

## **Peer-Led Team Learning in Online Engineering Courses: Examining the Peer Leader Experience NSF IUSE #2216325**

**John K Wilson, Embry-Riddle Aeronautical University - Worldwide**

**Dr. Kimberly A Luthi, Embry-Riddle Aeronautical University - Worldwide**

Kimberly Luthi serves as the Applied Aerospace Science Department Chair for the College of Aviation at Embry Riddle Aeronautical University. She has made extensive contributions on workforce development research and education training preparation to support an inclusive talent pipeline for the aerospace industry. With over 15 years of experience in talent management and workforce education, she has worked with a diverse range of stakeholders to identify the critical skills gaps in industry. Her background encompasses both her professional experience and research in autonomous systems and successful collaboration with industry to align the curriculum with industry needs. Her work focuses on creating accessible pathways into the space field through innovative training programs that will sustain a future workforce both in the civil and commercial sectors. She holds a Ph.D. from Old Dominion University, a Master of Science in Aeronautics from Embry-Riddle Aeronautical University and my Master of Science and Bachelor of Arts from the University of Florida. Her professional background includes serving in various administrative roles on sponsored projects across STEM disciplines. She is a FAA-certified remote pilot, an AUVSI Trusted Operator Program Instructor and holds the AUVSI Trusted Operator Program™ Level I, 2, 3 and Fundamentals of Instruction Certifications.

**David Paul Harvie, Embry-Riddle Aeronautical University - Worldwide**

David Paul Harvie is an Assistant Professor in the College of Aviation Graduate Studies Department at Embry-Riddle Aeronautical University – Worldwide Campus. David has a Ph.D. in Computer Science from the University of Kansas, a M.S. in Computer Science from North Carolina State University, and a B.S. in Computer Science from the United States Military Academy. He is a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE) and a Member of the Association for Computing Machinery (ACM).

**Monica Surrency, Embry-Riddle Aeronautical University - Worldwide**

Dr. Monica Surrency is the Director of Instructional Design Operations at Embry-Riddle Aeronautical University-Worldwide campus. She holds a Master's in Instructional Systems from Florida State University and a Ph.D. in Learning Technologies from the University of North Texas (UNT). She is the 2022 recipient of the Robert M. Gagné Award for Graduate Student Research in Instructional Design for her Ph.D. dissertation at UNT. Currently, she is working on a multi-year NSF grant researching Peer-Led Team Learning in asynchronous online engineering courses for non-traditional military and Veteran college students. Her contributions to this grant include logistical setup for the control and experimental courses, recruiting research participants, conducting interviews, along with collecting, coding, and analyzing the qualitative data from both the student and Peer Leader participants in this unique learning environment.

# **Peer-Led Team Learning in Online Engineering Courses: Examining the Peer Leader Experience NSF IUSE #2216325**

## **Abstract**

This study, conducted as part of a National Science Foundation Improving Undergraduate STEM Education (IUSE) project Award #2216325 investigates the impact of peer leader training on the confidence, role expectations, and leadership identity of undergraduate peer leaders in an online Peer-Led Team Learning (PLTL) program. Data were collected from introductory and end-of-course surveys (N = 35 pre, N = 28 post) over a three-year period. Quantitative findings revealed significant gains in peer leaders' communication, confidence, and ability to support students. Qualitative analysis identified emergent themes of onboarding, communication, peer support, applied problem-solving, time management, wellness, and leadership identity. These findings demonstrate that structured training enhances peer leaders' effectiveness in supporting student learning and contributes to their professional growth. The study concludes with implications for designing sustainable online PLTL programs that integrate leadership, and applied communication training to strengthen STEM pathways for diverse learners.

**Keywords:** Peer-led team (PLTL); peer leader; Improving Undergraduate Student STEM Education (IUSE)

## **Introduction**

This study, conducted as part of a National Science Foundation (NSF) Improving Undergraduate STEM Education (IUSE) project, extends ongoing work investigating the impact of Peer-Led Team Learning (PLTL) in online engineering pathways. Prior phases of the project explored the effectiveness of PLTL interventions in supporting primarily veteran and military students [1]. Results demonstrate encouraging trends in student performance, persistence, and engagement, particularly in historically challenging engineering courses such as statics, digital circuits, and aerodynamics. PLTL is a widely adopted collaborative instructional model that employs trained peer leaders to facilitate structured small group learning activities. The approach enhances conceptual understanding, persistence, and student engagement in STEM disciplines [2]. More recent scholarship highlights reciprocal benefits for peer leaders themselves, who gain valuable skills in teaching, leadership, and communication, often contributing to professional identity formation [3].

This paper focuses on the experiences of peer leaders leading non-traditional groups that are underexplored compared to student academic performance metrics [4]. Even fewer studies have systematically examined peer leadership in fully online learning environments, where peer leaders face unique challenges in fostering community, sustaining engagement, and navigating digital communication [5]. These gaps are particularly significant given the increasing reliance on online modalities in higher education, especially for nontraditional learners such as veterans in collaborative learning forums [6]. Analysis of the pre- and post-training survey data provides a comprehensive account of peer leaders' evolving perceptions and experiences. The insights contribute to refining training models, strengthening program design, and enhancing the sustainability of PLTL online.

## **Research Design/Methods**

The research informs practitioners on best practices for the development of peer leaders' confidence, role identity, and leadership practices in an online PLTL training program. Quantitative data were collected through pre- and post- training surveys carried out at the beginning and end of the course. These post-survey responses include open ended questions for qualitative data collection that offer deeper exploration of the lived experiences of peer leaders. PLTL is part of a collaborative learning model where peer leaders support others in courses they have already successfully completed [7]. The peer leaders are assigned to groups of three to five students and are trained to facilitate structured group learning activities that emphasize collaboration, problem-solving, and active engagement. Leadership development is a recurring theme, with peer leaders frequently describing increased confidence in facilitating group dynamics, providing feedback, and managing diverse learners [3]. These outcomes support their academic communities and prepare peer leaders for future professional roles. Leadership development is central to PLTL's success, serving as the bridge between course design and student experience.

The rise of online and hybrid education has introduced additional complexity for implementing PLTL. While in-person peer leadership benefits from organic interaction and community-building, online contexts pose challenges related to digital communication, engagement, and inclusivity [5]. Selected peer leaders completed a 10-hour self-paced training course designed to allow the leaders to learn about themselves as individual learners and student leaders, to develop communication skills to allow them to communicate with a diverse group of students in an online environment, to learn different teaching styles and technologies to support collaboration, and to provide effective feedback on an assignment using an active learning technique [8]. A total of 35 peer leaders completed the introductory survey, and 28 peer leaders completed the end-of-course survey, reflecting an attrition rate of approximately 20%. The survey responses provide both quantitative and qualitative insights into the perceptions, experiences, and developmental trajectories of peer leaders engaged in the training.

## **Data Collection and Analysis**

Surveys consisted of Likert-scale items (1 = Strongly Disagree to 5 = Strongly Agree) measuring perceptions of role expectations, confidence, communication, and support practices. Descriptive statistics were calculated for each item, and independent sample t-tests were conducted to compare pre- and post-training mean scores on overlapping items. The level of significance was set at  $p < .05$ . Analyses were conducted item-by-item using the pre- and post-survey instruments.

## **Results**

Analysis of the overlapping survey items between the Introductory and end-of-course instruments revealed several areas of growth in peer leader perceptions of their preparedness and confidence. Peer leaders reported increases in agreement from the beginning to the end of training. Three items demonstrated statistically significant improvement at the  $p < .05$  threshold: confidence in communicating student needs to faculty ( $p = .001$ ), comfort in

offering peer and learning support services ( $p = .003$ ), and capability to help students build academic confidence ( $p = .018$ ). The significant growth in items related to communication and support underscores the training's role in reinforcing skills most critical to the peer leader function in online environments.

The observed increases in confidence-related items are particularly noteworthy as confidence has been shown to function as both a marker of self-efficacy and a determinant of effective leadership and communication [8]. Additionally, leaders who feel confident in their ability to communicate with faculty and provide support to students are better positioned to foster motivating environments that contribute to student persistence [9]. These findings provide evidence that peer leader training contributes to role readiness and professional growth.

### ***Qualitative Results***

In addition to the quantitative survey items, the end-of-course survey included an open-ended question asking participants to provide additional comments or recommendations for the training. Responses were analyzed thematically, and five distinct themes emerged: interactivity and engagement, case studies and examples, coping and wellness, course-specific training, and positive feedback.

Despite these constructive recommendations, several participants provided affirming remarks about the effectiveness of the training. For instance, one respondent shared, "The training course does an excellent job providing foundational support." Such comments reinforce the overall positive reception of the program.

Taken together, the qualitative findings complement the quantitative results by illustrating how peer leaders not only reported growth in confidence and preparedness but also identified ways to further strengthen the training experience. The emphasis on interactivity, real-world application, wellness, and contextualization suggests potential avenues for

### **Discussion**

The findings provide evidence that structured peer leader training in an on-line PLTL program contributes to meaningful growth in confidence, communication, and leadership identity. Quantitative survey results demonstrated significant improvements in peer leaders' ability to communicate student needs to faculty, provide peer support, and build academic confidence among their peers. These outcomes align with existing PLTL research that highlights the role of peer leaders as facilitators of learning and persistence [10][11]. Importantly, qualitative analyses further contextualized these gains by showing how peer leaders described their evolving confidence, applied support strategies, and eventual transition from "helper" to "mentor."

The qualitative results also surfaced important emergent themes beyond confidence, such as wellness, time management, and coping. These themes resonate with literature on nontraditional and online learners, who often face competing priorities and heightened stressors.

## **Limitations and Future Research**

This study is limited by attrition across surveys (N = 35 pre, N = 28 post). We also recognize self-selection bias exists as the students who choose to participate in the peer leader program often are higher achieving students with characteristics such as higher self-efficacy, desire and confidence to begin with. The findings are reliant on self-reported data and the absence of a control group to compare personal growth. Research should explore longitudinal designs with larger cohorts, triangulate findings with student outcome data (e.g., persistence, grades), and investigate the specific impact of wellness-focused training modules on peer leader sustainability.

Taken together, these findings provide strong evidence that PLTL training fosters both personal and professional growth for peer leaders while enhancing their ability to positively influence the students they support. By integrating communication skills, leadership development, and wellness strategies, institutions can further strengthen PLTL programs and promote persistence, engagement, and success among diverse student populations.

## **Conclusion**

This study provides a more comprehensive understanding of peer leader development in online PLTL programs. The results suggest that future program design should integrate wellness, applied leadership, and communication training to ensure sustainability and effectiveness. Ultimately, investing in peer leader preparation strengthens both the leaders themselves and the broader student communities they serve, reinforcing PLTL's role as a transformative model for STEM education.

Peer leaders reported needing to balance time management, wellness, and digital communication while fostering community among their peers. These emergent themes point to the need for enhanced training modules that address not only academic facilitation but also resilience and self-care strategies for peer leaders.

This study contributes to the growing body of research on Peer-Led Team Learning (PLTL) by shifting attention toward the experiences and development of peer leaders in an online engineering education context. These findings highlight the reciprocal value of PLTL, supporting both student learning outcomes and peer leader professional growth.

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