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David R. Arendale, Editor

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Postsecondary Peer Assisted Learning Programs Offered Online: 2020 Annotated Bibliography

This topical annotated bibliography is drawn from a larger database of peer assisted learning (PAL) programs available at https://www.arendale.org/peer-learning-bib Major national and international models in the bibliography of nearly 1600 citations are: (a) Accelerated Learning Groups (ALGs), (b) Emerging Scholars Program (ESP), (c) Peer Assisted Learning (PAL), (d) Peer-Led Team Learning (PLTL), (e) Structured Learning Assistance (SLA), (f) Supplemental Instruction (SI), and (g) Video-based Supplemental Instruction (VSI). Some programs are also known by other names such as PASS for the SI Program. Check back throughout the year since the database is frequently updated.

Only two of these models provided research studies or implementation information for providing their program online: Peer-Led Team Learning (also known as cPLTL or Cyber PLTL), and Supplemental Instruction/PAL/PASS (also known as iPASS, OPAL, OPASS, and OSI). These publications provide examples from North America, Europe, and Australasia. When available, a weblink is provided so that they can be downloaded.

Alberte, J. L., Cruz, A., Rodriguez, N., & Pitzer, T. (2012). *PLTL in pajamas: Lessons learned.* Conference Proceedings of the Peer-led Team Learning International Society Inaugural Conference, Brooklyn, NY. http://pltlis.org/wp-content/uploads/2012%20Proceedings/Alberte-2012.docx

Peer-Led Team Learning (PLTL) in the Biology Department at Florida International University (FIU) incorporates the use of “cyber” learning (cPLTL). Using laptops and cameras, students and Peer Leaders communicate in real time, fulfilling the requirements of the standard model of PLTL. Participants are trained in the use of required software and technology. Initial observations indicate that students perform at least as well in cPLTL as in traditional workshops. Students who cannot or will not attend in-person PLTL workshops are able to take advantage of the boost. FIU is successfully moving toward cPLTL institutionalization alongside the in-person model. Real-time, interactive participation is a cornerstone of PLTL. In cPLTL, this is facilitated through the use of webcams, headsets with microphones, and personal document cameras. Students can borrow these materials directly from the PLTL office if they do not personally own the materials. There are no additional costs incurred for the students. Most students already have webcams and microphones. Even though many computers and webcams have built-in microphones, it is best to use a microphone that is directly attached to a headset, in order to reduce feedback, background noise, and the “echoing effect.” To facilitate the real-time sharing of student work, personal document cameras are used. This is particularly important when the learning objectives of the workshop module include the understanding of mathematics or the manipulation of chemical equations. (Using the document cameras is extremely beneficial, but it is not an absolute requirement in order to have a successful cPLTL workshop.) The iPEVO P2V USB personal document cameras were used at IUPUI and FIU (Mauser et al., 2011). We recommend the

establishment of a stable in-person PLTL program before attempting to develop a cyber PLTL program. Any program attempting to implement PLTL for the first time faces a number of pragmatic and pedagogical issues that will only be confounded if attempting to implement a cyber-based system(solely or concurrently). Once established it would be far easier to maneuver the technological landscape of cPLTL. During initial implementation of cPLTL, experienced PLs are used to conduct the cyber workshops. These PLs were chosen because of their experience and ability to properly conduct a workshop. This allowed the staff to focus more on technological issues. Starting with only a handful of PLs and PLTL sections is important in learning how to manage, structure, and build a PLTL program.

Alden, E. (2018). The changing role of Supplemental Instruction in the digital age *Communicating chemistry through social media* (pp. 139-150): ACM Publications

Supplemental Instruction (SI) was first implemented in 1973 at the University of Missouri-Kansas City. The program began as simple peer assisted study sessions lead by former students who had succeeded in historically difficult courses. Over the course of three years we have observed the evolution of the SI model at Central New Mexico Community College through the integration of the SI leader into non-traditional, flipped classrooms, as well as in the online classroom. Through the use of social media platforms and applications the SI session can now take place virtually anywhere. The SI model has come a long way from improving student retention and success and can now promote group collaboration, improve study skills, and encourage thinking beyond just problem solving. We propose a two-semester model that would allow students to successfully complete the general chemistry series in a hybrid learning environment with retention and success rates comparable to that of an in-person chemistry course.

Beaumont, T. J., Mannion, A., P, & Shen, B. O. (2012). From the campus to the cloud: The online Peer Assisted Learning Scheme. *Journal of Peer Learning, 5*(1), 1-15. https://files.eric.ed.gov/fulltext/EJ1154814.pdf

This paper reports on an online version of Peer Assisted Study Sessions (PASS), also known as Supplemental Instruction (SI), which was tested in two subjects in the University of Melbourne in 2011. The program, named the Online Peer Assisted Learning (OPAL) scheme, was implemented with the aims of extending the benefits of a successful peer learning program to students other than those who attend face-to-face sessions and contributing to scholarship on the viability of online peer learning with reference to student interest, leader and participant perspectives, and the suitability of synchronous communication platforms. Qualitative research led to mixed findings. Although OPAL was considered to be a viable online peer learning program by leaders and participants, multiple challenges were encountered. With reference to literature on related initiatives and the use of synchronous online learning platforms in higher education, this paper provides an account of the establishment and progress of the initiative, before presenting an analysis of its strengths and weaknesses and a series of

recommendations for researchers and practitioners who are interested in online adaptations of face-to-face peer learning programs. A number of platforms were considered by the project leaders, including Google Docs, DimDim, Open Meetings, Sakai, Adobe Connect, Elluminate, and Wimba. Research into the programs was conducted by means of inquiries, software research and trials, and reviews of literature on the use of synchronous platforms in higher education (Huijser & Kimmins, 2006; Huijser, Kimmins & Evans, 2008; Park & Bonk, 2007a; Park & Bonk, 2007b; Karabulut & Correia, 2008). Based on our analysis, we found Google Docs did not offer sufficient functionality on its own, and we envisaged difficulties in managing security and log-ins. DimDim had been bought out by Salesforce and was no longer taking new registrations. Open Meetings and Sakai were open source offerings that needed to be hosted locally and would have required more investment and preparation to deliver than a small scale trial could justify. This left three strong options with similar functionality: Elluminate, Adobe Connect and Wimba. All platforms offer break-out rooms, video, voice and chat functions together with whiteboards and the ability to upload documents. Further investigation revealed that the University of Melbourne had current licences for Adobe Connect which played a role in its selection as the platform we would use. The only significant variation between the training of the OPAL leaders and the PASS leaders was that the OPAL leaders were given training in use of Adobe Connect for OPAL over the last half-day of the two-day training. In this separate session, they practised using the software and role-played sessions using the platform. Additionally, OPAL leaders received a two hour ‘refresher’ and practice session just before semester began. During semester, leaders were provided with a range of support materials. These included the FBE PASS handbook, a simple guide to Adobe Connect, a guide for tutoring using Adobe Connect, and Adobe Connect trouble-shooting materials. In addition to the provision of these materials, the FBE OPAL leaders met with a PASS supervisor every week until Week Five of semester when it was determined that meeting every two to three weeks would be sufficient. In Engineering, OPAL and PASS leaders met their PASS supervisor every teaching week of semester as both programs were new. OPAL leaders of both faculties were supported to discuss their experiences with each other and exchange anecdotes, concerns and tips in the face-to-face meetings. Leaders were also emailed on a weekly basis to elicit their support needs and significant experiences. All leaders reported that material took longer to address in OPAL than in PASS. While this could be partly related to software lag and connection difficulties, reduced progress was also experienced when these problems were minimal and groups were small. One participant noted that if a question was posed in PASS, students could readily indicate when they had an answer, while in OPAL students often waited to see other responses, particularly when those responses were required as text. The general lack of visual clues available in this online environment caused by the participants’ invisibility to OPAL leaders is also likely to have contributed to this overall delay. Additionally, or perhaps as a result of this, participants reported that OPAL sessions often ran over time. Other

studies have noted similar issues in relation to the pace at which content can be addressed.

Beckmann, E. A., & Kilby, P. (2008). On-line, off-campus but in the flow: Learning from peers in developmental studies. *Australasian Journal of Peer Learning, 1*, 61-69. http://ro.uow.edu.au/ajpl/vol1/iss1/8

At the Australian National University, peer learning is a key for improved student learning outcomes for those enrolled in the Master of Applied Anthropology and Participatory Development (MAAPD) program .Online discussions support peer learning and provided opportunities for more shared engagement in critical thinking about issues of concern raised through the courses. An online collaboration learning environment called Alliance was employed to provide a more full collaborative learning environment. Using best principles from the Peer Assisted Learning Strategies (PALS) program that used traditional face-to-face student discussions, Alliance employed a variety of learning tools for online collaboration. Threaded discussions were a key element for developing meaningful online learning. It was critical to form students into smaller work teams that had more accountability regarding their continuous participation. These discussions needed structure and also an assigned facilitator to help guide the discussion and prompt participation, much in the same way as the student facilitator was key for the face-to-face PALS sessions.

Carter-Hanson, C., & Gadbury-Amyot, C. (2016). Implementing Supplemental Instruction online to create success in high-stakes coursework for pre-doctoral dental students. *Supplemental Instruction Journal, 2*(1), 53-75. http://info.umkc.edu/si/wp-content/uploads/2016/09/siJ-Volume-Two-Issue-One.pdf

There is a critical shortage of culturally diverse dental practitioners in the United States. In addition, many underrepresented minority (URM) and disadvantaged students have difficulty with the course material needed to pursue a dental degree. One strategy for helping students achieve higher grades and persist in difficult course work is the implementation of Supplemental Instruction (SI). The purpose of this study was to describe the outcomes of using SI online for the first time as part of the University of Missouri-Kansas City, School of Dentistry's (UMKC-SOD) Admissions Enhancement Program (AEP). The AEP program was designed to provide URM and disadvantaged pre-dental students with increased academic skills training in Biology, Chemistry, Organic Chemistry, and Math via online modules. Students met with their SI Leader three times per week at a specified time in a synchronous format to review course material, problem solve, and work collaboratively with fellow classmates. Twelve URM and disadvantaged students participated in the AEP from 2011 to 2014 for a total of 48. Success in the AEP was measured by an increase the student's Dental Admission Test (DAT) score and admission to dental school. At the end of each year's program, students completed a survey regarding all aspects of the AEP. The study found that AEP students who were admitted to dental school had a significantly higher DAT score than those students who were not admitted. Students also reported that

the required time for SI sessions and test taking instruction helped them prepare for the DAT. Over 72% of students responded favorably that SI contributed to their success in the AEP and to taking the DAT. Students reported that attending the SI sessions helped them work through problems in the course material. This study found evidence that SI is a viable strategy for helping URM and disadvantaged students be successful in high stakes courses needed to move forward and pursue health profession degrees. SI sessions were conducted using Blackboard Collaborate, a synchronous two-way audio-video platform allowing online users to "meet" in real time. Prior to starting the online modules, students and SI Leaders completed an online training session for navigating the Blackboard Collaborate interface. Upon completion of the training sessions, students were given access to the module material 24/7.

Dawson, P. J. (2010). *Examining how an online mentoring model may support new Supplemental Instruction leaders.* (Ph.D. dissertation), University of Wollongong, Wollongong, Australia. http://ro.uow.edu.au/theses/3208/

This study investigated online mentoring as a method of supporting inexperienced, geographically-dispersed Supplemental Instruction Leaders (SILs). Supplemental Instruction (SI) is an academic support program that employs successful senior students as SILs to facilitate regular peer learning sessions. Over 250,000 tertiary students attend SI each year worldwide (Arendale, 2002). Students who attend SI are more likely to succeed in their studies, achieve higher grades, and be retained at their institutions (Martin &Arendale, 1993). The Australian higher education sector has a need for initiatives like SI that support the success of non-traditional students (Bradley, Noonan, Nugent, & Scales, 2008); however such programs can be difficult to implement in multi-campus institutions (Winchester & Sterk, 2006). In this study, online mentoring was examined as a method of addressing some of the difficulties in supporting inexperienced SILs who are geographically isolated. There is minimal research literature about the use of mentoring or community to support SILs, and none addressing the problem of supporting geographically dispersed SILs. Online mentoring and community models have been used successfully in other contexts to support novices that are geographically isolated from potential mentors and their peers. SILs are different from mentees in most mentoring literature; traditional mentees are either career employees or students being mentored for their academic success. In this study, SILs are being supported for a part-time, fixed-term role that few intend to continue as a career. The following research questions were investigated: Research Question 1: What models are appropriate for mentoring geographically-dispersed Supplemental Instruction Leaders? Research Question 2: In what ways does participation in an online SIL support program impact on mentors, mentees and community members? The study consisted of two phases, each addressing the corresponding research question. In Phase 1, an exploratory qualitative study was conducted into the development of an online mentoring model for geographically-dispersed SILs. A new theoretical framework was developed from Social Learning Theory (Bandura, 1977) and Social Exchange Theory (Emerson, 1976; Homans, 1958) to inform the design of the

model. This framework assisted in understanding how mentoring happens, and why mentors and mentees might participate in it. In Phase 2 the model was investigated twice using a qualitative, multiple-case study methodology. There were 30 participants from six campuses of five Australasian universities in the first study, and 67 participants from 27campuses of 25 academic institutions from three continents in the second study. Data were analyzed using a deductive approach based on the theoretical framework. Key findings of this research were: A model for the mentoring of geographically-dispersed SILs. An understanding of the impacts of the model on participating SILs. Role modeling was found to be the component of mentoring most used for SIL development; this is interesting given Ensher, Heun and Blanchard's (2003) proposition that "role modeling may be the function of mentoring that is least efficiently done in a virtual setting" (p. 273). A set of design variables for the development and expression of mentoring models. These variables address an identified need in the literature for clarity in academic communications about mentoring. A set of design variables for the development and expression of mentoring models. These variables address an identified need in the literature for clarity in academic communications about mentoring. This research has significance for online mentoring and higher education in general, and more specifically, the support of geographically-dispersed, part time staff, such as SILs and university tutors or teaching assistants.

Dawson, P. J., Lockyer, L., & Ferry, B. (2007). *Supporting first year student supporters: An online mentoring model for Supplemental Instruction* Conference Proceedings of the Annual Pacific Rim First Year Conference, Australia. https://www.academia.edu/attachments/42685842/download_file?st=MTU3ODY4NTU1NCw3My4zNy4yNTUuMjAxLDQwOTQ5MQ%3D%3D&s=email&ct=MTU3ODY4NTU1NCwxNTc4Njg1NTcwLDQwOTQ5MQ==

Supplemental Instruction (SI), or Peer Assisted Study Sessions (PASS) as it is commonly known in Australia, involves experienced senior student Peer Leaders who provide regularly scheduled peer learning sessions with students enrolled in university courses. Commonly implemented on first year subjects, the sessions integrate "how to learn" with "what to learn", helping students achieve better grades and helping raise student retention rates. This paper discusses the challenges of supporting SI Leaders who are geographically dispersed across multiple campuses and considers the theoretical and empirical literature that informs the development of an online mentoring model.

Feder, E., Khan, I., Mazur, G., Vernon, T., Janke, T., Newbrough, J., . . . Varma-Nelson, P. (2016). Accessing collaborative online learning with mobile technology in Cyber Peer-Led Team Learning. Available online: http://er.educause.edu/articles/2016/4/accessing-collaborative-online-learning-with-mobile-technology-in-cyber-peer-led-team-learning

Using mobile devices in online collaborative learning models offers many potential advantages for students and faculty. However, while the technology can reduce costs and increase mobility for students, replacing traditional devices with mobile

devices can result in a loss of functionality. To address this functionality loss and investigate workarounds, a group of researchers at Indiana University-Purdue University Indianapolis tested mobile platforms for use in the institution's Cyber Peer-Led Team Learning model. The study found three platforms that offer a viable choice for institutions looking to implement online PLTL programs. Our cPLTL program uses Adobe Connect to create meeting rooms for its small online workshops; it also requires participants to have the following technologies: a personal computer (preferably with a high-speed internet connection through an Ethernet cable); Point 2 View USB document camera; a microphone; and a webcam. Adobe Connect, which IUPUI's cPLTL workshops already used, proved to be a leading competitor among the tested platforms, which also included Fuze, WebEx, BigBlueButton, VSee, and Blackboard Collaborate. Our research team's comprehensive comparison of platforms suggests that institutions consider Zoom and Adobe Connect when implementing mobile devices in online collaborative learning, as both preserve the four most critical features on various devices.

Finlay, K., & Mitchell, M. Z. (2017). *Evaluating the effectiveness of online vs. face-to-face Supplemental Instruction in introductory biology courses*. University of Regina. Canada. Available online: https://www.uregina.ca/ctl/assets/docs/pdf/ptls-2015-2016/Finlay,%20Kerri%20-%20PTLS%20Final%20Report.pdf

Our study found very little difference in the real and perceived differences when SI was offered live face-to-face, live online, and recorded online. Quantitative data: We found a significant positive correlation between students' final grades and their attendance at SI sessions of all types. In BIOL111, final grades were 5-6% higher for those students who attended more than 3 SI sessions (averaged 73% at both Regina and Saskatoon sites) compared to those who did not attend any SI sessions (67% in Saskatoon and 68% in Regina). Similarly, in BIOL110, students who attended more than 3 online SI sessions received an average of 6% higher final grades (73% at both sites) compared to students who did not attend any SI sessions (67% at both sites). Surprisingly, even those students who only accessed recorded SI sessions received 4% higher final grades than those students who did not, at all sites. Qualitative data: overall, students were very positive about the benefits of SI, in any format. In the survey data, where "strongly agree" is coded as a 5, and "strongly disagree" is coded as a 1, the average responses to all of the questions ranged from 4.2 to 4.5 indicating high agreement with all statements provided. We did not find any difference in agreement with the statements when the SI was offered online vs. face-to-face, and students found many benefits even from accessing the previously recorded sessions.

Finney, K., Musil, O., Tram, A.-L., & Trescott, S. (2018). *Standard Operating Protocol: Virtual Supplemental Instruction*. San Diego State University. San Diego, CA. https://docs.google.com/document/d/1wqqrdSdsLTvRCStwutoLMWyCH2Xz8vznjU1OLm11Sx8/edit?ts=5c7fff6b#

This document provides the procedures for conducting an online SI session and making it available for students to watch in the future. The Zoom software is used to record the online session. Extensive editing occurs afterwards of the video by breaking it into modules.

Hizer, S. E., Schultz, P. W., & Bray, R. (2017). Supplemental Instruction online: As effective as the traditional face-to-face model? *Journal of Science Education and Technology, 26*(1), 100-115.

Supplemental Instruction (SI) is a well-recognized model of academic assistance with a history of empirical evidence demonstrating increases in student grades and decreases in failure rates across many higher education institutions. However, as college students become more accustomed to learning in online venues, what is not known is whether an SI program offered online could benefit students similarly to SI sessions that occur in face-to-face settings. The in-person (traditional) SI program at California State University San Marcos has demonstrated increases in grades and lower fail rates for courses being supported in science and math. Students enrolled in four biology courses who participated in online SI received increases in academic performance similar to the students in the courses who attended traditional SI. Both the online and traditional SI participating students had higher course grades and lower fail rates as compared to students who did not participate in either form of SI. Self-selection, as measured by past cumulative college grade point average, did not differ between students who attended either form of SI or who did not attend. Student perceptions of online SI were generally positive and appeared to offer an alternative path to receive this valuable academic assistance for some students. Overall, results are promising that the highly effective traditional model can be translated to an online environment.

Huijser, H., & Kimmins, L. (2005). *PALS online and community building: A contradiction in terms?* Conference Proceedings of the 22nd annual ASCILITE Conference, Brisbane, Australia.

At the University of Southern Queensland (USQ), Peer-Assisted Learning (PAL) is a modified version of the Supplemental Instruction (SI) model. PAL is used to build community for the online learners. The paper reviews examples of implementing online mentoring and suggestions for improved service to the students. Some of the suggestions included periodic face-to-face PAL sessions to offset the social isolation of the online learning activities and also to provide online photographs and short background narratives about the PAL facilitators to help acquaint them with the students participating online.

Huijser, H., & Kimmins, L. (2006). *Developing a peer-assisted learning community through MSN Messenger: A pilot program of PALS online*. Unpublished manuscript. University of Southern Queensland. Southern Queensland, Australia.

At the University of Southern Queensland (USQ), Peer-Assisted Learning (PAL) is a modified version of the Supplemental Instruction (SI) model. PAL is used to build community for the online learners. The paper reviews examples of implementing

online mentoring and suggestions for improved service to the students. MSN Messenger is used as the venue for communication between the PAL facilitator and the students in the class. An economics and a data analysis class were selected for the study. The pilot program was evaluated using qualitative measures. While the online component helped to build community among the students, the initial academic outcomes appeared to be limited. The researchers encourage others to reproduce the experiment and seek to find more effective uses of the technology.

Huijser, H., Kimmins, L., & Evans, P. (2008). Peer assisted learning in fleximode: Developing an online learning community. *Australasian Journal of Peer Learning, 1*, 51-60. http://ro.uow.edu.au/ajpl/vol1/iss1/7

At the University of Southern Queensland in Australia use an adaptation of Peer Assisted Learning Strategy (PALS) to support online learners. This version of PAL is named Meet-Up. Since 2006 MSN Messenger has been used to serve these distance learning students. This paper describes the use of Wimba software within an institution-wide Moodle learning management system. Use of these enhancements provides a chat function, sharing of PowerPoint slides, and document sharing. This more comprehensive suite of learning tools provides more interactivity and more content sharing that the earlier use of instant messaging alone.

Janke, T., & Varma-Nelson, P. (2014). *Cyber Peer-Led Team Learning (PLTL).* Conference Proceedings of the World Conference on Educational Media and Technology,, Tampere, Finland. Available online: https://www.learntechlib.org/primary/p/147479/

This paper describes the challenges and opportunities of adapting a high-impact face-to-face pedagogy to an online environment. At Indiana University-Purdue University Indianapolis (IUPUI), USA, Cyber Peer-led Team Learning (cPLTL) was developed by adapting Peer Led-Team Learning (PLTL) to an online environment. PLTL is a model of teaching that preserves the lecture and replaces recitation in science courses with a weekly two-hour problem solving session called a workshop. In this project, an online, synchronous, collaborative environment for conducting PLTL workshops was created by using web-conferencing software coupled with a two-camera-per-learner configuration. As in PLTL workshops, six to eight students in cPLTL workshops are guided by a peer leader through problem-solving activities for two hours. Learning gains in cPLTL were similar to those seen in PLTL. Discussed here is the development of cPLTL as well as adoption at other institutions.

Jimenez, R. (2018). *Implementing an online Supplemental Instruction program.* Conference Proceedings of the Society for information Technology & Teacher Education Conference.

This paper will offer an Online Supplemental Instruction (OSI) Implementation framework that higher education institutions can use to implement their own OSI program. The paper will review traditional SI program structures, the theoretical

underpinnings supporting SI programs, and the foundations of OSI. The theoretical frameworks reviewed include constructivism, active learning theory and Tinto's theory of student persistence. In addition, a review of the OSI Implementation Framework is introduced. The OSI implementation framework is explained and how it can be used by higher education institutions to develop their own OSI program. Constructivist learning environments and TPACK influences that inform the OSI Implementation framework are discussed. Finally, recommendations and conclusions about the OSI Implementation Model will be discussed. This includes student training to support their needs in using online environments and in developing a "train the trainer" program and ongoing support for the student leaders (SILs) that will be leading SI/OSI sessions.

Jimenez, R. (2018). *Supporting STEM college student success via traditional and online Supplemental Instruction: A mixed-methods causal comparative study.* (Ph.D. dissertation), New Jersey City University.

The goal of this causal-comparative, mixed methods study was to measure the degree of success that Supplemental Instruction (SI) promotes success and retention. The overarching goals of SI are to improve student grades, reduce attrition, and increase student retention in a science, technology, engineering, and math (STEM) field. The study encompassed a review of traditional SI program structures, the theoretical underpinnings supporting SI programs, and the foundations of Online Supplemental Instruction (OSI). Theories used to frame the study included constructivism, active learning theory, and Tinto's theory of student persistence. An OSI pilot was conducted in the Fall 2017 semester and discussed in terms of its implementation and the data collected. The quantitative and qualitative data collection procedures were discussed, and the analyzed results were compared to the existing literature. Finally, recommendations and implications to the field and future OSI implementations were discussed.

Kartsonaki, E., Bailey, C., & Lawrie, G. A. (2015). *iPass: Online collaborative peer-assisted study support.* Conference Proceedings of The Australian Conference on Science and Mathematics Education (formerly UniServe Science Conference). https://openjournals.library.sydney.edu.au/index.php/IISME/article/view/8855/9076

Peer-assisted learning is a powerful strategy to assist students to both develop effective study skills and to apply formative feedback in self-regulated learning. In this study, existing successful face-to-face PASS learning activities have been translated into a virtual mode of delivery to enhance parallel online learning experiences. The model and template for the implementation and delivery of a cyber-peer-led team-learning (cPLTL) environment has been adopted from the initiative of Professor Pratibha Varma-Nelson [Smith et al, 2014]. Virtual iPASS sessions are hosted through the Adobe Connect tool which represents a platform that can enable a single PASS leader to synchronously guide up to 10 first-year chemistry students through collaborative study exercises. This technology enables students in the online PASS group to share their work with each other

and with their leader while they are located in their preferred environment including their homes. An objective of offering a virtual PASS option was that it would enrich the on-campus experience by enabling peer support access for students who could not, or who preferred not to, engage in the face-to-face contact sessions. Translation of activities involved consideration of the format of the tasks and the training of the iPASS leaders in facilitation of the sessions to deliver an inclusive environment. Evaluation of the effectiveness of iPASS has been achieved by the comparison of a trial pilot iPASS group in parallel with a traditional face-to face PASS contact session. Consent was sought from participating students for researchers to record and characterise the nature of their interactions with their leader(s), provision of feedback and engagement with activities. Factors that must be considered for online peer support include students' technological literacy and group composition. The outcomes of this trial will be shared in this presentation.

Leon, S., Turchannova, A., Perez, E., Cervantes, I., & Rodarte, F. (2015). *Developing hybrid PLTL workshops for an intermediate programming course.* Conference Proceedings of the 2015 Peer-Led Team Learning International Society, Richardson, Texas. https://pltlis.org/wp-content/uploads/2018/03/2015-Leon.pdf

PLTL online workshops are utilized as supplemental material for CS 1: Intro to C++, the introductory programming course at the University of Houston-Downtown. These workshops have been shown to positively affect student performance in the course. Students who are pursuing a degree or minor in Computer Science subsequently enroll in CS 2: Data Structures and Algorithms. Face-to-face workshops have been offered for this course since Spring 2014, but have garnered only inconsistent attendance from students. We propose a change in the way CS 2 workshops are delivered, with the dual aim of increasing attendance and impact by incorporating proven techniques from CS 1 workshops. The new approach will include both face-to-face and online workshops. We hope to widen the scope of ideas introduced to CS 2 students and to provide more thorough training in the applications of course concepts.

Mauser, K., Sours, J., Banks, J., Newbrough, J., Janke, T., Shuck, L., . . . Varma-Nelson, P. (2011). Cyber Peer-Led Team Learning (cPLTL): Development and implementation. *EducauseReview*. http://er.educause.edu/articles/2011/12/cyber-peerled-team-learning-cpltl-development-and-implementation

Given the proven success of peer-led team learning, an experiment explored whether cyber Peer-Led Team Learning (cPLTL) could achieve similar success, especially in STEM fields. Results indicated that cPLTL students achieve at the same level as PLTL students in General Chemistry courses. cPLTL workshops eliminate the ongoing need for physical classroom spaces. Students can be effective partners with faculty in improving educational practice. The type and amount of student interaction with major socializing agents on campus - faculty and their peers - determine the impact of college on students. Much of the research on postsecondary education links the quality of peer interactions directly to student learning outcomes and satisfaction with the college experience

and Alexander Astin went so far as to suggest that "peers are the single most potent source of influence".

Miller, D. A. (2006). *Helping students understand technical calculus via an online learning supplement and group learning*. Unpublished manuscript. West Virginia University. Morgantown, WA. http://math.unipa.it/~grim/21_project/21_charlotte_MillerDavidPaperEdit.pdf

This report describes an adaptation of the traditional Supplemental Instruction (SI) for online learners. This experiment was for students enrolled in a technical calculus course. This version of SI was voluntary for the students. Students that participated in the study performed significantly higher than non-participants, were motivated to learn, and had a positive attitude towards calculus, their perceptions on how the discussion sessions and the online SI sessions helped them to perform better in the course. The name for this adaptation of SI was called Technical Calculus Learning Supplement (TCLS).

Ng, R., Kaur, A., Farina, S., Mohamed, S., Latif, A., & Ramli, B. (2009). E-mathematics : pre-instructional and supplement instruction and their impact of student's online participation and final exam score. *AAOU Journal, 4*(1), 27-36.

Open University Malaysia (OUM), Malaysia's first open and distance learning with over 70.000 students, offers more than 51 programs to-date. More than 90% of its students are working adults who are unable to leave their jobs or families behind to pursue their dream of getting a degree. The blended learning approach adopted by OUM provides the flexibility for working adult's to obtain the required paper qualification and to upgrade their knowledge. One of the important elements of blended learning is the use of online discussion forum where learning takes place beyond classroom. Mathematics, a traditionally difficult course, forms part of the prerequisite for students to obtain a business degree at OUM. The adult learners at OUM generally have left school for at least five years and most of them have low grades in Mathematics at O' Level. Thus it is a big challenge for these adult learners to undertake a Mathematics course via online with minimum Face-to-Face contact with their tutors. This paper focuses on the implementation of pro-instruction workshop and Supplemental Instruction to find its impact on student's online participation and exam results of 88 students. The contents of the online forum were also analyzed using a 34-item instrument derived from the Community of Inquiry model. Results obtained showed that there was a strong correlation between workshop participation and final exam score. Independent samples t-test conducted showed that there was a significant difference between the mean score of online discussion ratio and final examination between participants attached to a tutor conducting the workshop and extended coaching compared to participants attached to another tutor using the normal teaching guide. The means COI score obtained for mathematics between the two tutors indicated that there is a difference in the teaching and cognitive presence but almost similar in the social presence.

Ng., R., Kaur, A., & Latifah, A. L. (2009). *Online Supplemental Instruction: An alternative model for the learning of mathematics. .* Conference Proceedings of the International Conference on Information,, Kuala Lumpur, Malaysia.

More than 90% of Open University Malaysia (OUM)'s learners are working adults who are unable to leave their jobs or families behind to pursue their dreams of getting a degree. The blended learning mode adopted by OUM provides the flexibility for working adults to obtain their paper qualifications and to upgrade their knowledge. Mathematics, a traditionally difficult course, forms part of the pre-requisite for learners to obtain a business degree at OUM. The adult learners at OUM generally have left school for at least five years and most of them have low grades in Mathematics at O' Level. Thus it is a big challenge for these adult learners to undertake a Mathematics course via online with minimum Face-to-Face contact with their tutors. This paper proposes an alternative model of learning mathematics known as Online Supplemental Instruction (OSI) model which involves three components; pre-tutorial workshop, online mentoring, and online video support. The research which involved 132 learners under the tutorship of two tutors was carried out to find the impact of the model on learners' online participation and final exam score. The contents of the online discussion forum were analyzed using a 34 item instrument derived from the Community of Inquiry (COI) model. Learners' online participation behavioral pattern was also analyzed. Results obtained showed that there was a strong correlation between learners who have participated in the OSI model of learning and their online participation and final exam score.

Nikolic, S., & Nicholls, B. (2017). *Exploring student interest of online peer assisted learning using mixed-reality technology.* Conference Proceedings of the International Conference on Interactive Collaborative Learning

Supplementary Instruction, also known as Peer Assisted Study Sessions (PASS), is a popular program supporting the educational development of students in a collaborative setting. Flexibility of delivery has been explored for a number of reasons including: work and family commitments; distance from campus; and integrating regional and transnational satellite campuses. Previous studies have found attempts to undertake online delivery of PASS lacking in student interest and have been restrained by the technology. This study attempts to build upon this research by investigating student interest and the suitability of using a mixed reality technology called iSee, based on video avatars within a 3D virtual world. Consistent with previous studies student interest was low, converting a planned quasi-experimental study into a simulation. The simulation suggests that the technology was suitable for online collaboration, with effective communication of course content between participants and a good sense of presence. This suggests this trial may gain greater student interest if undertaken within institutions offering predominantly online, distance education.

Pittenger, A., & LimBybliw, A. L. (2013). Peer-Led Team Learning in an online course on controversial medication issues and the US healthcare system *American*

Journal of Pharmaceutical Education, 77(7), Article 150. doi: 10.5688/ajpe777150. http://www.ajpe.org/doi/abs/10.5688/ajpe777150 .
Objective. To implement peer-led team learning in an online course on controversial issues surrounding medications and the US healthcare system. Design. The course was delivered completely online using a learning management system. Students participated in weekly small-group discussions in online forums, completed three reflective writing assignments, and collaborated on a peer-reviewed grant proposal project. Assessment. In a post-course survey, students reported that the course was challenging but meaningful. Final projects and peer-reviewed assignments demonstrated that primary learning goals for the course were achieved and students were empowered to engage in the healthcare debate. Conclusions. A peer-led team-learning is an effective strategy for an online course offered to a wide variety of student learners. By shifting some of the learning and grading responsibility to students, the instructor workload for the course was rendered more manageable.

Prior, J. (2004). *Development of PAL Online: An analysis of the first part of a two-stage trial*. Unpublished manuscript. Oxford Brookes University.
This report abstract describes the use of Peer Assisted Learning (PAL) at Oxford Brookes University (England) in the Business School. PAL is an adaption of the Supplemental Instruction (SI) program. The researcher are studying the impact with online academic support though the use of PAL leaders. Their role would be slightly different with a shift towards being more interventionist and less of a facilitator. This trial will form the first stage of a two stage trial. Stage two will be the implementation of online discussion on a large core module next term. The ultimate aim of the research is to develop a model for PAL online that covers areas such as site design, PAL leader training and support, the needs of both participant and leaders and the potential benefits for both groups.

Randloff, J. D., Maybee, C., Slebodnik, M., & Pelaez, N. (2014). *Why are we doing this? The role of personal relevance in developing biological information literacy using cyber Peer-led Team Learning*. Paper presented at the Impact Purdue, West Lafayetter, IN. http://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1010&context=impsymposium
Student-centered learning necessitates that students engage with an array of materials to develop their own understandings, often requiring students to find and critically engage with biological information. This project describes a course (BIOL 131; Biology II: Development, Structure and Function of Organisms) that utilizes cyber Peer-led Team Learning (cPLTL) as a student-centered approach to enhance students' biological information literacy. Emphasizing the social aspects of learning, students work together in small groups led by a peer mentor using online meeting software. Scaffolded across the first half of the semester, students were given information literacy focused questions as part of a weekly problem set, beginning with finding images or videos on the Internet to eventually examining experiments to understand what kind of evidence biologists use to

solve problems. In the cPLTL environment, students teach one another to be critical and consider ethical guidelines in using biological information. In the second half of the semester, the students applied what they had learned to create academic posters. The first iteration of the redesigned course was successful in making Biol 131 more student-centered and did enhance students' biological information literacy. However, a review of the small group sessions revealed some students did not make the connection between the weekly information literacy questions and developing a greater understanding of how biological information holds personal relevance. In the next iteration of the course, efforts will be made to reframe the information literacy component to emphasis students' engagement with biological information in personally relevant ways.

Rockefeller, D. J. (2003). An online academic support model for students enrolled in Internet-based classes [Dissertation, University of North Texas, 2000]. *Dissertation Abstracts International, 63*(09), 3095.

This doctoral dissertation from the University of North Texas describes a research study that examined the effectiveness of an experimental Supplemental Instruction (SI) program that utilized computer-mediated communication (CMC) rather than traditional SI review sessions. During the Spring 1999 semester, six sections of an introductory computer course were offered via the Internet by a suburban community college district in Texas. Using Campbell and Stanley's Nonequivalent Control Group model, the online SI program was randomly assigned to four of the course sections with the two remaining sections serving as the control group. The students hired to lead the online review sessions participated in the traditional SI training programs at their colleges, and received training conducted by the researcher related to their roles as online discussion moderators. Following recommendations from Congos and Schoeps, the internal validity of the groups was confirmed by conducting independent t-tests comparing the students' cumulative credit hours, grade point averages, college entrance test scores, and first exam scores. The study's four null hypotheses were tested using multiple linear regression equations with alpha levels set at .01. Results indicated that the SI participants earned better course grades even though they had acquired fewer academic credits and had, on average, scored lower on their first course exams. Both the control group and the non-SI participants had average course grades of 2.0 on a 4.0 scale. The students who participated in at least one SI session had an average final course grade of 2.5, exceeding their previous grade point average of 2.15. Participation in one SI session using CMC was linked to a one-fourth letter grade improvement in students' final course grades. Although not statistically significant, on the average, SI participants had slightly better course retention, marginally increased course satisfaction, and fewer student-initiated contacts with their instructors.

Rowe, J. A. (2019). *Synchronous and asynchronous learning: How online Supplemental Instruction influences academic performance and predicts persistence.* (Ph.D. dissertation), Capella University.

While Supplemental Instruction (SI) programs have garnered wide support in educational research literature and adoption in higher education, the impact of Online Supplemental Instruction (OSI) remains unknown. Using the theoretical framework of social cognitive theory, this study compared the impact of synchronous OSI and asynchronous OSI on academic performance, and in terms of how OSI predicts persistence. The goal was two-fold: to consider if similar academic and persistence benefits predicted from SI extend to OSI, and to investigate how academic performance and persistence of students listening to asynchronous recordings might differ from students attending live synchronous OSI sessions. An ANOVA procedure was used to investigate academic performance, and a logistic regression procedure was used to investigate persistence to test two hypotheses with a sample of 1727 (N = 1727) online graduate students. Results were significant for both synchronous and asynchronous groups, indicating that OSI is comparable to SI in terms of having a positive impact on academic performance when compared to students with no OSI exposure. Persistence results were significant for OSI as a whole and specifically for students who attended synchronous OSI.

Shaw, C. S., & Holmes, K. E. (2014). Critical thinking and online Supplemental Instruction: A case study. *The Learning Assistance Review, 19*(1), 99-119.

A wealth of research is available regarding Supplemental Instruction (SI); however, a dearth exists regarding Online Supplemental Instruction (OSI) and critical thinking. This case study explored what was assumed to be known of critical thinking and investigated the extent to which critical thought was promoted within a university's OSI online program. Survey and persistence data indicated the university's OSI program was successfully facilitating critical thinking. However, after conducting online session observations, based upon the Paulian critical thinking theory and the adoption of Bloom's taxonomy as a critical thinking model, the case investigation revealed the initial assumption was flawed

Smith, J., Wilson, S. B., Banks, J., Zhu, L., & Varma-Nelson, P. (2014). Replicating Peer-Led Team Learning in cyberspace: Research, opportunities, and challenges. *Journal of Research in Science Teaching, 51*(6), 714-740. doi: 10.1002/tea.21163. http://onlinelibrary.wiley.com/doi/10.1002/tea.21163/full

This quasi-experimental, mixed methods study examined the transfer of a well-established pedagogical strategy, Peer-Led Team Learning (PLTL), to an online workshop environment (cPLTL) in a general chemistry course at a research university in the Midwest. The null hypothesis guiding the study was that no substantive differences would emerge between the two workshop settings. Students in the PLTL (n = 220) condition were more satisfied with their workshop and earned statistically significantly higher course grades, yet earned comparable standardized final exam scores. They also had lower incidence of students' earning D or F course grades or withdrawing from the course (DFW rates) than students in the cPLTL setting (n = 175). Interviews with 10 peer leaders and 2 faculty members, as well as discourse analysis of workshop sessions, revealed more similarities than differences in the two conditions. The

final exam scores and discourse analysis support the null hypothesis and use of both face-to-face and synchronous online peer-led workshops in early science courses. In cPLTL, six to eight students and a trained peer leader participate in the virtual workshop session by logging into a web-conference, such as an Adobe Connect meeting. After logging in, each participant shares his or her webcam, microphone, and USB document camera. With guidance from the peer leader, the students complete problem sets, case studies, or other course-related content. The document camera share window permits students to observe one another's work, make comments, and provide peer guidance. Students may also form small groups and meet in virtual rooms to collaborate before reuniting with their full groups to discuss problems. Throughout the session, the peer leader maintains the ability to observe and interact with all participants. The cPLTL setup is similar to that of a two-way audiovisual data and document cameras, PictureTele, that enabled students at different locations to view student work with a document camera, but the statistics course Brown and Kulikowich (2004) studied did not include peer-facilitated collaborative group work. Similarly, the Interwise synchronous e-learning system utilized by the Open University of Hong Kong provided audio of classmates and visuals of shared files, but provided neither webcam view of classmates as they worked in partnership nor collaborative problem-solving activities (Ng, 2007). The cPLTL synchronous online workshop environment utilizes a combination of common web conferencing service user interface components (Mauser et al., 2011; McDaniel et al., 2013), including: 1. Participant's list—displays the names of all participants who enter the room. This list permits the peer leader to identify who enters or exits the room during the session. 2. Audio/video sharing window—enables all participants in the workshop to see and hear each other during the virtual session. 3. Chat window—enables peer leaders to share instructions or web links to educational resources for activities. It can also be used as an alternate method of communication if a technical glitch were to occur with headsets, microphones, or web-cameras. 4. Presentation window—enables each student to share his or her own work with the document camera while viewing the work of all other participants at the same time. This setup allows for an environment in which students can collaboratively engage in problem-solving. 5. Two cameras—the principal technology component of cPLTL is the capacity to use two cameras simultaneously. The document camera displays each participant's work while web-camera captures the real-time image of the student. 6. Recordings—the peer leaders are trained to automatically record all cPLTL sessions, providing a valuable resource for faculty, peer leaders, students, and researchers. 7. Constant access to workshop recordings—students have access to the recordings of their workshop sessions, so they can review conversations any time.

Spaniol-Mathews, P., Letourneau, L. F., & Rice, E. (2016). The impact of online Supplemental Instruction on academic performance and persistence in undergraduate STEM courses. *Supplemental Instruction Journal, 2*(1), 19-32.

http://info.umkc.edu/si/wp-content/uploads/2016/09/siJ-Volume-Two-Issue-One.pdf

Though demonstrated as an effective strategy for enhancing academic performance and course persistence in higher education, traditional Supplemental Instruction (SI) relies on face-to-face interaction in a classroom setting. Consequently, students who have other obligations or feel apprehensive in a group setting often cannot attend traditional SI sessions. This paper focuses on an innovative alternative to traditional SI: an online SI program currently being implemented at Texas A&M University-Corpus Christi (TAMUCC). This paper describes TAMUCC's online SI program and discusses results from a pilot study that compared the STEM course performance and persistence of TAMUCC undergraduates (N=585) randomly assigned to SI groups (i.e., traditional SI or online SI) in the spring semester of 2015. Online SI is essentially the same as traditional SI, except that SI Leaders and participants interact through a personal computer or other hardware device instead of in a face-to-face environment (Boggs, Heaney, Kramer, & Williams, 2011). SI Leaders ask questions and share content such as study guides, exercises, videos, PowerPoint presentations, and other documents on the virtual whiteboard. SI Leaders and participants communicate with one another by using a microphone and headset or by typing, which allows participants to receive feedback and communicate with the SI Leader without being constrained to a particular location. Moreover, because online SI sessions are recorded, students can view them anytime and as many times as they wish. Although a relatively recent phenomenon and not nearly as well studied as traditional SI, online SI models have been shown to have certain advantages over traditional sessions. Painter, Bailey, Gilbert, and Prior (2006) note that online SI allows students access to supplemental materials anytime, anywhere. Students who are anxious about speaking or solving problems in front of others may find online SI appealing because they are not surrounded by other students. Online SI sessions can be recorded and viewed multiple times for students who missed a session or need additional support. Moreover, even when the hardware, software, and technical support are suitable, students sometimes lack the requisite computer-literacy skills or technology (e.g., microphones and cameras) to fully engage in online SI sessions. Finally, in the online environment, SI Leaders may encounter difficulties managing students that would not occur in a traditional SI setting. For example, maintaining student attention can be challenging due to the students' ability to easily leave and reenter the discussion. In addition, SI Leaders may encounter communication issues with subjects such as math and chemistry because these disciplines utilize unique symbols that can be difficult to use in a digital format.

Taksa, I., & Goldberg, R. (2004). Web-delivered Supplemental Instruction: Dynamic customizing of search algorithms to enhance independent learning for developmental mathematics students. *Mathematics and Computer Education, 38*(2), 152-164.

Supplemental Instruction (SI) was modified for web delivery to increase its use and effectiveness of results for students. The focus was on serving developmental math students at the City University of New York.

Varma-Nelson, P., & Banks, J. (2013). PLTL: Trackng the trajectory from face-to-face to online environments. In T. Holme, M. Cooper & P. Varma-Nelson (Eds.), *Trajectories of chemistry education innovation and reform* (pp. 95-110): American Chemical Society

Over the past three years, an interdisciplinary team of investigators, led by Varma-Nelson, has worked to adapt the Peer-Led Team Learning (PLTL) instructional model to a cyber-environment (aka cPLTL). PLTL is a pedagogy that preserves the lecture and replaces the course recitation with a weekly two-hour workshop in which six to eight students work collaboratively to solve challenging problems under the guidance of a peer leader. cPLTL is the “cyber” evolution of PLTL to an online format. The team’s work represents a new direction for educational research and expands the knowledgebase on teaching science, technology, engineering and mathematics (STEM) concepts, while using technology as an educational tool. With funding from the National Science Foundation (NSF) and the Next Generation Learning Challenges (NGLC) initiative, the team is examining cPLTL’s impact on student performance. Analysis of course grades and standardized exam scores has shown cPLTL’s positive impact on educational outcomes. This chapter traces the evolution of a pedagogy developed for the face-to-face classroom environment to an online platform. Specifically, it outlines the rationale that led to the development of cPLTL; describes how technology was integrated into the PLTL model; summarizes its effectiveness, outcomes, and lessons learned; and speculates on the future use of cPLTL.

Varma-Nelson, P., Newbrough, R., Banks, J., Janke, T., Shuck, L., Zhu, L., . . . Smith, J. (n.a.). Cyber Peer-Led Team Learning: Taking the classroom experience online. *Online Learning Consortium*. https://secure.onlinelearningconsortium.org/effective_practices/cyber-peer-led-team-learning-taking-classroom-experience-online.

Peer-Led Team Learning (PLTL) is a model of teaching that preserves the lecture and replaces recitation in science courses with a weekly two-hour session. During these interactive sessions (workshops), six to eight students work as a team to solve carefully constructed problems under the guidance of a peer leader. Web conferencing software makes it possible to adapt this face to face pedagogy to a synchronous online environment. This led to the development of cyber Peer-Led Team Learning (cPLTL). Preliminary data gathered through our implementation of cPLTL at IUPUI indicates that it is possible for students to engage in productive problem solving under the guidance of a peer leader in a synchronous online environment via web conferencing software. cPLTL methods engage students as active participants, not passive recipients, in online activities that involve complex problem solving, working collaboratively, communicating effectively, and fostering self-directed learning. Indiana University-Purdue

University Indianapolis (IUPUI), Purdue University (PU) at West Lafayette in Indiana, and Florida International University (FIU) are participating as a consortium to test the transportability of Cyber Peer-Led Team Learning (cPLTL) developed at IUPUI. The model has been studied and is showing positive impact on student learning in introductory chemistry. Purdue and Florida International Universities (FIU) were selected as replication sites because they have the infrastructure and the interest necessary for introducing cPLTL into their introductory biology courses. Peer-Led Team Learning (PLTL), the face-to-face predecessor to cPLTL, has proven to be a high-impact pedagogy in the Science Technology, Engineering, and Mathematics (STEM) disciplines (Gafney & Varma-Nelson, 2008; Gosser, Kampmeier & Varma-Nelson, 2010). This project has made it accessible in the online

Watts, H., Makis, M., & Billingham, O. (2015). Online Peer Assisted Learning: Reporting on practice. *Journal of Peer Learning, 8*(1), 85-104. http://ro.uow.edu.au/ajpl/vol8/iss1/8/

Peer Assisted learning (PAL) in-class is well-established and flourishing in higher education across the globe; nevertheless, interest is growing in online versions and is reflected by a number of pilot schemes. These programs have responded to perceived and actual needs of students and institutions; they have explored the available software packages and have begun to create a bank of learning through academic publications, institutional reports, evaluations, and SINET listserv discussions. This paper examines existing online PAL practice from Australia, Canada, the UK and the USA, and focuses on synchronous modes. We discuss (a) the context, mode, and scope of online PAL, and (b) implementation considerations. Despite some “teething problems” of these pilots we are convinced by the early and so far limited explorations highlighted here that online PAL can make a significant contribution to learners in higher education by improving engagement through the flexibility afforded by the online space.

Wilson, S. B., & Varna-Nelson, P. (2019). Characterization of first-semester organic chemistry Peer-Led Team Learning and Cyber Peer-Led Team Learning students’ use and explanation of electron-pushing formalism. *Journal of Chemical Education, 96*(1), 25-34. doi: 10.1021/acs.jchemed.8b00387.

The purpose of this parallel convergent mixed methods study was to characterize organic chemistry students’ expression of electron-pushing formalism skills who had participated in peer-led team learning (PLTL) and cyber Peer-Led Team Learning (cPLTL), a synchronous online version of Peer-Led Team Learning (PLTL) workshops. A new electron-pushing formalism analytic framework was developed from a review of the literature in addition to analysis of students’ interview artifacts, using a constant-comparison process. Utilization of this new electron-pushing formalism analytic framework for coding student interview artifacts revealed that cPLTL students were significantly less likely to successfully draw the product suggested by the curved arrows than their PLTL classmates. Implications for instructors are suggested, including encouraging

students to verbally explain their rationale while drawing mechanisms as well as optimizing graphical collaborative learning activities for online learners.

Woolrych, T., Zaccagnini, M., Stephens, M., Stace, M., Middleton, R., Stephen, M., . . . Kornhoff, A. (2018). *Peer Assisted Study Sessions (PASS) Online: Investigating the impact of an online format across different first year university subjects.* Conference Proceedings of the 2018 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE), Wollongong, NSW, Australia. https://ro.uow.edu.au/cgi/viewcontent.cgi?article=5571&context=sspapers

As the demand for flexible learning increases, it is important to explore and expand online learning opportunities, especially in student supported learning. Peer Assisted Study Sessions (PASS) is a student led academic support program designed to help students transition into university and increase student retention. PASS is offered in traditionally challenging first year core subjects. Due to increased popularity of PASS, along with limited space and time availability, a synchronous online format (Blackboard Collaborate) was piloted in three first year University of Wollongong (UOW) subjects in the faculties of Business, Nursing, and Psychology. The aim was to test the effectiveness of the online delivery of PASS by comparing student final grade outcomes from online cohorts with face-to-face (F2F) modes, and those students who had not attended PASS. Results demonstrated that students who attended PASS obtained significantly higher marks compared to students that did not attend PASS. Final grade outcomes for F2F versus online also varied between subjects. The different result profiles for the three subjects suggests there may be different drivers for student success in the online space. This paper presents these findings providing consideration of different factors that may influence student success, with directions for future research.