

Annotated Peer Bibliography, David Arendale, Report by the study group facilitator or participant that the experience has influenced their future vocation, 90 citations, revised May 17, 2023

Arendale, D. R., & Hane, A. R. (2016). Peer study groups as catalyst for vocational exploration. *Journal of Developmental Education*, 39(2), 2-4, 6, 10-11, 26-27. University of Minnesota Digital Conservancy, www.hdl.handle.net/11299/200357.

Peer assisted learning programs generate more outcomes than increasing academic achievement for participants. Studies, including this one, document impact with personal, vocational interest exploration, and job skill development for facilitators. This study explores why these programs generate these outcomes through linking leading theorists to the research outcomes. Peer learning programs present an untapped cocurricular experience that could be more powerful if it was intentional rather than serendipitous with professional development outcomes. The peer learning program occupies the intersection between student academic assistance and teacher candidate preparation. The program can serve a valuable role as a learning experience before traditional student teaching as well as generator of more students interested in pursuing a teaching career. With the highly competitive job market for today's graduates, institutions must use every opportunity to increase job readiness skills of its graduates. The Peer Assisted Learning (PAL) program at the University of Minnesota is a primary academic support program for historically difficult, introductory college courses that serve as gatekeepers to academic degree programs. Based upon operating principles of other programs and educational theories, PAL is integrated into the courses it serves.

Ashwin, P. W. H. (1993). *Supplemental Instruction: Does it enhance the student experience of higher education?* (Ph.D. dissertation), Kingston University, London, England.

This doctoral dissertation is concerned with the student experience of Higher Education in Britain that is influenced by Supplemental Instruction (SI). The qualitative research study of SI's impact in two classes (Applied Social Science and Computer Science) at Kingston University (UK) included interviews with SI leaders and questionnaires of first year students who were enrolled in the two classes. The purpose of this case study was to examine to what extent the educational theory of SI was matched by the student experience of it. Qualitative research suggests that SI was beneficial to students who took advantage of the service. SI leaders listed the following benefits of the program for themselves: increased confidence, greater sense of community between different years of the course, greater understanding of the material they were facilitating, and increased interest by potential employers because of the cocurricular nature of the SI leader experience.

Barr, S. A., Ross, M. J., & Otero, V. (2012). *Using artifact methodology to compare learning assistants' and colleagues' classroom practices* Conference Proceedings of the Physics Education Research Conference, Omaha, NE. https://pubs.aip.org/aip/acp/article-pdf/1413/1/119/12210709/119_1_online.pdf

The University of Colorado's LA-Test K-12 research team investigated the classroom practices of former Learning Assistants' who went on to become K-12 teachers. One of the tools used for this analysis of classroom practice was the Scoop Notebook, an instructional artifact package developed to assess teachers' use of reform-oriented practices. In this paper, the authors characterize differences in classroom practices between former Learning Assistants teaching at the secondary level and their colleagues through the collection and analysis of teaching artifacts. Analyses of these artifacts indicate significant differences between LA and non-LA groups. A description of the methodology and implications of using artifact packages to study classroom practice will be discussed, detailing the role of the LA experience in teacher preparation.

Brown, K., Naim, K., van der Meer, J., & Scott, C. (2014). "We were told we're not teachers...It gets difficult to draw the line" Negotiating roles in Peer-Assisted Study Sessions (PASS). *Mentoring & Tutoring: Partnership in Learning*. doi:10.1080/13611267.2014.902559.

Peer learning models in pre-service teacher education are in the early stages of implementation. In this article, we evaluated a pilot Peer-Assisted Study Sessions (PASS) program that supplemented a course for pre-service teachers at one New Zealand university. PASS participants discussed experiences of the program, revealing tensions between what students and facilitators felt should happen in PASS, and how they acted differently. We explained these tensions by considering how social and cognitive congruence operated between students and facilitators. The majority of our peer facilitators were pre-service teachers, suggesting these intersecting roles offered important considerations for reciprocity in near-peer relationships, and joint negotiations of roles and responsibilities. We conclude this article with implications for future training of PASS facilitators, including those training as teachers.

Capstick, S. (2004). *Benefits and shortcomings of Peer Assisted Learning (PAL) in higher education: An appraisal by students*. Unpublished manuscript. Bournemouth University. Bournemouth, United Kingdom.

The benefits and shortcomings of a Peer Assisted Learning (PAL) scheme [based upon Supplemental Instruction] are

described from the perspective of its student participants. Qualitative methodology is used to investigate and describe student outcomes, together with an analysis of influence of PAL on marks in one course. A wide range of benefits are reported for students engaged in PAL, as well as for those students responsible for managing PAL discussion groups. PAL leaders improved presentation skills, group speaking, and confidence. Some PAL leaders said the experience helped them during job interviews as well as promoting interest in teaching as a career. Negative aspects of PAL as described by the PAL leaders was the rule that they are not permitted to make short lectures to clear up confusion by the participants. This rule is common among British SI-like programs to clearly define how SI is different than what professional tutors and the course instructor does. It is argued that qualitative benefits of PAL are more pronounced and demonstrable, and more appropriately portray the scheme, than quantitative outcomes.

Carbon, D. (1995, August 1). Universities give peer program top marks, *Courier Mail Newspaper*.

This newspaper article reports on the implementation of Supplemental Instruction (SI) at three postsecondary institutions in Australia (Queensland University of Technology, University of Queensland, and the University of Southern Queensland). Henry Loh, QUT anatomy professor, reported reducing students' failure rate from 20 to 5 percent after the introduction of the SI program. However, he implemented the program more to increase academic performance than to just reduce student failure rates. Barbara Kelly of UQ reports that SI leaders regularly provide feedback to the course professors regarding the comprehension level of the students. At UQ the SI program is being used in biochemistry, microbiology, engineering, chemistry, and law. Kelly requires SI leaders to maintain diaries to record SI session activities, student behaviors, and suggestions to improve the program. SI leaders report improvement of their confidence levels, developed better communication skills, and believed that their employment prospects were improved.

Carr, R. A., Evans-Locke, K., Abu-Saif, H., Boucher, R., & Douglass, K. (2018). Peer-learning to employable: learnings from an evaluation of PASS attendee and facilitator perceptions of employability at Western Sydney University. *Journal of Peer Learning*, 11(1), 41-64.
www.ro.uow.edu.au/cgi/viewcontent.cgi?article=1127&context=ajpl.

This study examines student experiences of Peer Assisted Study Sessions (PASS) at Western Sydney University (WSU), investigating attendee and facilitator perceptions of the relationship between peer-learning and employability. It defers to contemporary higher education scholarship and related sector definitions of employability as an objective criteria for evaluating outcomes which may result from student experiences with PASS. This investigation observes the extent to which such definitions are evident in the skills and attributes students have acquired via their participation in PASS through both quantitative and qualitative research. Quantitative and qualitative data was collected across two consecutive semesters at WSU (Autumn and Spring) in 2015. Survey responses were collected from 297 PASS attendees and 45 PASS facilitators, further incorporating data collected via focus groups with 46 PASS attendees. The evidence allowed the researchers to examine how students perceived they had gained attributes from PASS that render them more employable. The research results highlight the benefits and limitations of the methods utilised to collect data from PASS participants, and this article elaborates key insights gained as a result of the research process that may be useful to peer-learning practitioners beyond WSU. The study found that attendees and facilitators of the WSU PASS program perceive that the program contributes to student employability in a variety of ways such as improving participants' core technical skills, organisational skills, social skills, professionalism and business acumen, appreciation of mentoring, and critical thinking skills.

Chilvers, L., & Waghorne, J. (2018). Exploring PASS leadership beyond graduation. *Journal of Peer Learning*, 11(1), 5-26. www.ro.uow.edu.au/cgi/viewcontent.cgi?article=1137&context=ajpl.

Developing University graduates' employability is of increasing strategic institutional focus in the UK. Existing research evidences the role of Peer Assisted Study Sessions (PASS) in supporting students to develop personal, professional and employability skills. This research explores the impact of the PASS Leader role on graduates' job application experiences, their employability and effectiveness in their current roles. PASS Leader graduate survey (n=62) and interview (n=12) findings demonstrated participants referred to their PASS Leader Role significantly on their CVs, application forms and in job interviews. Respondents said that PASS Leadership, aided by reflection, enabled them to clearly evidence their development of employability skills, which they perceived as enabling them to stand out from other job candidates. Interview participants explained their PASS Leadership informed their development of a range of employability skills and attributes, including communication, confidence, teamwork, facilitation and leadership. PASS Leadership was regarded as addressing gaps in their course curriculum for developing skills they perceived as important for their current roles, highlighting the value of co and extra-curricular programmes, such as PASS.

Close, E. W., Close, H. G., & Donnelly, D. (2013). *Understanding the Learning Assistant experience with physics*

identity. Conference Proceedings of the Physics Education Research Conference, Philadelphia, PA. https://pubs.aip.org/aip/acp/article-pdf/1513/1/106/12185895/106_1_online.pdf

Learning Assistants (LAs) have been shown to have better conceptual understanding and more favorable beliefs about science than non-LAs, and are more likely to choose a career in K-12 science teaching [1]. We propose that connections between elements of identity, persistence, and participation in an LA program can be explained using the concept of the community of practice and its intimate relationship to identity [2]. In separate work, Hazari et al. found that physics identity was highly correlated to expressed career plans in physics [3]. We hypothesize that a thriving LA program has many features of a well-functioning community of practice and contributes to all four elements of physics identity: personal interest, student performance, competence, and recognition by others. We explore how this analysis of the LA experience might shape decisions and influence outcomes of adoption and adaptations of the LA model.

Cochran, G. L., & Brookes, D. T. (2012). *Prospective teachers serving as physics learning assistants' perspectives on reflective practice*. Conference Proceedings of the 12th Annual South Florida Education Research Conference, Miami, FL. <https://digitalcommons.fiu.edu/cgi/viewcontent.cgi?article=1305&context=sferc>

A physics Learning Assistant (LA) program was established at Florida International University (FIU) for recruiting and preparing pre-service physics teachers. One goal of this program is to help prospective teachers to develop reflective practice. The purpose of this study is to understand these prospective teachers' perspectives on reflective practice.

Cochran, G. L., Brookes, D. T., & Kramer, L. H. (2013). *A framework for assessing learning assistants' reflective writing assignments* Conference Proceedings of the Physics Education Research Conference, Philadelphia, PA. https://pubs.aip.org/aip/acp/article-pdf/1513/1/15/12186029/15_1_online.pdf

At Florida International University we have implemented a learning assistant (LA) program based on the Colorado Learning Assistant Model. [1] As a part of this program, students take a course on science and mathematics education theory and practice in which they are required to submit written reflections. Past anecdotal evidence suggests that students in the LAP at Florida International University are using these writing assignments to reflect on their teaching experiences. The purpose of this study was to a) determine if the writing assignments submitted give evidence that our students are engaging in reflection and b) determine if our students are engaging in deep levels of reflection. In this investigation, we relied on a rubric based on Hatton and Smith's (1995) [2] "Criteria for the Recognition of Evidence for Different Types of Reflective Writing." In this paper, we document a) a system for characterizing student reflections and b) how we give them feedback.

Conroy, G. J. (1996, 1996, May 28). Supplemental Instruction program shows results first year, *The Observer Newspaper*, pp. 3-4.

This newspaper article describes the use of Supplemental Instruction (SI) at Southern Illinois University at Edwardsville. SI sessions were offered in an introductory biological sciences course (Biology 120). The article indicated one of the SI program benefits was that SI leaders who were biology education majors learned pedagogical methods. The SI supervisor reported a preference for hiring education majors. According to data from Fall 1995 in Biology 120, SI participants to attended four or more sessions earned a mean grade of a low B, whereas those who attended one to three sessions averaged a C. Those who did not attend any SI sessions averaged a D.

Davis, E. E. (1999). *Student mentors: Experiences of being a Supplemental Instruction leader*. (Master of Science thesis), Indiana University.

The purpose of this Master Thesis was to examine the experience of serving as a Supplemental Instruction (SI) Leader upon the individual at Indiana University Purdue University Indianapolis (IUPUI). A qualitative research study was conducted of SI leaders during Fall 1997. Some common benefits cited were improved: communication skills, problem solving skills, subject matter knowledge, people skills, friendships, knowledge of campus layout and resources, time management skills, involvement and knowledge of campus activities, leadership skills, and feelings of connection to the campus. Some mentioned that SI opened doors to new experiences that drew them closer to their desired career goal.

Diegelman-Parente, A. (2012). *The scholarship of Peer-led Team Learning: My progression from student leader to*

faculty. Conference Proceedings of the Peer-led Team Learning International Society Inaugural Conference, Brooklyn, NY. www.pltlis.org/wp-content/uploads/2012%20Proceedings/Parente-2012.docx

Twenty years ago, I was an undergraduate majoring in Biology and Chemistry, struggling with the desire to integrate the details I had learned in my Chemistry courses with the 'big picture' philosophy stressed in my Biology curriculum. These early educational experiences fostered my passion for curricula geared towards interdisciplinary learning and in programs designed to increase awareness of alternative learning styles and pedagogies for instruction. My Workshop journey began shortly thereafter with PLTL's inception at the University of Rochester. Now as a faculty member, I have implemented PLTL and two other pedagogies into my General Chemistry, Organic Chemistry, and Biochemistry curricula with a "full-circle" perspective that has been nearly two decades in the making. This article will examine the evolution of my educational philosophy as I progressed from student leader to faculty as well as some strategies I have found useful for its implementation and means to involve these alternative pedagogies in my scholarly activities for promotion and tenure.

Dreyfuss, A. E., Villatoro, M. L., Loui, M. C., Becvar, J., Saune, G. B., & Johnson, W. (2015). *Getting past the first year: Retaining engineering majors*. Conference Proceedings of the Frontiers in Education Conference, El Paso, TX.

Peer Led Team Learning (PLTL) is a nationally recognized curriculum enhancement strategy adopted in various forms by over 150 universities and colleges across the United States. Consistent with the outcomes and the vision of ABET Engineering Criteria 2000 and the National Academy of Engineering Engineer 2020, PLTL prepares students to work in teams; apply knowledge of mathematics, science, and engineering to solve problems; communicate effectively; engage in life-long learning; and develop leadership skills. Published PLTL program data have shown that using peer leaders in small group workshop settings boosts performance in critical first-year courses including core math, science and engineering courses. The PLTL model promotes the growth of critical workplace skills for students and peer leaders such as working in teams, listening, critical thinking and leadership. This paper will present the basics of the PLTL instructional model, including sample materials developed for engineering workshops. Consideration of the practicalities of the six critical components will be discussed: integration of the workshop component into the course structure, involvement of the teaching faculty, training and supervision of the peer leaders, creation of challenging materials, and provision of appropriate institutional resources.

Edelnant, V. (1999). Supplemental Instruction program helps students succeed. *Recruitment and Retention in Higher Education*, 13(5), 3.

This short article describes the use of Supplemental Instruction (SI) at Wartburg College in Waverly, IA. The SI program is four years old at the 1,500 student undergraduate Wartburg College. Benefits for the SI leaders reported by the author include developing empathy for the faculty members, experimenting with a possible career as a teacher, and development of their leadership skills.

Eller, J. L. (2016). *Investigating the Supplemental Instruction leader experience: A phenomenological study of undergraduate peer educators*. (Ph.D.), Liberty University, Lynchburg, VA.
www.digitalcommons.liberty.edu/cgi/viewcontent.cgi?article=2345&context=doctoral

The purpose of this transcendental phenomenological study was to describe the experiences of undergraduate students who serve as Supplemental Instruction (SI) leaders at a mid-sized, private research university in the Midwestern United States. Using Schlossberg's transition theory as a theoretical framework, this study attempted to answer the central research question: What is the experience of students who serve as SI leaders at a mid-sized, private research university located in the Midwestern United States? Sub-questions sought to address student expectations moving into the experience, how expectations were met or not met as they moved through the SI leader experience, the expected and unexpected outcomes as they moved out of the experience, and what students perceive to be the value of their experience beyond their tenure as an SI leader. Criterion, intensity, and maximum variation sampling were used to secure 12 co-researchers who experienced the phenomenon of serving as an SI leader at the research site. Data collected through questionnaires, interviews, archival records, and focus groups revealed four themes: (a) importance of relationships, (b) engagement for self and others, (c) valuing teaching and learning, and (d) developing intrapersonal skills for life, learning, and work. The study findings and limitations, implications for practitioners, and recommendations for future research are discussed.

Fineus, E., & Fernandez, M. L. (2013). *An investigation of participants' perspectives about a Learning Assistant Program and their thinging about becoming a mathematics teacher*. Conference Proceedings of the 11th Annual College of Education & GSN Research Conference, Miami, FL.
<https://digitalcommons.fiu.edu/cgi/viewcontent.cgi?article=1203&context=sferc>

A Learning Assistant program that recruits strong STEM undergraduates to become mathematics teachers was

explored through a qualitative study. Three program participants were purposely selected and interviewed. The program reaffirmed one participant's choice to become a teacher and clarified for one that it might be a career for him.

Fogarty, J., Altman, R., & Lundmark, J. (2022). *Impact of peer-assisted learning and leadership development on undergraduate students*. Conference Proceedings of the Excellence through Diversity ASEE Annual Conference, Minneapolis, MN. <https://peer.asee.org/41968.pdf>

With college advisory boards and potential employers consistently voicing their desire for engineers and scientists who can communicate well, work effectively in teams, and independently problem-solve, the Colleges of Engineering & Computer Science (ECS) and Natural Sciences and Mathematics (NSM) at Sacramento State University, a large, public, primarily undergraduate institution, have deployed two programs to explicitly address these skills for undergraduate science, technology, engineering, and mathematics (STEM) students. The goals of the NSF-funded Achieving STEM Persistence through Peer-Assisted Learning and Leadership Development (ASPIRE) project are to increase retention and decrease time to graduation for STEM students, as well as increase retention of women and underrepresented minorities (URM) in the STEM workforce by implementing evidence-based practices to promote student success during two critical transitions: 1) from lower-division to upper-division coursework in engineering; and 2) from upper-division coursework to an entry-level STEM career. ASPIRE aims to achieve these goals by: 1) adapting and implementing the NSM Peer Assisted Learning (PAL) program in gateway engineering courses; and 2) developing the Hornet Leadership Program which includes scaffolded opportunities for students to explore their leadership capacity and develop leadership skills. The main research questions for this study include: (1) Will the ECS PAL model and Hornet Leadership Program result in increased persistence and workforce readiness in STEM majors at a large, diverse university? (2) What attitude changes will this project have on students and faculty and the relationships between them? The first question is addressed through pre- and post-implementation student surveys and student course/GPA data. The second question is addressed through faculty surveys, faculty focus groups/interviews, and pre- and post-data from a faculty professional development workshop. In general, preliminary results from this study indicate the new ECS PAL program successfully attracts URM students and thus has the potential to support their persistence and STEM workforce readiness. Additionally, undergraduate students across both Colleges who participated in the inaugural Hornet Leadership Program gained non-technical skills and experiences directly linked to competitiveness and preparation for workforce entry and graduate programs. Finally, faculty surveys and the faculty professional development workshop indicate that faculty value student leadership development, but identify barriers to accomplishing this work.

Ford, N., Thackeray, C., Barnes, P., & Hendricks, K. (2015). Peer learning leaders: Developing employability through facilitating the learning of others. *Journal of Learning Development in Higher Education*, November. [www.aldinhe.ac.uk/ojs/index.php?journal=jldhe&page=article&op=view&path\[\]=373](http://www.aldinhe.ac.uk/ojs/index.php?journal=jldhe&page=article&op=view&path[]=373).

Employability is a key theme in higher education and attitudes towards its development have shifted from a focus on technical skills development to a broader focus on values, intellect, social engagement and performance contributing to graduate identity (Hager and Hodkinson, 2009). Peer Assisted Learning (PAL) and Language Conversation Clubs are both examples of student-led peer learning schemes at Bournemouth University (BU), and are reviewed to explore the development of students employed to lead and facilitate group learning sessions. Data from four annual evaluation surveys (n=239) is reviewed in addition to qualitative comments and reflective writing. Peer leaders were found to have developed employability attributes including: leadership, time management and organisation, communication, and cultural awareness. Above all, peer leaders identified with developing confidence in their roles. Comments provided examples of student leaders who had actively selected peer learning as an opportunity to develop their confidence and were able to transfer this to other academic and employment contexts.

Gafney, L. (2002). PLTL and secondary school teaching, Peer-Led Team Learning: leader training. *Progressions: The Peer-Led Team Learning Project Newsletter*, 3(2). www.pltlis.org/wp-content/uploads/2012/10/High-School-Implementation-Gafney-PLTL-and-Secondary-School-Teaching.pdf.

This report is an excerpt from a telephone interview conducted by Leo Gafney as part of the study of former peer leaders at St. Xavier University in Chicago. It provides a dramatic illustration of how the peer leader experience inspired Yvonne O'Connell in her work as a secondary school teacher at a private school for boys.

Gafney, L., & Varma-Nelson, P. (2003). *Impact of being a peer-leader on undergraduate students*. Conference Proceedings of the 226th American Chemical Society National Meeting, New York, NY. For more information, contact the author at the PLTL Workshop Project, 147 Wells Hill Road, Lakeville, CT 06039, gafney@pop3.discovernet.net

The Peer-Led Team Learning (PLTL) is dependent upon the student peer facilitators who conduct the sessions. A survey of the effects of serving as a peer leader regarding personal mastery of chemistry concepts, impact on career and graduate education options, and interpersonal skill development.

Gardiner, R. (1996). *Supplemental Instruction: A cost-effective, student-centered collaborative learning program*. Conference Proceedings of the Second International Open Learning Conference, Brisbane, Queensland, Australia.

This paper presented by Emeritus Professor Ron Gardiner of Queensland University of Technology describes the use of Supplemental Instruction (SI) in Australia. After an extensive description of the SI model, program benefits for the SI Leaders and the course instructors are described. Benefits to the SI Leaders include: deeper understanding of the course content; development of leadership and group facilitation skills; increased self-confidence; improved job marketability and admission to advanced graduate work due to service as SI Leader; development of professional relationship with course professor; membership in an effective peer support network; and modest financial reward. Benefits for the course professors that have SI attached to their lectures: timely feedback concerning the comprehension level of the students regarding course material; opportunity to repeat previous lecture material in a modified fashion to increase comprehension; an option to modify future teaching strategies based on feedback from students; a basis for accessing additional funds through grants (e.g., teaching and learning development grants); increased rapport with students and SI Leaders; membership in local, national and international SI network; increased recognition from their colleagues; and increased satisfaction with their teaching role. The institution benefits in several ways: deployment of a cost-effective, student-centered learning enhancement program; membership in national and international SI networks; and effective means of managing the collective learning power of its students.

Gates, A. Q., Casas, C., Servin, C., & Slattery, M. (2015). *Using Peer-Led Team Learning to build university-community college relationships*. Conference Proceedings of the Frontiers in Education Conference, El Paso, TX.

Through support from the National Center for Women & Information Technology (NCWIT), the University of Texas at El Paso (UTEP) and the El Paso Community College (EPCC) began a program to collaborate on adoption of Peer-Led Team Learning (PLTL) at EPCC. The NCWIT-funded effort aims to transfer this effective retention practice to the EPCC in order to establish early connections with female students, create community, and provide activities that improve students' problem-solving skills. PLTL provides an active learning experience for students and creates leadership roles for undergraduates. For the peer leaders, the experience of working with faculty and guiding their peers through a challenging course is rewarding, and they learn communication, teaching, leadership, and interpersonal skills. Peer leaders become more confident about their career path, and many continue to be involved in the department through undergraduate research positions. This is important for retention and advancement efforts, since the peer-leading experience influences the students' motivation to attend graduate school. This paper describes how the UTEP-EPCC partnership was structured, how the practice was transferred, and the challenges that were encountered. It also presents the evaluation results.

Ghosh-Dastidar, U., Kennedy, N., Samaroo, D., & Solis, A. (2022). *Advancing student futures in STEM*. Conference Proceedings of the Excellence through Diversity ASEE Annual Conference, Minneapolis, MN. <https://peer.asee.org/advancing-student-futures-in-stem.pdf>

This paper concludes the work-in-progress presented in a paper published in the ASEE proceedings in 2018 [1] and the epiSTEMe8 conference proceedings [2]. This project contributes to the national effort in recruiting, supporting, and educating future STEM professionals for the national workforce by providing scholarships and curricular support to academically promising STEM students with financial need in associate degree programs in Computer Science and Chemical Technology and baccalaureate degree programs in Applied Chemistry, Applied Mathematics, and Biomedical Informatics. Based on 2015-16 data, nationally a higher percentage of bachelor's degrees awarded to females than to males is observed (58% vs. 42%). In STEM related fields, however, female participation is disproportionately lower than their male peers: the ratio of bachelor's degrees awarded in STEM fields to males is to females is 64% to 36%. Similarly, the trend of higher percentage of all bachelor's degrees awarded to females than to the males in all fields is similar across different racial and ethnic groups. However, a different pattern emerges when the study domain is restricted to bachelor's degrees awarded only in STEM fields. This disparity is observed widest among Black

students (11% women), followed by students of two or more races (21%), Asian students (21%), American Indian/Alaska Native (23%), Hispanic (25%), Pacific Islander (28%), and even in Caucasian populations (33%). Based on 2014 data, the proportion of females awarded bachelor's degrees nationally in Computer Science in particular is about 18.1% [3]. The average proportion in Mathematics and the Statistics is 41.7% [4]. Additionally, Pew research cites significant underrepresentation of Black and Hispanic population in the STEM related jobs including computing fields despite significant recent growth. Blacks and Hispanics held 9% and 8% of all STEM jobs respectively, whereas Whites represent 67% of all STEM jobs. The same research also finds underrepresentation of women in physical sciences, computing, and engineering fields although women are well-represented in the health-related workforce. While women represent 74% in health-related jobs, this representation is a quarter or lower in computing and engineering fields [5]. Because of the significant underrepresentation of women and minorities in Computer Science and in STEM fields overall, the program described here placed a heavy emphasis on recruiting and enrolling greater numbers of female students and in providing evidence-validated interventions to support their retention, graduation, and workforce entry.

Gill, D., Parker, C., Spooner, M., Thomas, M., Ambrose, K., & Richardson, J. (2006). Tomorrow's doctors and nurses: Peer assisted learning. *The Clinical Teacher*, 3(1), 13-18. www.theclinicalteacher.com.

This article describes the use of Peer Assisted Learning (PAL) in the United Kingdom to improve achievement for health science students at the Royal Free and University College London Medical School and the School of Health and Social Sciences at Middlesex University. PAL is based upon the Supplemental Instruction (SI) model. Senior nurses served as the PAL leaders for the first-year students. Outcomes for the PAL leaders included gains in confidence, knowledge of the subject material, gains in teaching and clinical examination skills, and an opportunity to enhance interprofessional relationships.

Gill, M., & McConnell, C. (2016). "What's in it for me?" - An investigation into the motivations, challenges and benefits of peer leadership in a School of Education. *Student Engagement and Experience Journal*, 5(1). doi: 10.7190/seej.v4i1.117. www.research.shu.ac.uk/SEEJ/index.php/seej/article/view/117/pdf.

This case study of practice provides an account of an academic peer-learning scheme in a university School of Education in the South of England. The significance of this case study is to provide insights specifically into the experiences of undergraduate peer leaders. The scheme is called PASS (Peer Assisted Study Sessions), and is a nationally recognized student-led mentoring scheme involving trained student volunteers from levels five and six (second and third year) facilitating weekly study sessions for level four (first year) students. Through the voices of seven student PASS leaders, this small-scale study employed a qualitative approach using a focus group to explore leaders' motivations, and to enable a discussion of the benefits and challenges they experience through leadership. The findings also reveal the leaders' awareness of their growing confidence, communication and employability skills development, particularly pertinent for Education students in relation to their future career paths in teaching and learning settings.

Gillmore, J. G. (2010). PLTL impacts a career - from peer leader to the professoriate. Peer-led Team Learning: The experience of leading. *Progressions: The Peer-Led Team Learning Project Newsletter*, 12(1). www.pltlis.org/wp-content/uploads/2012/10/Experience-of-Leading-Gilmore-PLTL-Impacts-a-Career.pdf.

In August of 1998, the author arrived at the University of Rochester fresh from a five-year BS/MS at Virginia Tech. That fifth year to complete a master's thesis convinced the student of desire to be a physical organic chemist, and consider an academic career rather than the original pharmaceutical industry trajectory. At Rochester she joined Joe Dinnocenzo's group to study photoinduced charge transfer initiated cation radical reactions in polymeric media, and realized she would not teach for at least a semester or two. The experience as a Peer Led Team Learning (PLTI) facilitator solidified resolve to become a teacher.

Gray, K. E., & Otero, V. K. (2008). *Analysis of Learning Assistant's views of teaching and learning*. Conference Proceedings of the Physics Education Research Conference, Melville, NY. <https://www.per-central.org/document/ServeFile.cfm?ID=8001&DocID=711&Attachment=1>

For several years the University of Colorado has been using undergraduate Learning Assistants (LAs) in their introductory science and math courses. While the LAs have teaching duties very similar to graduate Teaching Assistants (TAs), first year LAs are also required to take an education course focused on teaching methods. The purpose of this course is to first help LAs improve their teaching in the university classrooms and to encourage some of the LAs to consider careers as K-12 science teachers. Throughout the semester LAs are asked to reflect on their learning about teaching and on the applications of these concepts to their current teaching experience. This paper will present an analysis of this learning experience from the perspective of the LAs. The paper will also present how LAs evolve as teachers and as learners throughout this experience.

Gray, K. E., & Otero, V. K. (2009). *Analysis of former Learning Assistants' views on cooperative learning*. Conference Proceedings of the AIP Conference, Ann Arbor, MI.

https://pubs.aip.org/aip/acp/article-pdf/1179/1/149/11806008/149_1_online.pdf

The University of Colorado Learning Assistant (LA) program integrates a weekly education seminar, meetings with science faculty to review content, and a semester-long teaching experience that hires undergraduates to work with groups of students in university science courses. Following this three-pronged learning experience, some of the LAs continue into the teacher certification program. While previous research has shown that this model has more than doubled the number of science and math majors graduating with a teaching certification, the question remains whether these teachers are better prepared to teach. The analysis presented here addresses this question by comparing the views of former LAs to the views of comparable teachers on the issue of cooperative learning. Interviews were conducted with ten middle school and high school science teachers throughout their first year of teaching. Results suggest differences in former LAs' views toward group work and their purposes for using group work.

Gray, K. E., Webb, D. C., & Otero, V. K. (2010). *Are Learning Assistants better K-12 science teachers?* Conference Proceedings of the Physics Education Research Conference, Portland, OR.

https://pubs.aip.org/aip/acp/article-pdf/1289/1/157/11752816/157_1_online.pdf

This study investigates how the undergraduate Learning Assistant (LA) experience affects teachers' first year of teaching. The LA Program provides interested science majors with the opportunity to explore teaching through weekly teaching responsibilities, an introduction to physics education research, and a learning community within the university. Some of these LAs are recruited to secondary science teacher certification programs. We hypothesized that the LA experience would enhance the teaching practices of the LAs who ultimately become teachers. To test this hypothesis, LAs were compared to a matched sample of teachers who completed the same teacher certification program as the LAs but did not have the LA "treatment." LAs and "non-LAs" were compared through interviews, classroom observations, artifact packages, and observations made with Reformed Teacher Observation Protocol (RTOP) collected within the first year of teaching. Some differences were found; these findings and their implications are discussed.

Gray, K. E., Webb, D. C., & Otero, V. K. (2012). *Effects of the Learning Assistant experience on in-service teachers' practices* Conference Proceedings of the Physics Education Research Conference, Omaha, NE.

https://pubs.aip.org/aip/acp/article-pdf/1413/1/199/12210590/199_1_online.pdf

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

Gray, K. E., Webb, D. C., & Otero, V. K. (2016). Effects of the Learning Assistant Model on teacher practice. *Physical Review Physics Education Research*, 12(2). doi: <https://doi.org/10.1103/PhysRevPhysEducRes.12.020126>.

<https://journals.aps.org/prper/pdf/10.1103/PhysRevPhysEducRes.12.020126>.

Through the transformation of undergraduate STEM courses, the Colorado Learning Assistant Program recruits and prepares talented STEM majors for careers in teaching by providing them with early, sustained teaching experiences. The research reported here compares teaching practices of K-12 teachers who served as learning assistants (LAs) as undergraduates to colleagues that were certified through the same teacher certification program but did not serve as LAs. Observations of teacher practices revealed that former LAs used significantly more reformed teaching practices than their colleagues, especially in their first year of teaching. These results suggest the LA Program serves as a valuable supplement to traditional teacher certification programs.

Harrison, D., Lentz, J., Schmatz, N., Escovedo, C., & Stark, E. (2017). Peer-based anatomy tutoring for first-year medical students: An analysis of peer-tutoring from the tutors' perspective. *Medical Science Educator*, 27(1), 57-61.

In response to student demand for additional anatomy lab instructional time outside of typical teaching hours, a peer-based anatomy tutoring program was implemented at the David Geffen School of Medicine at UCLA. Peer tutoring is a well-studied form of supplemental instruction, and is known to benefit students and tutors alike. This study aims to address the effect of tutoring on the tutors themselves, specifically in the context of the gross anatomy laboratory. A one-time 12-question survey was distributed to all students who acted as

tutors over a three-year period (n = 57), asking them to reflect on their experiences as tutors. Specifically, we aimed to address their thoughts on their career plans and academic achievement as they relate to their experience as tutors, as well as their opinions on effective tutoring techniques. Based on a 100% response rate, 85.7% of tutors reported being “very interested” in incorporating a teaching component to their career, and 73.7% of respondents reported that their experience tutoring influenced this plan. In contrast to an expectation that tutors would skew their residency choices toward anatomy-focused specialties, the distribution of tutors’ anticipated specialty choices actually reflected the overall distribution of the class. The tutors believed their experience tutoring improved their academic and clinical performance. The overwhelming majority reported believing that their experience as a tutor improved their USMLE Step 1 score (90.2%, n = 46). Sixty-one percent (n = 31) reported feeling that the experience as a tutor helped with their clerkship evaluations. Finally, the most effective tutoring techniques were quizzing the students directly and using the tutors’ own notes and study materials from the prior year. This study supports the finding that tutoring provides a significant beneficial effect on the tutors based on their own perceptions, and further studies obtaining quantitative data on academic achievement and clinical performance of the tutors will be beneficial.

Healy, C. E. (1994). Introducing Supplemental Instruction in engineering. In C. Rust & J. Wallace (Eds.), *Helping students to learn from each other: Supplemental Instruction, SEDA Paper 86* (pp. 25-30). Birmingham, England: Staff and Educational Development Association

This chapter describes the implementation of Supplemental Instruction in engineering courses at Glasgow Caledonia University in Scotland. The University is seeking to initiate cultural change through partnership events involving students, staff and employees. Research studies suggested improvements by both the SI participants (64.8 percentile vs. 54.4 percentile for non-SI participants) and the SI leaders. Some SI leaders reported that they had now considered pursuing a teaching career based on the positive experience with the SI program.

Henry, J., Bruland, H. H., & Sano-Franchini, J. (2011). Course-embedded mentoring for first-year students: Melding academic subject support with role modeling, psycho-social support, and goal setting. *International Journal for the Scholarship of Teaching and Learning*, 5(2), Article 16. <http://files.eric.ed.gov/fulltext/EJ1136285.pdf>.

This article examines a mentoring initiative that embedded advanced students in first-year composition courses to mentor students to excel to the best of their abilities. Mentors attended all classes along with students and conducted many out-of-class individual conferences, documenting each of them using program-implemented work logs. Four hundred four first-year students provided end-of-term anonymous feedback on standardized forms, which were transcribed, digitized, and tabulated for analysis. Analysis showed that the mentoring was effective in providing the four constructs key to mentoring as identified by Nora and Crisp (2008): psychological/emotional support; support for setting goals and choosing a career path; academic subject knowledge support aimed at advancing a student's knowledge relevant to his or her chosen field; specification of a role model. Analysis also revealed a key construct not mentioned by Nora and Crisp: the mentee's predisposition. Recommendations for implementing embedded mentoring for first-year students in other contexts follow the Discussion.

Johnson, E. C., & Loui, M. C. (2009). *How can students benefit as peer leader of learning teams?* Paper presented at the 39th ASEE/IEEE Frontiers in Education Conference, San Antonio, Texas.

In a course for freshmen in electrical and computer engineering, students may choose to attend optional supervised study sessions, which implement Peer-Led Team Learning (PLTL) workshops. In the sessions, students work on difficult problems from previous semesters’ exams under the supervision of a team leader. The team leaders are graduate teaching assistants, undergraduate teaching assistants, and undergraduate volunteers. For two semesters, team leaders were asked to keep weekly reflective journals. The researchers qualitatively analyzed fourteen journals and found that leaders faced common challenges such as irregular student attendance and inadequate student preparation. Leaders reported that they increased their self-confidence, developed an appreciation for intellectual diversity, and gained an increased interest in teaching. Leading PLTL workshops provides an excellent opportunity for personal development. Leaders gain important insights about other students’ perspectives and learn to justify and explain their own work. Leading a PLTL workshop enhances the leaders’ ability to collaborate in teams and take on leadership roles in the future.

Kampmeier, J. A. (2003). *The scholarship of teaching*. Unpublished manuscript. City University of New York. New York, NY.

This article provides an overview of the Peer-Led Team Learning (PLTL) program developed at the City University of New York. The author describes the impact of

the PLTL program upon teacher preparation of the student peer group facilitators.

Kenney, P. A., & Kallison, J. M. (1992). *Learning to study college-level mathematics: Effects of a Supplemental Instruction (SI) program in first-semester calculus courses*. Conference Proceedings of the American Educational Research Association 1992 Annual Conference, San Francisco, CA.

This paper details results from a Supplemental Instruction program designed for students in college-level calculus courses during Fall 1989. The studies were conducted at the University of Texas at Austin by two teaching assistants employed by the mathematics department and were selected and trained by the SI program by the staff of the University's Learning Skills Center. The first study compared the performance of students in Business Calculus. While SI was beneficial to all SI participants (2.39 vs. 1.96 for non-SI participants), it was especially helpful for lower-ability students. The second study focused on an Engineering Calculus course. While the difference was closer for the two groups (2.01 vs. 1.91 for non-SI participants), SI provided disproportionate help to the lower-ability students as measured by SAT quantitative scores. More than 70 percent of students felt that the study strategies introduced by the SI leaders were either "very helpful" or "helpful." Almost 80 percent indicated that exposure to study strategies for calculus changed the way they studied either "very much" or "somewhat," and that the techniques that these skills would help them in future courses either "very much" or "somewhat." More than 80 percent of the students responded that it was either "very important" or "important" that all SI leaders incorporate study strategies into discussion sections. SI leaders mentioned the positive impact of the SI program on themselves as well: reflect about their teaching methods; develop new teaching methods; and learned how to integrate learning strategies with content instruction.

Laurs, D. E. (2018). Perceived impact of PASS leadership experience on student leaders' transferable skills development *Journal of Peer Learning*, 11(1), 27-40.
www.ro.uow.edu.au/cgi/viewcontent.cgi?article=1138&context=ajpl.

The PASS (Peer Assisted Study Support) program has been operating at Victoria University of Wellington, New Zealand, since 2000, and currently provides weekly study sessions in more than 50 courses each year. As well as enhancing the first-year learning experience, PASS contributes to an institution-wide award that acknowledges the impact of extra-curricular activities on students' graduate attributes and employability skills. Selected from high-caliber candidates, PASS leaders already possess strong communication and thinking skills. Nevertheless, an online survey of current and former leaders between 2009-2014 [n=185] revealed a significant majority perceived that the experience of leading a study group, in particular the associated writing of weekly reflections, enhanced their confidence, cognitive and communication skills, as well as contributing to their CVs and job application success. Such results highlight the potential for student leaders to translate their day-to-day experiences into added value for life after university.

Liou-Mark, J. (2002). Leading Workshops at Brooklyn International High School. Peer-Led Team Learning: Implementation in high schools. *Progressions: The Peer-Led Team Learning Project Newsletter*, 3(3).
www.pltlis.org/wp-content/uploads/2012/10/High-School-Implementation-Liou-Mark-Leading-Workshops-Brooklyn-International-HS.pdf.

New York City College of Technology (NYCCT) students who took the Peer-Led Team Learning (PLTL) leader training course at the City College of New York (CCNY) via videoconferencing have had an opportunity to tutor students in mathematics at the Brooklyn International High School. Once a week during the Spring 2002 semester, these students helped prepare 9th and 10th grade students for the Mathematics Regents A* examination. This experience gave students the opportunity to apply the Workshop model at a local high

school. These NYCCT students are also enrolled in the Teacher Preparation Program at CCNY (Ellen Goldstein, Co-PI). As part of the program, they are required to take the Peer Leader Training course as an introductory course to teaching. These students are mostly associate-degree computer science majors interested in teaching mathematics. They then are encouraged to transfer to CCNY and complete their Bachelor's degree.

Lipsky, S. A., & Kapadia, M. (2013). Effects of work experiences for academic peer educators. *Synergy*, 6, Article 3. www.myatp.org/wp-content/uploads/2015/04/Synergy-Vol-6-Kapadia.pdf.

This study employed a qualitative research model to understand the potential outcomes of the Supplemental Instruction (SI) program on the SI leaders. Thirteen experienced SI leaders participated in focus groups. The study was completed as part of the program's assessment and accountability system in addition to understanding a topic not often investigated in a rigorous fashion. The study revealed several findings: (1) intellectual growth (knowledge of subject matter, learning strategies, and higher-level cognition); (2) personal growth (listening, interpersonal communication, time management, leadership, and self-confidence); and (3) professional growth (work and career-related knowledge and self-efficacy). The SI leaders saw how these skills would be useful as they began their work careers. For SI leaders who had considered a career in education, the experience of serving with the program had solidified their decision. Some SI leaders now were considering a decision or change from previous interests for a career in teaching.

Lozada, N., & Johnson, A. T. (2018). Bridging the Supplemental Instruction leader experience and post-graduation life. *The Learning Assistance Review*, 23(1), 95-114. www.files.eric.ed.gov/fulltext/EJ1170143.pdf.

This qualitative study explores the experience of former Supplemental Instruction (SI) leaders who worked at a four-year, private university while completing their undergraduate degrees. Serving as an SI leader prepared them for their post-graduation lives through the transferability of skills to post-graduate studies and employment: knowledge skills, interpersonal skills, communication skills, collaboration skills, and future vocational plans.

Malm, J., Collins, J., Nel, C., Smith, L., Carey, W., Miller, H., . . . Zaccagnini, M. (2022). Transferable skills gained by student leaders in international SI-PASS programs. *The International Journal of Learning in Higher Education*, 29(1). doi.org/10.18848/2327-7955/CGP/v29i01/65-82. www.cgscholar.com/bookstore/works/serve_pdf?adv=false&category_id=179&version_id=243409.

Supplemental Instruction/Peer Assisted Study Sessions (SI-PASS) is a peer learning program used worldwide to improve students' learning and performance in challenging courses in higher education. A bonus effect of the program is the transferable skills that the student leaders may develop when facilitating the study sessions. These student leaders can potentially gain communication, group management, and other personal skills that are useful later in life. The relatively few studies devoted to this topic suggest that this is the case; however, these earlier studies have several limitations. They cover only one SI-PASS program, raise generalizability questions, and frequently use their own definitions of skills gained by student leaders that seldom are linked to employability skills. Furthermore, it is rare that these studies include former leaders and their use of the developed skills in working life. This study addresses these limitations for a broader understanding of skills gained by SI-PASS Leaders and how these skills transfer to a job environment. The study includes student leaders from three SI-PASS programs in three countries across three continents. Two questionnaires were used—one for active SI-PASS Leaders and one for former student leaders who graduated from their university. The results show that the SI-PASS Leaders gained transferable skills within several areas, primarily in communication and group management. This skill improvement is independent of the SI-PASS program. The study also shows that most former leaders report the use of these developed skills both in the application/hiring process as well as in the job itself.

Maloney, R. S. (1992). *The Supplemental Instruction program as an alternative field experience for secondary education majors*. (Bachelor of Science with Honors thesis), University of New Orleans, New Orleans, LA.

The College of Education at the University of New Orleans, LA (UNO) requires all education majors to complete twenty five hours of a Professional Laboratory Experience (PLE), which has traditionally been as a teacher aide in an area high school, prior to the student teaching experience. The goal of the PLE is to provide a varied and enriching teaching experience for prospective student teachers. The primary purpose of this study is to study the use of Supplemental Instruction (SI) in College Life sections of English 0150 during Fall 1991 to provide an effective alternative field experience for secondary education majors prior to student teaching. Students were divided into two groups: one group served as SI leaders in the English course and the other group were placed in the traditional high school teacher aide position. Surveys were given to the secondary education majors -- those who completed their PLE at the high school and those who served as SI leaders at the college -- prior to and at the completion of their PLE (course name EDCI 3205) to measure their preparedness to perform specific teaching tasks. The results suggest that there is a greater change in

preparedness levels for those who participated as SI leaders in the following areas: (a) lesson preparation (write performance objectives, choose appropriate materials, vary methodology, allocate time for content coverage, construct evaluation instruments, and provide feedback of assessment and evaluation results); (b) classroom management (manage time, manage classroom routines, maintain student engagement, manage task related behavior, and monitor and maintain student behavior); and c) instructional skills (initiate lessons and activities, provide accurate content information, emphasize essential elements of content knowledge, and implement learning activities at an appropriate pace). The researcher suggested that one of the reasons for the significant gains for the SI leaders was that they had more power to select and experiment with activities. The high school teaching aides were limited by the cooperating high school teacher. Based upon analysis of the data, the researcher suggests that SI can serve as an alternative experience for education majors.

Marin, M. (2022). Five essays on the trail to medical school. *Advances in Peer-Led Learning*, 2(1), 101-110. doi: <https://journal.pltlis.org/wp-content/uploads/2023/01/8-Marin-APLL-Vol-2.pdf>.
<https://journal.pltlis.org/wp-content/uploads/2023/01/8-Marin-APLL-Vol-2.pdf>.

This collection of essays provide advice and guidance to students, especially Peer Leaders (PLs), seeking to apply to graduate or professional schools. These essays were inspired by my experiences as a leader and helped me craft my medical school applications. These essays exemplify how journaling the opportunities encountered as a PL proves to be of extreme value. In addition to the essays, my PL experiences helped to provide meaningful insights which I could share and reflect on throughout the interview process. When faced with provocative questions (e.g., Describe a challenge you have faced; discuss the importance of diversity; tell us about a time you failed), I continuously found myself able to rely on lessons learned from working as a Peer Leader. I am pleased to describe a variety of special experiences that enabled me to present different aspects of my character to interviewers and to clearly personify the traits that appealed to them in my written application.

McGlone, F. D. (1994). *A training and implementation program for first year student peer mentors*. Unpublished manuscript. Queensland University of Technology, Brisbane, Queensland, Australia.

The Queensland University of Technology (QUT) Faculty of Law (Brisbane, Australia) Supplemental Instruction (SI) program encouraged students to: develop deep approaches to learning, develop generic learning skills, and increase student autonomy while encouraging them to work and learn cooperatively with others. The SI program operates in two classes: Torts and Contracts with class sizes exceeding 350. In addition to improving academic performance of student participants, the SI leaders reported enhanced communication and interpersonal skills which they perceived to increase their job marketability.

Meikle, J. (1993, February 16). Learning to help others, *Guardian Education Newspaper*, p. 10.

This newspaper article describes the use of Supplemental Instruction (SI) at Kingston University in the United Kingdom. In an interview with Jenni Wallace, SI Certified Trainer for the United Kingdom, she explains that SI sessions are positioned between the classroom lectures by the professor and the tutorial sessions. The SI sessions help students to be better prepared to maximize their time spent in the tutorial sessions. There are reports that former SI leaders and participants in succeeding academic terms form their own study groups in classes where formal SI sessions are not offered. Former SI leaders report that potential employers are impressed with the skills that they developed as facilitators of the study groups.

Merwin, D. D. (1991). A comparative analysis of two tutoring methods assessing student achievement and retention [Dissertation, Montana State University, 1990]. *Dissertation Abstracts International*, 52(02), 438A. (University Microfilms No. 9109700).

The purpose of this doctoral dissertation research study was to compare the effectiveness of two tutoring methods with regard to achievement and retention for high-risk undergraduate students at Northern Montana College (Havre, MT) enrolled in English 150 during the 1986-87 academic school year (eleven courses sections over the fall, winter and spring academic terms). Supplemental Instruction (SI) was compared with another form of tutoring. English 150 is a three-credit course considered to be developmental in content since it encompassed the basic skills areas (sentence structure, parts of speech, grammar, usage, punctuation, and paragraph development). The two tutoring

methods were group tutoring (i.e., Supplemental Instruction, or SI) and individual tutoring. The treatment was randomly assigned to each of the eleven course sections and attendance was mandatory by the students. The problem was investigated by: (1) examining how the tutoring methods and other independent variables affected student achievement and student retention, and (2) comparing the two tutoring methods in terms of cost effectiveness. Achievement was measured by the pretest-posttest gain score from the Tests of Adult Basic Education (TABE). The TABE test for English measured students' competency in capitalization, punctuation, expression, and spelling. Retention was measured by the ratio percentage of the number of student credit hours earned compared to the number of hours attempted for the first and second years following treatment. The cost effectiveness of both tutoring methods was compared by determining the cost of one grade level of improvement. Some of the major findings were: students in SI tutoring had higher retention rates than students receiving individual tutoring for the first and second years following treatment; the combined results of the two tutoring methods did make a significant difference in student achievement; the SI tutoring method compared to the individual tutoring method was more cost effective (\$3.46 average cost for SI program to improve one grade level of one students vs. \$16.30 for one-on-one tutoring to do the same); and individual tutoring had a relatively short-term effect. An unexpected finding was that students who participated in SI groups continued to meet at other times outside of class and that the groups were heterogeneous groupings. Interviews with these students revealed that they had met the other students through the SI sessions. It was assumed that students would tend to meet with their own homogeneous affinity groups. The SI students revealed that they enjoyed the social interactions in the groups and felt more comfortable working with other SI participants when they needed additional academic assistance with the English 150 course. The SI program also had an impact upon the SI leaders. Three of the seven SI leaders changed their degrees -- two were business majors and one was a vocational-technical major -- to education so they could become professional teachers. One-on-one tutors reported frustration with the tutoring program when students canceled their scheduled tutoring sessions. Since SI leaders worked with groups, they did not encounter that problem.

Micari, M., Streitwieser, B., & Light, G. (2006). Undergraduates leading undergraduates: Peer facilitation in a science workshop program. *Innovative Higher Education*, 30(4), 269-288. doi: 10.1007/s10755-005-8348-y.

This article presents the results of a study at Northwestern University concerning experiences of undergraduate students serving as facilitators of Peer led Team Learning (PLTL) sessions for introductory undergraduate sciences and engineering course. The PLTL facilitators reported growth in a variety of areas: cognitive growth (consolidating knowledge in the discipline, enhancing conceptual understanding, and developing problem-solving skills); personal growth (communication skills in confidence, audience understanding, and self-expression; pedagogical skills; improved ability to explain concepts; and skill at learning to allow students to work out their ideas on their own without interrupting to offer guidance; understanding the role of the teacher); and instrumental growth (career development and striving to achieve professional goals).

Montes, M. O., & Becvar, J. E. (2021). Per leader alumni reflections: Advancing visibility and reach of Peer-Led Team Learning. Panel from the 2021 PLTLIS Conference. *Advances in Peer-Led Learning*, 1(1), 122-141. doi: doi.org/10.54935/apll2021-01-11-122. www.doi.org/10.54935/apll2021-01-11-122.

Calculating roughly, starting in 1992 with Peer Leaders from "Workshop Chemistry" at the City College of New York,

Peer-led Team Learning programs may have an aggregate of perhaps 30,000 students who became Peer Leaders and are now alumni. How are Peer Leaders affected by their experiences? This paper is an edited transcription of Peer Leader Alumni panelists from the discussion at the 2021 PLTLIS Annual Conference, held online on Saturday, June 5, 2021.

Muller, O., Scacham, M., & Herscovitz, O. (2017). Peer-led Team Learning in a college of engineering: First-year students' achievements and peer leaders' gains. *Innovations in Education & Teaching International*. doi: 10.1080/14703297.2017.1285714.
www.srhe.tandfonline.com/doi/full/10.1080/14703297.2017.1285714?scroll=top&needAccess=true.

Due to high dropout rates (30%) among first-year students, our college of engineering operates programmes for promoting students' retention and learning. The peer-led team learning (PLTL) programme accompanies Science, Technology, Engineering and Mathematics introductory courses with a high rate of failures, and incorporates workshops of small groups of students for developing active-learning and problem-solving skills. The workshops are led by outstanding students from advanced years; the peer leaders (PL). This study focused on the effects of the PLTL programme (40 workshops, 26 PLs) on the achievements of students who participated in the workshops compared with those who did not, and on its impact on the PLs. Findings reveal that workshops advance students of all levels and improve their achievements in several courses, while contributing more to students with higher academic capabilities. PLs felt satisfaction and believe they have gained self-confidence, and mentoring and communication skills for their future careers.

Murray, M. H. (1996). *Resources for the resourceless: Maximizing student learning*. Conference Proceedings of the 8th Conference of the Australian Association of Engineering Education, Sydney, Australia.

This article (which won "Best Paper" award at the conference) describes the use of Supplemental Instruction (SI) in the School of Civil Engineering, Queensland University of Technology (Australia). A basic engineering statics course in the first year has been transformed from a traditional lecturer-centered teaching mode into a student-centered resource-based model. Central to this transformation has been the integration of SI into the course. The SI sessions focus on interaction, discussion, and investigation rather than just simple problem solving. Before integration of SI in the course the total class (SI and non-SI students) mean final score was 46, in 1996 after the integration the score increased to 55. These results are based on the aggregated score from four quizzes during the semester, from a spaghetti bridge design/build/test project, and from a final end-of-semester exam. Based on standardized scores, the students in 1996 were less academically prepared than the ones in 1994 before SI was introduced. The SI participants received a higher mean final percentile grade in each year of the study (1995: 48 vs. 41; 1996: 56 vs. 42). There was a positive increase in final course score and higher levels of SI attendance. Students evaluated the SI session most useful of all course components (SI sessions, 53%; lecture, 22%; text book, 16%; study guide, 13%; and tutorial, 9%). SI leaders mentioned the following benefits of the program for themselves: increased skill in group management; improved public speaking; gained skills in team building; increased group facilitation skills; improved personal time management; and increased interest from potential employers because of skills developed as a SI leader.

Murray, M. H. (1996). Alternative to lecturer-centered teaching enhances student learning and costs no more. *Academic Staff Development Unit Update (Queensland University of Technology, Australia)*, 6-7.

This article describes the use of Supplemental Instruction (SI) in the School of Civil Engineering, Queensland University of Technology (Australia). A basic engineering statics course in the first year has been transformed from a traditional lecturer-centered teaching mode into a student-centered resource-based model. Central to this transformation has been the integration of SI into the course. The SI sessions focus on interaction, discussion, and investigation rather than just simple problem solving. Before integration of SI in the course the total class (SI and non-SI students) mean final score was 46, in 1996 after the integration the score increased to 55. These results are based on the aggregated score from four quizzes during the semester, from a spaghetti bridge design/build/test project, and from a final end-of-semester exam. Based on standardized scores, the students in 1996 were less academically prepared than the ones in 1994 before SI was introduced. The SI participants received a higher mean final percentile grade in each year of the study (1995: 48 vs. 41; 1996: 56 vs. 42). There was a positive increase in final course score and higher levels of SI attendance. Students evaluated the SI session most useful of all course components (SI sessions, 53%; lecture, 22%; text book, 16%; study guide, 13%; and tutorial, 9%). SI leaders mentioned the following benefits of the program for themselves: increased skill in group management; improved public speaking; gained skills in team building; increased group facilitation skills; improved personal time management; and increased interest from potential employers because of skills developed as a SI leader.

Nadelson, L. S., & Finnegan, J. (2014). Path less traveled: Fostering STEM majors' professional identity development through engagement as STEM Learning Assistants. *Journal of Higher Education Theory & Practice*, 14(5),

29-40. http://www.na-businesspress.com/JHETP/NadelsonLS_Web14_5_.pdf.

Professional identity development of undergraduate STEM majors is associated with their retention, engagement, and career success. Student professional identity development is posited to occur when students engage in professional roles. Learning assistants (peer learning facilitators) assume roles of authority, leadership, and content experts, which we posited would foster a more mastery perspective of learning (focused on concepts over facts) and internalize perceptions of themselves as professionals. Our research on a group of STEM education learning assistants revealed over time the students tended to shift toward a mastery perspective of learning and used internal cues to communicate their professional identity.

Narode, R. (2001). PLTL and the future of science teacher education. Peer-Led Team Learning: Implementation in high schools. *Progressions: The Peer-Led Team Learning Project Newsletter*, 2(2). www.pltlis.org/wp-content/uploads/2012/10/High-School-Implementation-Narode-PLTL-Future-of-Science-Teacher-Education.pdf.

The current shortage of math and science teachers (especially physical science teachers) is exacerbated by two important factors: 1) a strong economy offering excellent employment opportunities with higher starting salaries, faster financial growth, and greater status than teaching, and 2) a culture among scientists that encourages students to become scientists far more frequently than to become teachers of science. While PLTL cannot directly change the first of these factors it can directly and indirectly address the second factor. By supporting Peer-Led Team Learning (PLTL) faculty with initial funding, professional development, inquiry-based curriculum for student-led workshops, guides for workshop development, and continuing education of workshop leaders, the PLTL Model educates college science faculty about the potential of students as teachers / learning-facilitators. The student workshop leaders themselves awaken faculty to the understanding that their talents ought to be directed toward the profession of teaching. Furthermore, the presence and support of learning specialists in collaboration with PLTL science faculty and workshop leaders complete the connection to teacher education.

O'Donnell, R. (2004). *Introducing peer-assisted learning in first year accounting in Australia*. Unpublished manuscript. Department of Economics, Macquarie University. Sydney, New South Wales, Australia. www.econ.mq.edu.au/Econ_docs/research_papers/2004_research_papers/PALDec04.pdf

At Macquarie University in Australia, Peer Assisted Learning (PAL) is an adaptation of the Supplemental Instruction (SI) model. PAL was piloted in an accounting course. The paper describes the pilot program regarding its design, outcomes, benefits, costs, and lessons learned. There was a positive correlation between higher grades and more frequent attendance in the PAL sessions. There were also benefits for the PAL facilitators: development of key skills such as leadership, communication, group management; deeper understanding of course content; valuable enhancement to employability; and financial payment.

Ody, M., & Carey, W. (2000). *Demystifying Peer Assisted Study Sessions (PASS): What...? How...? Who...? Why...?* Unpublished manuscript. The University of Manchester. Manchester, U.K. www.documents.manchester.ac.uk/display.aspx?DocID=7418

PASS offers benefits at several levels to various stakeholders. At an institutional level it provides an additional cost-effective method of student support, which has been highlighted as good practice by the Quality Assurance Agency in supporting the student experience. The impact of PASS on a student's employability is also recognized by employers and professional accreditation bodies; during a recent visit to the School of Chemical Engineering and Analytical Sciences the IChemE reported positively on the use of PASS and notably its impact on the transferable skills developed by PASS Leaders. Anecdotal feedback from a range of graduate employers recognizes that students who engage in voluntary roles, such as a PASS Leader, develop competencies and transferable skills that increase their employability prospects

Otero, V., Finkelstein, N., McCray, R., & Pollard, S. (2006). Who is responsible for preparing science teachers? *Science*, 313(5786), 445-446. doi: <https://psycnet.apa.org/doi/10.1126/science.1129648>.

Teachers knowledgeable in both science and pedagogy are critical for successful math and science education in primary and secondary schools. However, at U.S. universities, too many undergraduates are not learning the science, and our highest performing students are choosing fields other than teaching. With a few exceptions [such as (5, 6)], universities convey that teaching kindergarten to 12th grade (K-12) is not a career worthy of a talented student. Two out of three high school physics teachers have neither a major nor a minor in the discipline, and the greatest teacher shortages are in math, physics, and chemistry. The shortages of teachers with these majors have likely contributed to the poor current outcomes for math and science education. This article discusses a program developed at the University of Colorado (CU), that engages both science and education faculty in addressing national challenges in education. (PsycINFO Database Record (c) 2018 APA, all rights reserved)

Otero, V., Pollock, S., & Finkelstein, N. (2010). A physics department's role in preparing physics teachers: The Colorado learning assistant model. *American Journal of Physics*, 78(11), 1218-1224. doi: <https://doi.org/10.1119/1.3471291>.
https://pubs.aip.org/aapt/ajp/article-pdf/78/11/1218/13132646/1218_1_online.pdf.

In response to substantial evidence that many U.S. students are inadequately prepared in science and mathematics, we have developed an effective and adaptable model that improves the education of all students in introductory physics and increases the numbers of talented physics majors becoming certified to teach physics. We report on the Colorado Learning Assistant model and discuss its effectiveness at a large research university. Since its inception in 2003, we have increased the pool of well-qualified K–12 physics teachers by a factor of approximately three, engaged scientists significantly in the recruiting and preparation of future teachers, and improved the introductory physics sequence so that students' learning gains are typically double the traditional average.

Otero, V. K. (2015). Nationally scaled model for leveraging course transformation with physics teacher preparation. In C. Sandifer & E. Brewster (Eds.), *Recruiting and educating future physics teachers: Case studies and effective practices* (pp. 107-116): American Physical Society.
<https://www.compadre.org/portal/document/ServeFile.cfm?ID=13728&DocID=4154&Attachment=1>.

All undergraduate physics instructors are involved in teacher preparation. Future physics teachers make up a fraction of the students in undergraduate physics courses, so the teaching and learning practices that take place in these courses serve as models for how future high school physics teachers will teach their students. It is therefore the responsibility of physics instructors to ensure that their methods for teaching, and the learning practices they promote, are aligned with their expectations for introductory students' high school preparation. However, making changes to a course is not always straightforward and is often time consuming. This article describes a model for making small to large transformations to undergraduate physics courses. Lessons learned from 10 years of implementation at the founding institution and from emulating institutions throughout the nation are discussed. Resources for making transformations, along with data to support claims about the effectiveness and adaptability of the model, are also described.

Parente, A. D. (2010). The scholarship of Peer-Led Team Learning: My progression from student leader to faculty. Peer-Led Team Learning: The experience of leading. *Progressions: The Peer-Led Team Learning Project Newsletter*, 12(1).
www.pltlis.org/wp-content/uploads/2012/10/Experience-of-Leading-Parente-The-Scholarship-of-Peer-Led-Team-Learning.pdf.

This is a first-hand account to a student facilitator involved with the Peer-led Team Learning (PLTL) program. Twenty years ago, I was an undergraduate majoring in Biology and Chemistry, struggling with the desire to integrate the details I had learned in my Chemistry courses with the 'big picture' philosophy stressed in my Biology curriculum. These early educational experiences fostered my passion for curricula geared towards interdisciplinary learning and in programs designed to increase awareness of alternative learning styles and pedagogies for instruction. My Workshop journey began five years later, shortly after the program's inception in Organic Chemistry at the University of Rochester under the direction of Jack Kampmeier. To this day, I can't remember how I became involved with this program, but know it was a life-changing opportunity with incredible people that played a central role in shaping my academic career.

Patt, G. R. (1996). The best way to learn is to teach. *Bioscience*, 4(2).

This article describes the use of Supplemental Instruction (SI) as a form of peer-group instruction in biology at Southern Illinois University at Edwardsville. SI leaders report benefits for them since it helps them to prepare for comprehensive examinations such as MCAT or GRE as well as developing teaching skills. Data from Fall 1995 reports that those who attended SI session four or more times earned a mean final course grade of a low B, those who attended one to three times earned a C, and those who did not attend any SI sessions earned a high D grade.

Quinn, K. B. (1990). *Retaining undergraduates and training graduates: A variation on Supplemental Instruction in a College Biology class*. Conference Proceedings of the 14th Annual Conference of the National Association for Developmental Education,

Boston, MA.

This article described a retention program based on a variation of the Supplemental Instruction (SI) model piloted in the Academic Skills Program at the University of Illinois at Chicago. SI leaders were graduate students enrolled in the Masters of Teaching Science program at the university. The intent of the pilot program was not only to increase the academic performance of students and the number of students who completed Biology 102 -- one of the most difficult courses for non-majors at the university -- but also to provide a training experience for graduate students who were going into teaching science in the public schools and the community colleges. Research suggests that freshmen SI participants earned higher mean final course grades (3.23 vs. 2.90). Students who attended SI six or more times during the academic term received no lower than a final course grade of B. There was a positive correlation between SI attendance and higher grades (zero to five point scale): attended one SI session, mean final course grade of 3.16; attended two to five, 3.56; attended six to ten, 4.50; attended eleven to twenty-seven, 4.00.

Rodrick, H. K. (2020). *Helping them changes us: Experiences of Supplemental Instruction leaders with transformative learning*. (Ph.D. dissertation), Wichita State University, Wichita, KS.

www.soar.wichita.edu/bitstream/handle/10057/18819/d20022_Rodrick.pdf?sequence=1&isAllowed=y

Supplemental Instruction (SI) is an academic success program with a proven track record that was developed in the early 1970s to improve student academic performance in traditionally difficult courses (Arendale, 2000; Bonsangue et al., 2013; Bowles, McCoy, & Bates, 2008; Rabitory, Hoffman, & Person, 2015; Widmar, 1994). In over 40 years of program implementation, SI has been almost exclusively studied from the perspective of benefits to the Institutions of Higher Education (IHE) and the students receiving the instruction. Notably less research about SI has been conducted from the SI leader's point of view or included descriptions of their experiences in relation to changes in perception or critical self-reflection (A. W. Astin, 1985; Cress, Astin, Zimmerman-Oster, & Burkhardt, 2001). Using Mezirow's (1991) transformative learning theory in combination with Nohl's (2014) practice-based model as the theoretical structure, I conducted an interpretive qualitative study to investigate SI leaders' experiences. I interviewed former SI leaders who have held the position for at least 2 semesters in one of two institutions in different countries. The experience of being an SI leader shaped participants' whole college experience, their post-graduate education, and professional careers. It also changed their perspectives about themselves, their career choices, and teaching and learning. Implications for policy and practice include teaching and learning connections, educating future teachers, structure and support for peer leaders, recruiting program leaders and participants, broadening student success, applied learning opportunities, and expanding the SI program. Implications for Mezirow's (1978) transformative learning theory in combination with Nohl's (2014) practice-based model include: the theories coexist and interact, context influences learning, stages may be skipped or experienced out of order, stages have nuances, and perspective transformation takes time.

Sabella, M. S., Van Dezor, A. G., Passehl, J., & Weisenburger. (2012). A collaboration between university and high school in preparing physics teachers: Chicago State University's Teacher Immersion Institute. *The Physics Teacher*, 50(5), 296-300. doi: <https://doi.org/10.1119/1.3703548>.

https://pubs.aip.org/aapt/pte/article-pdf/50/5/296/16058852/296_1_online.pdf.

Because of the diverse character of colleges and universities throughout the United States, it is naive to believe that a one-size-fits-all model of teacher preparation aligns with specific resources and student population needs. Exploring innovative models that challenge traditional programs is now being encouraged by organizations such as the American Association of Physics Teachers and the American Physical Society. Chicago State University (CSU) is now exploring exciting changes to its physics teacher preparation program by utilizing the expertise of Chicago Area teachers and early teaching experiences for students interested in, but not yet committed to, the physics teaching profession.

Sabella, M. S., & Van Duzor, A. G. (2013). *Cultural toolkits in the urban physics learning community* Conference Proceedings of the Physics Education Research Conference, Philadelphia, PA.

https://pubs.aip.org/aip/acp/article-pdf/1513/1/34/12186095/34_1_online.pdf

Chicago State University has been involved in curriculum development, teacher preparation, and education research that targets urban physics learners on the south-side of Chicago. Through this work we have begun to recognize specific cultural norms that our students bring to the classroom. These cultural norms appear to help our students establish strong communities in classes. Because of the homogeneity of our population, with most students coming from within a five-mile radius of our campus, there are a set of shared experiences that help establish a level of trust and sense of community that manifests itself in the science learning environment. Aspects of community play a major role in the preparation of teachers. In this paper we discuss our understanding of CSU student culture, its importance in the development of community, and its role in the preparation of future physics teachers.

Saunders, D., & Gibbon, M. (1998). Peer tutoring and peer-assisted student support: Five models within a new university. *Mentoring & Tutoring*, 5(3), 3-13.

This article describes the use of Supplemental Instruction (SI) -- called Peer Assisted Student Support (PASS) by the local institution -- in the Business School at the University of Glamorgan in Glamorgan, Wales, United Kingdom. SI has been offered in the School of Applied Sciences since 1991. It is called PASS within the Business School. Most of the PASS group facilitators are volunteers and have previously been participants in groups when they were first year students. Positive reports from facilitators included: satisfaction gained from being able to positively help their peers, improved self-confidence, better communication and oral presentation skills as a result of running sessions, and being able to strengthen their job resume. The author identified several challenges with the PASS scheme: student attendance was erratic due to perceived time conflicts of students; difficulty to maintain the voluntary program as committed PASS facilitators graduated and new leaders needed to be recruited to take over responsibilities.

Schick, C. P. (2018). *Trying on teaching: Transforming STEM classrooms with a Learning Assistant Program*. Conference Proceedings of the ACS Symposium. <https://pubs.acs.org/doi/pdf/10.1021/bk-2018-1280.ch001>

The nationally recognized Learning Assistant (LA) model, originating at the University of Colorado, Boulder (CU-Boulder), has been adapted for the two-year college setting at Montgomery College. LAs are recruited to assist in STEM classrooms and laboratories with a variety of unique assignments designed to enhance collaborative learning and student engagement. LAs get the opportunity to 'try on teaching' as they work alongside their faculty mentors, assisting students in the classes they support. Highlights on the faculty mentorship and reflections on teaching for the LAs are presented. Academic success, for both the students in the LA-supported classes and the LAs themselves, plus positive transformations in the STEM classrooms are discussed. The LAs, their faculty mentors, the classroom students, and the field of STEM education all benefit from this collaboration.

Sedghi, G., & WFashbourn, G. (2021). An essay: PAL training and future use in one's career. In A. Strømme-Bakhtiar, R. Helde & E. Suzen (Eds.), *Supplemental Instruction: Student learning processes*, volume 2 (pp. 141-159). LMunster and New York: Waxmann. www.waxmann.com/index.php?elD=download&buchnr=4325.

The transition between school and university is a longstanding issue in higher education (HE) due to significant differences between the two educational environments. The lack of extra support to ease the transition for students results in poor retention in HE institutions. Various provisions are introduced at universities to support students with adapting to the new educational environment. One of the means of tackling this issue is peer-assisted learning (PAL), a student-led scheme in which higher year students, called leaders, provide lower year students with subject support through facilitating discussions in small groups. Several benefits of PAL, to both student participants and higher year students, are reported in the literature. There are also many reports about leader training, what it covers and how it is delivered. However, there is not much in the literature about how, when and where the acquired skills are articulated in one's career. In this chapter, we will explain the details and structure of initial and ongoing leader training, in supporting students to not only gain various skills through PAL leadership but also reflect on and articulate the skills to future studies or employment. Different PAL leadership roles and progression pathways will be explained as a means to enhance employability. We will reflect on one's journey from becoming a leader to a lecturer, and how the gained skills through PAL leadership are mapped to the globally-recognised framework, for benchmarking success within HE teaching and learning.

Smith, L. D. (1999). *SI leadership and personal growth: A South African perspective*. Conference Proceedings of the First National Conference on Supplemental Instruction and Video-based Supplemental Instruction, Kansas City, MO.

Many first year students at South African tertiary institutions come from a disadvantaged educational background. They tend to be passive learners and rely on rote memorization rather than understanding. This leaves many ill equipped for the demands of higher education. Although Supplemental Instruction (SI) provides

academic support, its emphasis on students' identifying problems, finding answers and taking responsibility for their learning requires a significant change in approach for both participants and the SI leader. This study documents the benefits of working as an SI leader. Initial attitudes are compared with those developed in the course of a year, by means of a questionnaire covering self-confidence, self-efficacy, identification with institution, class participation and relationship with lecturers. The personal growth of SI leaders is also compared with that of a group of non-SI cohorts. Employers' perceptions of the responsibility, initiative, creativity and reliability of SI and non-SI graduates are documented.

Smuts, K. B. (1996). The role of student leaders in Supplemental Instruction. *South African Journal of Higher Education*, 16(3), 225-231.

Benefits for the Supplemental Instruction (SI) leaders include: develop a sense of personal adequacy; communication skills; relationship skills; find meaningful use of the subject matter in their own studies; improves their own grades; reinforce their own knowledge of fundamentals; review of course material assists them with professional school entrance exams; develop citizenship skills; and skills for the workplace.

Spike, B. T., & Finkelstein, N. D. (2012). *Toward an analytic framework of physics teaching assistants' pedagogical knowledge*. Conference Proceedings of the Physics Education Research Conference, Omaha, NE.
https://pubs.aip.org/aip/acp/article-pdf/1413/1/363/12210853/363_1_online.pdf

Graduate Teaching Assistants (TAs) are the subject of increasing attention in education research, both as partners in supporting the goals of research-based curricula, and as future faculty learning about the nature of physics instruction. In previous work [1], we began documenting TA beliefs and presented two contrasting case studies of TA beliefs about teaching physics. In this paper, we begin to build a framework that identifies categories of epistemological and pedagogical resources that TAs draw upon when talking about and when engaging in teaching practices. By applying this framework to observations and interviews of a set of TAs from an introductory physics course, we demonstrate emergent differences in how these instructors talk about their own teaching, as well as examples of how these differences appear to be reflected in their framing of the instructional activity. We conclude with implications for teacher preparation and professional development at the graduate level.

Staff. (1990, November 19). Education student gets SCUP of reality at Westport High, *University News (Student newspaper of the University of Missouri-Kansas City)*, p. 4.

The newspaper article describes the use of Supplemental Instruction (SI) with high school students enrolled in English and history classes at an urban high school in Kansas City, MO. Students from the UMKC School of Education were some of persons who served as SI leaders. The article contains an interview with an education major who commented on the positive impact of the experience of working with high school students early in the education degree program rather than until the field teaching experience in a school as an upper level student.

Staff. (1995, August 2). Students helping boost pass rates, *The University of Southern Queensland Newspaper*, p. 5. This newspaper article describes the implementation of Supplemental Instruction (SI) at the University of Southern Queensland at Toowoomba in the Nursing Department during Fall 1995. In addition to describing the academic benefits to the SI participants, the USQ SI coordinator, David Anderson, reports that a value for SI leaders is that the experience provides leadership development and increases their post-graduate opportunities.

Stout, M. L., & McDaniel, A. J. (2006). Benefits to Supplemental Instruction leaders. In M. E. Stone & G. Jacobs (Eds.), *Supplemental Instruction: New visions for empowering student learning* (pp. 55-62). New Directions for Teaching and Learning, No. 106. San Francisco: Jossey-Bass

This chapter explores the many benefits that accrue to Supplemental instruction (SI) leaders as a result of their participation: academic competency, improved communication and relationship-building skills, enhanced personal development such as higher self-confidence and self-esteem, and enhanced professional development such as leadership skills, teamwork strategies, verbal and written expression, and self-assurance.

Suzen, E., Helde, R., & Strømme-Bakhtiar, A. (2021). Supplemental Instruction as a programme for developing leaders and facilitators for learning. In A. Strømme-Bakhtiar, R. Helde & E. Suzen (Eds.), *Supplemental Instruction: Student learning processes, volume 2* (pp. 11-24). Munster and New York: Waxmann.
www.waxmann.com/index.php?eID=download&buchnr=4325.

The topic of this article is the student-active programme Supplemental Instruction (SI) and the students who lead this programme, the SI leaders. SI is a voluntary offer of professional guidance under the leadership of the students themselves. The purpose of SI is to improve student performance and reduce interruptions to

studies through collaborative learning strategies. We have chosen to focus on the students who lead this programme, the SI leaders. The question we have sought to answer is: How do SI leaders understand and experience (a) SI as pedagogical programme and (b) SI as a leadership development programme? A phenomenological approach was chosen in relation to the aim of the study in order to obtain a deeper understanding of how SI leaders have understood and experienced their role as leaders and educational facilitators. The study was aimed at the SI leaders in the subject of physics working on the driving instructor education at Nord University, Norway, autumn 2017. We conducted two interviews with each SI leader, both interviews regarding their experience of being an SI leader. Six main themes emerged from our analysis indicating that SI leaders benefit from the SI programme, both in terms of leadership development and as a pedagogical learning arena for themselves as future teachers.

Taylor, G. T., Healy, C. E., & Macdonald, M. (1994). Engineering educational development: Raising the quality through partnerships. In J. Wallace (Ed.), *Kingston University HEFCE Supplemental Instruction Project* (pp. 225-230). London, England: Kingston University

The changes which face education today make it essential that quality is raised by moving from a teaching to a learning culture. Supplemental Instruction (SI) was used to create a partnerships between student, staff and employers working together to develop a learning environment in the Department of Energy and Environmental Technology at Glasgow Caledonian University in Glasgow, England. Students indicated the following reasons for SI participation: students want to work in peer groups; students recognize the academic difficulty of their courses; and students believe that peer groups are a source of information and help for them. In an evaluation of the SI program, SI leaders indicated growth in the following areas: verbal and nonverbal communications, learning techniques, interpersonal communication skills, consideration of college major change to a teaching career, and gaining employment skills that makes them more attractive to potential employers.

Turner, M. (2004, 2004, October 2). \$3M grant helps students with learning, teaching, *The Modesto Bee*, p. A 22.

This newspaper article describes how Supplemental Instruction (SI) is being implemented to support academic success of students but also provide a professional development experience for the SI leaders. The article contains quotations from SI program administrators and SI leaders. One of the leaders describes how serving as a SI leader provided insight to a potential teaching career.

Upmacis, R. K. (2021). Peer-Led Team Learning and student success. *Advances in Peer-Led Learning*, 1, 25-43. doi: <https://doi.org/10.54935/apll2021-01-04-25>. www.doi.org/10.54935/apll2021-01-04-25.

Peer-Led Team Learning (PLTL), a nationally recognized teaching and learning model, was introduced into the General Chemistry course at Pace University in 2014. The objective of this study was to determine the effect of the introduction of PLTL on the students' final exam scores, and through surveys, determine how students viewed both the PLTL program and their Peer Leaders. In addition, this study sought to monitor the progress of Peer Leaders as they entered an upper-level Inorganic Chemistry class to determine whether the experience of being a Peer Leader helped their success in this course. The biggest difference, when comparing exam scores from two separate years before and after PLTL implementation, was found to be 10%. However, upon averaging exam scores over several years before and after the introduction of the PLTL program, a more modest average increase of 4% was determined. It was found that students with Peer Leader experience performed better in an upper-level Inorganic Chemistry class compared to those with no Peer Leader experience. Results from surveys administered to both students and Peer Leaders regarding their experiences, as well as the results from students evaluating their Peer Leaders, are reported here. Overall, the implementation of PLTL has led to greater interactions between the Instructor, Peer Leaders, and undergraduate students, thereby furthering a greater interest in chemistry and increasing the students' sense of community.

Wang, B. (2010). From Peer-Led Team Learning to professional work experiences. Peer-Led Team Learning: The experience of leading. *Progressions: The Peer-Led Team Learning Project Newsletter*, 12(1). www.pltlis.org/wp-content/uploads/2012/10/Experience-of-Leading-Wang-PLTL-to-Professional-Experience.pdf.

The author relates their personal story of how serving as a student facilitator of the Peer-led Team Learning (PLTL) program had benefits for himself as well as for the participating students. Some of those new skills were:

improved problem-solving skills, increased interpersonal communication skills, and deeper understanding of the course material that benefited degrees in Computer Science (CS) and obtained employment as a Tech Analyst at JPMorgan Chase.

Wilcox, F. K. (1996). Supplemental Instruction in South Africa: An interview with Andre Havenga. *Supplemental Instruction Update*, 1, 3.

This interview describes the development of the Supplemental Instruction (SI) program at institutions in the Republic of South Africa. Andre Havenga is an SI Certified Trainer for South Africa and is also the Director of Instructional and Organizational Development at the University of Port Elizabeth (UPE). UPE provides SI support for 77 courses in 21 academic departments. Havenga reports the following benefits of the SI program: provides academic support for the new student subpopulations that were formerly excluded by government policy; academic support is mainstreamed with academic courses; provides faculty development through feedback that allows the instructor to clarify and provide additional information at the next class session; and provide another forum for social integration. SI leaders report a number of benefits for themselves: enhanced academic skills; improved self-confidence; additional work experience that may help with job interviews; and additional contact with key faculty members from their discipline.

Wilcox, F. K. (1996). Supplemental Instruction in Sweden: An interview with Marita Bruzell-Nilsson and Leif Bryngfors. *Supplemental Instruction Update*, 1, 3.

This interview describes the development of the Supplemental Instruction (SI) program in Sweden. Academic assistance at postsecondary institutions in Sweden is a new movement. The interviewees are SI Supervisors at Lund University (Lund, Sweden) and are also Certified Trainers for SI. Nearly a dozen institutions in Sweden have established SI programs. SI leaders report that they like serving in the program since they have an opportunity to: develop their presentation skills; practice putting forth a point of view; and developing group management skills that will be useful when they become employed.

Zacharopoulou, A., Giles, M., & Condell, J. (2015). Enhancing PASS leaders' employability skills through reflection. *Journal of Learning Development in Higher Education*(November).
[www.alinhe.ac.uk/ojs/index.php?journal=jldhe&page=article&op=view&path\[\]=348](http://www.alinhe.ac.uk/ojs/index.php?journal=jldhe&page=article&op=view&path[]=348).

Whilst the benefits for students attending Peer Assisted Study Sessions (PASS) have been widely acknowledged, the benefits for its leaders have not been as clearly evaluated. This paper will explore how the more senior students who take on the role of PASS leader can develop employability skills through a programme of activity that formally rewards students for their participation and assists them in articulating their competencies. The paper presents the findings of a project undertaken by a cross-disciplinary team at Ulster University which focused on the benefits for PASS leaders and, more explicitly, on graduate employability skills such as communication, teamwork and leadership. Students were required to reflect on the PASS process and plan for subsequent sessions whilst also engaging in a series of skill-building activities (games and various practical exercises) which focused on those facets of employability that are of direct relevance to the PASS experience. Quantitative and qualitative methods were employed to evaluate the impact of the PASS programme: initial findings suggest that the programme served to enhance students' perceived competence in respect of some employability skills (e.g. spoken communication) but, more generally, served to raise their awareness and highlight their limitations in some areas. This paper suggests that the process of reflection has helped them to better articulate these skills and identify the steps needed to further develop them. As such, this project has provided research evidence to support the effectiveness of the PASS process and a collection of materials to support the further development of its leaders.