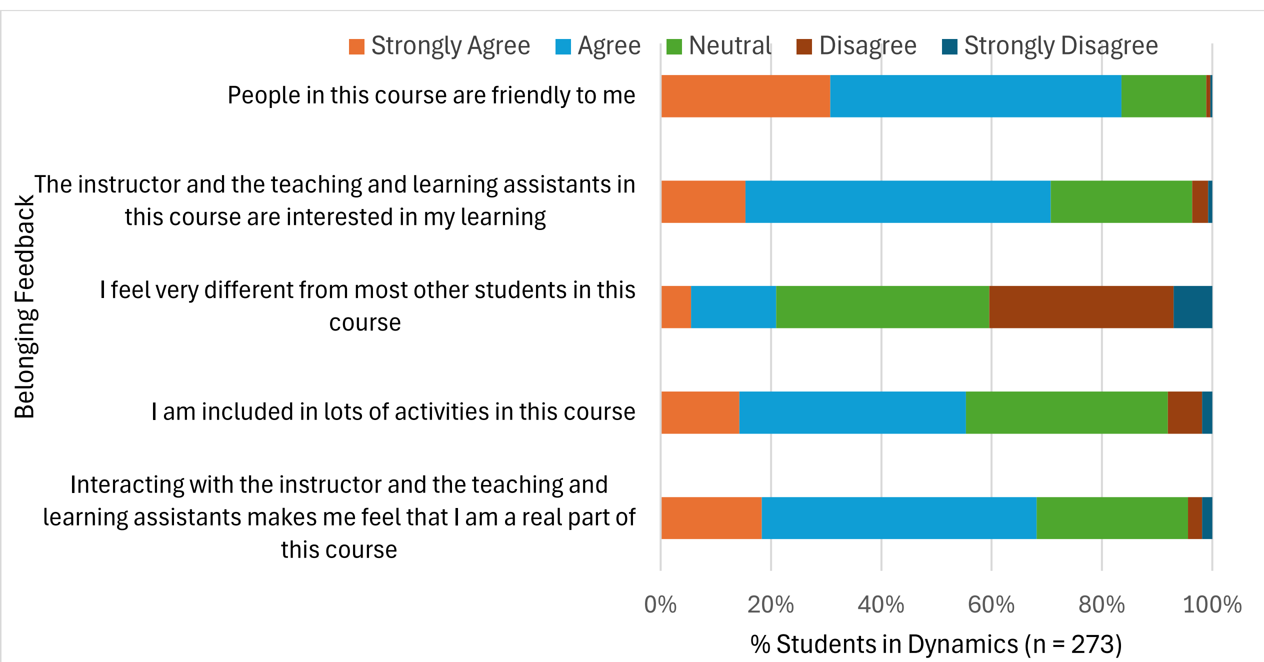
S = Statics, n =523; D = Dynamics, n = 273, T= Thermodynamics, n = 171

Exit Survey Questions on LA Practices and Value of LAs	Strongly Agree - Agree (%)			Neutral (%)			Strongly Disagree - Disagree (%)		
	S	D	T	S	D	T	S	D	T
The LAs can explain concepts in a manner that is easy to understand	70%	67%	67%	27%	31%	33%	3%	1%	1%
When I interact with LAs, they provide me with helpful feedback specific to my question.	76%	66%	64%	21%	33%	34%	3%	1%	2%
When I ask a question about content, the LAs respond with guiding questions to lead me to a solution	71%	64%	55%	27%	34%	40%	3%	1%	5%
When I ask a question about content, LAs give me an answer without encouraging me to think about it first	30%	32%	32%	28%	38%	40%	42%	30%	20%
The LAs help me identify what I don't know or don't understand	65%	62%	62%	31%	34%	35%	4%	1%	3%
I feel comfortable asking the LAs questions about course content	73%	71%	64%	21%	26%	31%	6%	4%	5%
After interacting with an LA, I feel more confident with the course content	64%	64%	58%	31%	34%	38%	5%	3%	5%
The LAs have a sufficient understanding of the course content	79%	80%	77%	19%	7%	22%	2%	0%	1%
I value the support provided by the LAs in the class	80%	81%	73%	17%	16%	24%	3%	3%	3%
The feedback that LAs give me is helpful for my learning of the course content	73%	71%	61%	22%	28%	37%	5%	1%	2%
I find the interactions with LAs during in-class activity helpful	*na*	62%	45%	*na*	32%	47%	*na*	6%	8%
I find the interactions with LAs during learning sessions helpful	60%	67%	66%	34%	30%	31%	6%	3%	3%
I find the interactions with LAs during mini-project sessions helpful	72%	46%	31%	23%	45%	62%	5%	9%	7%
The LAs were well-prepared for the in-class/learning/project sessions	67%	72%	58%	28%	24%	36%	5%	4%	6%

3e. Student Perception of Impact of LA Support on Belonging

Pedagogical literature has consistently demonstrated that a sense of inclusion or belonging within educational settings can significantly impact student engagement, achievement, and long-term aspirations [1], [2]. Past studies in STEM fields have shown that the social and cognitive similarities between LAs and peer students in the class allow them to express greater empathy and a better understanding of students' experiences in LA supported classrooms, thereby enhancing the learning process and diminishing feelings of social isolation [4]. This motivated the authors to use exit survey questions to examine LA involvement and students' sense of belonging in the Statics, Dynamics, and Thermodynamics courses. Figure 6 shows preliminary results of the exit survey.





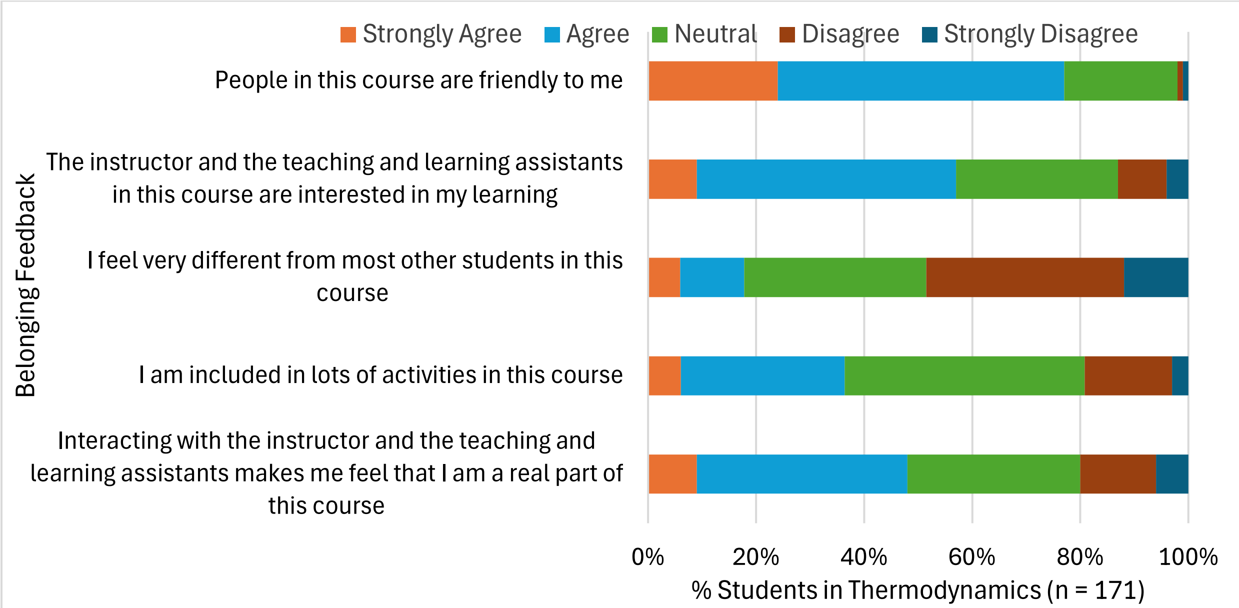


Figure 6: Feedback on student belonging in the Statics, Dynamics, and Thermodynamics courses collected from exit survey responses.

The students' responses to belonging questions were quite positive across all three courses. In the Statics and Dynamics courses, 68–71% of survey respondents perceived themselves as a real part of the classroom community, while 70 -72% reported that they believed the instructor and LAs were interested in their academic success. More than half of the students in the Thermodynamics course expressed similar opinions in the survey. Additionally, 55% of students in Dynamics reported strong engagement in many course activities. The majority of students (77-84%) across all three courses felt their peers were amiable, while 18-24% felt somewhat different from others in the course. The data, though positive, reflects the inherent challenges of cultivating a strong sense of belonging in large-enrollment, conceptually demanding engineering courses that serve students from diverse backgrounds and with varying levels of prerequisite knowledge. The data also underscores the need to continue modifying and strengthening LA instructional practices in these courses at the institutional level.

Conclusion and Future Work

This study examined the impact of a multi-pronged LA integration model on student success and students' perceptions of learning and belonging in three foundational gateway engineering courses: Statics, Dynamics, and Thermodynamics. These courses play a critical role in the progression and retention of middle-year engineering students. LAs supported students through in-class active learning activities, out-of-class learning sessions, and hands-on project-based assignments. The effectiveness of the LA supported sessions was measured by comparing course grades and assignment data between student groups that attended the sessions and those that did not.

The study results indicate that both the in-class and out-of-class LA sessions positively affected students' learning experience in the course. In the Dynamics and Thermodynamics courses, students who needed and attended the outside-class learning sessions received higher percentages of "A", "B", or "C" grades than students who did not attend. Similarly, 100% of the students in the Dynamics course who participated in the LA facilitated in-class active learning sessions passed the course with an "A", "B", or "C" grade, compared to 75% for the student group who did not participate. Similar positive effects of the LA supported project-based sessions were evident in the Statics course project assignment grades. Exit survey results from all three courses on students' perceptions of learning demonstrated high confidence in LA support in the different course activities. 75-80% of students in all three courses valued and trusted the support provided by the LAs. Although students' sense of belonging showed encouraging trends, the data also suggests opportunities for continued refinement of LA practices. A shortcoming of the current study is that it is a pilot study and analyzes only one semester of implementation data. To address this limitation, when analyzing student success rates in the course, course grades were compared between student groups that used the LA resources and those that did not, as tracked by the instructors and the LAs through recorded attendance. Future studies will include a more robust implementation of control groups

The data gathered from this study provide helpful insights for instructors on areas for improvement in implementing the LA model in engineering courses. Future efforts would involve strengthening LA instructional and mentoring practices to better prepare them to support students, act as role models for peers, and increase their belonging in the program. The research team plans to continue implementing and evaluating LA interventions across multiple semesters and to analyze student performance and success using statistical tools and control groups. This will enable longitudinal tracking of student performance, persistence in advanced coursework, and retention in engineering programs. Overall, the findings suggest that the LA model holds strong promise for improving learning outcomes and student experiences in gateway engineering courses.

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