Veterans Assisting Veterans Using Peer-led Team Learning

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Abstract

This work is an Evidenced-Based Practice Paper. Peer Led Team Learning (PLTL) involves a peer leader who facilitates active learning sessions with a small group of students. The intent of the PLTL is to assist in the learning of various topics and concepts introduced in a course. PLTL has been a successful peer support intervention in traditional classroom environments in science, technology, engineering and mathematical (STEM) education. This National Science Foundation (NSF) sponsored work under the Improving Undergraduate STEM Education (IUSE) program seeks to investigate the effectiveness of PLTL in an online campus environment at a unique, private university recognized for offerings in aerospace and aviation-related degrees. Peer leaders are recruited from, and have achieved success in, various undergraduate courses that have historically proven difficult for students in completing their engineering degree. Those courses include statics, dynamics, digital circuit design, and aerodynamics. Selected peer leaders participate in a leadership training program which includes providing effective feedback, online communication techniques, leadership strategies, and active learning techniques. A large student population of the online campus is either military veterans or currently serving military personnel. This demographic characteristic results in a larger percentage of military and veteran students both serving as peer leaders and as students participating in the program. This work examines how military service influences students' willingness to serve as a peer leader, how military and veteran peer leaders perform, and how military and veteran students respond to peer leadership. The intent is to leverage military and veteran leadership experience to better improve the training of peer leaders to facilitate learning for all students. It also provides a great opportunity to witness veteran students assisting other veteran students to succeed in their education.

Keywords: Peer-led team learning (PLTL); active learning; STEM, Non-traditional groups; Veterans in engineering pathway

Introduction

Peer Led Team Learning (PLTL) involves a peer leader who facilitates collaborative learning sessions with a small group of students using strategies such as muddiest point, think-pair-share, round robin, gallery walk, and concept drawing. The intent of the PLTL is to assist in the learning of various topics and concepts introduced in a course. PLTL has been a successful peer support intervention in traditional classroom environments in science, technology, engineering and mathematical (STEM) education and is yet to be fully explored in an online asynchronous learning environment [1] [2]. This National Science Foundation (NSF) sponsored work under the Improving Undergraduate STEM Education (IUSE) program seeks to investigate the effectiveness of PLTL in an online campus environment at Embry-Riddle Aeronautical University Worldwide campus.

Approximately 54% of the undergraduate population of the online campus are either military veterans or currently serving military personnel. As a result, a larger percentage of military and veteran students both serve as peer leaders and as students participating in the program. Research shows that increased interactions outside of the traditional classroom can offer social connections to support military veterans in engineering pathways [3]. The maturity and leadership skills developed during military service enables military students to assist traditional students with complex problems [4]. Also, veterans and service members in engineering related fields are better acclimated through the mentorship of other veterans because their shared experiences help to establish mentoring relationships [5]. Likewise, research shows that peer mentorship is a proven strategy to support undergraduate student veterans [6].

This work examines how military service influences a students' willingness to serve as a peer leader, how military and veteran peer leaders perform, and how military and veteran students respond to peer leadership. The intent is to leverage military and veteran leadership experience to better improve the training of peer leaders to facilitate learning for all students. It also allows for strong opportunities to witness veteran students assisting other veteran students to succeed in their education.

Research Plan

The overall research hypothesis for this work is that PLTL learning support in courses with high attrition rates that integrated applied mathematics, specifically statics, dynamics, aerodynamics, and digital circuit courses, will support engineering education and lead to greater persistence in associated engineering degrees. The three research goals for this research are:

- **Goal #1:** Increase students' commitment to engineering pathways.
- **Goal #2:** Increase academic performance and persistence in engineering.
- **Goal #3:** Increase persistence of Veterans in engineering pathways.

Two of the projects' primary outcomes highlighted in this paper focus on both the academic success and commitment of Veterans to engineering pathways. The research team evaluated measures of success by analyzing the average final grades of veteran students participating in the PLTL labs compared to veteran students in non-PLTL groups. Commitment to engineering pathways was determined by the number of veterans in PLTL labs who declare or maintain their status in engineering.

Course data is used to assess academic performance and institutional data is used to trace persistence. Enrollment data is collected to track students in the upper-level engineering course sequence as well as major declaration compared to non-PLTL groups. Focus groups, peer leader journals, classroom observations, and faculty surveys are used to assess commitment to engineering and engineering identity. Non-cognitive factors that have a promising effect on commitment such as motivation, self-efficacy, and confidence are measured using pre- and post-survey instruments [7].

Peer Leader Training

The first step in this work was the development of a 10-hour self-paced peer leader training course. This course consists of three modules. In the first module, the peer leaders start by learning about themselves. They develop an understanding of how they learn and begin to examine their personality and leadership style. In the second module, the peer leaders learn how to effectively communicate online to a diverse student audience. Another objective of this second module is learning how to build community and establish peer relationships using empathy. The final module allows the peer leaders to practice their newly developed leadership and communication skills with an example assignment. The peer leaders demonstrate how to provide effective feedback using an active learning technique, such as think-pair-share or muddiest point.

The peer leaders are undergraduate students who have recently and successfully completed the course(s) for which they are being recruited. They must have a minimum of a B average with a clear preference for an A average. Grades are not the only criteria. The research team asks the instructors of the targeted engineering courses who they would recommend as potential peer leaders. The recruitment of the peer leaders is repeated approximately six to eight weeks prior to the start of the term to allow for hiring, onboarding, and completing the peer leader training course.

During Year 1 (AY22-23), eight peer leaders were trained. Three of those eight peer leaders (37.5%) were military students (i.e., a veteran or currently serving). These eight peer leaders served in four engineering sections (one section in the January 2023 term and three sections in the March 2023 term). Four of the original peer leaders returned for Year 2. In the Fall terms for Year 2 (August 2023 and October 2023 terms), seven peer leaders served in five engineering sections. Two of those seven peer leaders (28.6%) were military students.

Year 1 Experience

The first half of Year 1 (AY22-23) was allocated to the development of the peer leader training course, developing PLTL activities, and recruiting peer leaders to serve during the Spring 2023 terms (January 2023 and March 2023). Three PLTL activities were developed for the first course, Digital Circuits. A PLTL activity begins with a problem that is similar to other problems that students will encounter in the course curriculum. For example, one of the PLTL activity problems in Digital Circuits required students to construct a multi-level circuit using AND gates, OR gates, and inverters based on an equation. Peer leaders engage with their assigned students in an online discussion board using those problems and active learning techniques, such as think-pair-share and muddiest point. Six more PLTL activities were developed for the next two courses, Aerodynamics and Statics.

At the beginning of each course, students were assigned to peer groups. However, participation in the peer groups to include the PLTL activities was completely voluntary. Peer leaders hosted weekly office hours, which allowed students assigned to their group to engage with their peer leader, ask questions, and receive mentorship. Students were offered the opportunity to earn extra credit as an incentive to participate in the PLTL activities. Pre- and post-surveys were offered to the students on a voluntary basis.

Table 1 shows the overall class enrollment for the four sections that offered PLTL. This table shows the large number of military students as well as the number of students that participated in PLTL activities. These pilot courses had a very low PLTL participation rate of just 13 out of 108 students (12.0%). Seven of those 13 students who participated in PLTL activities were military students. The participation rate for military students was higher than their overall representation in the class.

Table 1: Year 1 Class Enrollment Breakdown by Military Population and PLTL Participation

Course	Overall Enrollment	Military Enrollment	PLTL Student Enrollment	PLTL Military Enrollment
CESC 220 Digital Circuits (January 23)	30	10 (33.3%)	3 (10.0%)	2 (6.7%)
ASCI 309 Aerodynamics (March 23)	29	17 (58.6%)	3 (10.3%)	2 (6.9%)
CESC 220 Digital Circuits (March 23)	30	10 (33.3%)	1 (3.3%)	1 (3.3%)
ESCI 201 Statics (March 23)	19	7 (36.8%)	6 (31.6%)	2 (10.5%)

The low participation rate in PLTL activities made it impractical to compare military students who participated in PLTL activities with those who did not. In addition, the pre- and post-survey participation rates were even lower. Only 10 pre-surveys and one post-survey were completed. Even though there were incentives to participate in the PLTL activities, the students opted not to participate. Due to the demographic of the students, any activity that is not required will most likely not be completed due to competing time demands from jobs and family responsibilities.

Year 2 Adjustments

The researchers changed the approach to PLTL for Year 2 (AY23-24). PLTL activities were required for all students in the PLTL course. However, the assessment of the PLTL activities would not contribute to the student's overall grade as this requires a change to the curriculum. The extra credit that was previously offered as an incentive to participate in the PLTL activities would now be offered to completion of the pre- and post-surveys to increase the participation rate of those survey instruments. Since all the students in a PLTL course would be required to participate in PLTL activities, that PLTL section can be compared to a control section that did not have PLTL.

Three sections, ASCI 309 Aerodynamics, CESC 220 Digital Circuits, and ESCI 201 Statics, incorporated PLTL during the August 2023 term. During this term, there was another ASCI 309 Aerodynamics section and ESCI 201 Statics section that could serve as Control sections.

Similarly, two sections, CESC 220 Digital Circuits and ESCI 201 Statics, incorporated PLTL during the October 2023 term. There were Control sections for these two courses during this term.

Students were assessed in the PLTL activities in the online discussion board using a 10-point scale: 10 points – Actively Participates; 8 points – Moderately Participates; 6 points – Minimally Participates; and 0 points – No Participation. Student participation across the PLTL activities was averaged and then categorized as the following PLTL Efforts: PLTL High Effort – 8.0-10.0; PLTL Medium Effort – 5.0-7.9; and PLTL Low Effort – 0.0-4.9.

Table 2 shows the overall student performance in ASCI 309 Aerodynamics in both the PLTL and Control Sections. Both section averages were practically the same. However, students with high and medium PLTL efforts outperformed the overall section average. Table 3 shows military student performance in the same ASCI 309 Aerodynamics Sections. The military student average in the PLTL Section was slightly higher than the Control Section. Similar to the overall performance, military students with high and medium PLTL efforts outperformed the overall military student average.

Table 2: ASCI 309 Aerodynamics, August 2023, Student Performance (PLTL and Control)

	Student Count	Student Average		Student Enrollment	Student Average
ASCI 309 Aerodynamics (PLTL)	28	88.09	ASCI 309 Aerodynamics (Control)	28	88.14
PLTL High Effort	19	90.67			
PLTL Medium Effort	2	96.00			
PLTL Low Effort	7	78.84			

Table 3: ASCI 309 Aerodynamics, August 2023, Military Student Performance (PLTL and Control)

	Military Student Count	Military Student Average		Military Student Enrollment	Military Student Average
ASCI 309 Aerodynamics (PLTL)	12	85.96	ASCI 309 Aerodynamics (Control)	13	85.40
PLTL High Effort	6	94.28			
PLTL Medium Effort	1	97.34			
PLTL Low Effort	5	73.69			

Table 4 shows the overall student and military student performance in CESC 220 Digital Circuits for the one section offered in August 2023 which was a PLTL Section. The students with high

PLTL effort outperformed the overall section average. Like the overall performance, military students with high PLTL effort outperformed the overall military student average.

Table 4: CESC 220 Digital Circuits, August 2023, Student Performance (PLTL)

	Student Count	Student Average	Military Student Count	Military Student Average
CESC 220 Digital Circuits (PLTL)	27	90.01	11	92.76
PLTL High Effort	14	91.32	4	94.01
PLTL Medium Effort	5	88.06	3	92.17
PLTL Low Effort	8	88.94	4	91.96

Table 5 shows the overall student performance in ESCI 201 Statics in both the PLTL and Control Sections. The PLTL Section average was higher than the Control Section. Also, students with high PLTL effort outperformed the overall section average. Table 6 shows the military student performance in ESCI 201 Statics in both the PLTL and Control Sections. The Control Section had a higher overall military student average than the PLTL Section. Within the PLTL Section, military students with a high PLTL effort had a higher average than the overall military average.

Table 5: ESCI 201 Statics, August 2023, Student Performance (PLTL and Control)

	Student Count	Student Average		Student Enrollment	Student Average
ESCI 201 Statics (PLTL)	17	82.46	ESCI 201 Statics (Control)	19	79.41
PLTL High Effort	11	84.40			
PLTL Medium Effort	4	79.96			
PLTL Low Effort	2	76.76			

Table 6: ESCI 201 Statics, August 2023, Military Student Performance (PLTL and Control)

	Military Student Count	Military Student Average		Military Student Enrollment	Military Student Average
ESCI 201 Statics (PLTL)	8	80.79	ESCI 201 Statics (Control)	11	81.69
PLTL High Effort	6	82.98			
PLTL Medium Effort	2	74.23			
PLTL Low Effort	0	N/A			

Table 7 shows the overall student performance in CESC 220 Digital Circuits for October 2023 in both the PLTL and Control Sections. The PLTL Section average was higher than the Control Section. It was interesting that the one student with low PLTL effort outperformed the overall PLTL average. This may indicate that the student felt comfortable with the course material being covered in the peer-led activities. Table 8 shows the military student performance in the same sections. The PLTL Section had a slightly better average for military students than the Control Section.

Table 7: CESC 220 Digital Circuits, October 2023, Student Performance (PLTL and Control)

	Student Count	Student Average		Student Enrollment	Student Average
CESC 220 Digital Circuits (PLTL)	16	90.09	CESC 220 Digital Circuits (Control)	17	88.60
PLTL High Effort	14	89.86			
PLTL Medium Effort	1	89.34			
PLTL Low Effort	1	94.03			

Table 8: CESC 220 Digital Circuits, October 2023, Military Student Performance (PLTL and Control)

	Military Student Count	Military Student Average		Military Student Enrollment	Military Student Average
CESC 220 Digital Circuits (PLTL)	5	91.97	CESC 220 Digital Circuits (Control)	3	91.44
PLTL High Effort	5	91.97			
PLTL Medium Effort	0	N/A			
PLTL Low Effort	0	N/A			

Table 9 shows the overall student performance in ESCI 201 Statics in both the PLTL and Control Sections. The PLTL Section average was higher than the Control Section. Also, students with high and medium PLTL effort outperformed the overall section average. Table 10 shows military student performance in the same sections. The performance of military students was similar to overall student performance.

Table 9: ESCI 201 Statics, October 2023, Student Performance (PLTL and Control)

	Student Count	Student Average		Student Enrollment	Student Average
ESCI 201 Statics (PLTL)	24	76.49	ESCI 201 Statics (Control)	25	75.70

PLTL High Effort	6	84.10			
PLTL Medium Effort	13	80.87			
PLTL Low Effort	5	55.96			

Table 10: ESCI 201 Statics, October 2023, Military Student Performance (PLTL and Control)

	Military Student Count	Military Student Average		Military Student Enrollment	Military Student Average
ESCI 201 Statics (PLTL)	6	78.50	ESCI 201 Statics (Control)	8	70.35
PLTL High Effort	2	81.12			
PLTL Medium Effort	2	84.16			
PLTL Low Effort	2	70.23			

Pre- and Post-Surveys

Offering an incentive to complete the pre- and post-Surveys had the desired effect of increasing student completion of those instruments. 94 students completed the pre-survey and 68 students completed the post-survey. In both surveys, students were asked demographic questions that included military status. Students also answered questions regarding self-efficacy in general engineering, engineering skills, tinkering, and design [8].

In the post-survey, students were asked the following open-ended questions:

- Has the interaction with peers helped support your academic and career goals? If so, how?
- Please list the ways you felt most supported and any areas for improvement in the peer led team learning activities.

The following responses from military students were indicative of many military students:

- “Peer lead teams help add another layer to the chain of command, I can reach out to one of them for help. If they cannot help then the professor can help.”
- “I believe the weekly study sessions were a great tool. I definitely enjoyed the videos from them since the times they were held did not really fit my schedule”
- “I believe the peer leader needs a better understanding of his role in the course, otherwise he did a great job helping whenever he could.”

The first response is indicative that the peer leader is another resource that students can reach out to for support. A student may feel more comfortable contacting a peer before reaching out to the instructor. The second response indicates that peer leaders who did a good job providing weekly overviews were beneficial. Some peer leaders performed better than others, and student comments correspond to the individual peer leader’s effort. The third response which was critical

of the peer leader's performance was indicative that responses from military students were a little more critical than the overall student response. Military students understand and practice leadership, so they have higher expectations. These responses can help provide feedback to peer leaders on how to improve. Also, peer leader performance improves with more practice as a peer leader.

Future Work

The level of participation in the peer activities can be measured by the student's willingness to engage with the peer leader. As a result, it is important that the group size is small enough for peer leaders to build meaningful relationships with the students. The team will increase peer leader training to incorporate more strategies that allow for early communication within the small groups. Part of this strategy is to require that participation in the PLTL count as part of the student's overall course grade rather than voluntary commitment. The requirement to engage in dialogue and participate in PLTL activities as part an integrated activity to existing course work rather than supplemental reduces the student workload. The intent for the PLTL activities is to benefit the students and not create additional requirements. A potential solution is to build peer led activities into the current course assessments transforming traditional solo work into collaborative learning with more opportunities for peers to lead peers. For the future 2024 terms, course assessments will be rewritten, with appropriate curriculum approval, to incorporate PLTL. Additional foundational courses have been identified to potentially incorporate PLTL.

Conclusion

The results have been encouraging so far. The military affiliated student course average seems to indicate support of increased academic performance in meeting the project goals to increase the average final grades of veteran students participating in the PLTL labs compared to veteran students in non-PLTL groups. As an in-progress paper, the final assessment of commitment will be best determined in Year 3 (AY24-25) to review student's commitment to engineering major over a two-to-three-year timeframe.

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