Pre-Workshop Proposal for ESERA 2019

1. Title

Building the Community from Within: The Learning Assistant Model as a Mechanism for Creating Collaborative Classrooms and Recruiting STEM Teachers

2. Contact Information

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3. Requested maximum number of participants

Maximum of 40 participants.

4. Short description of relevant areas of expertise for each workshop facilitator

Dr. Hagit Kornreich-Leshem is a Research Assistant Professor with the STEM Transformation Institute in Florida International University (FIU) in Miami, Florida. She has been the Director of the FIU Learning Assistant (LA) Program since 2014. She is an education researcher with interest in the design of collaborative learning environments and the effect of peer interactions on students' metacognition and development of disciplinary identity. She is currently a co-PI on an NSF grant that focuses on LA research. She has been facilitating LA workshops for faculty at FIU and with the Learning Assistant Alliance since 2015. She completed her PhD in Chemistry at the Weizmann Institute of Science in Israel.

Dr. Eleanor Close is an Associate Professor of Physics at Texas State University (USA) and a physics education researcher. She directs the TXST Physics LA Program, co-organizes regional and international workshops through the Learning Assistant Alliance, and is currently PI of an NSF Phase I Noyce Teacher Scholarship project. Her research interests include physics teacher preparation and professional development, physics teacher identity, situated learning and identity development through communities of practice, and embodied cognition. She received her Physics M.S. from the University of Washington in 2003 and her Ed.D. in Curriculum & Instruction from Seattle Pacific University in 2009. Between receiving her B.A. in Physics from Bryn Mawr College and starting graduate school, she taught high school physics and physical science for three years in rural North Carolina, where she became science department chair by seniority after teaching for five months.

Dr. Laurie Langdon is a Research Associate in the School of Education and Director of the Learning Assistant Program at University of Colorado Boulder (USA). She received her PhD in Chemistry Education from University of Northern Colorado, and her postdoctoral work included partnering with chemistry faculty to implement and research outcomes of active learning approaches in first-year university chemistry courses. It was in this context that she first worked with undergraduate Learning Assistants. Dr. Langdon has extensive curriculum development experience, including as a writing team member for the 4th, 5th, and 6th editions of the American Chemical Society's high school textbook, Chemistry in the Community (ChemCom). She is a founding member of the international Learning Assistant Alliance and supports faculty at other institutions that are starting, growing, and sustaining their LA Programs. Dr. Langdon received the 2019 Excellence in Physics Education award (American Physics Society) for her work in establishing the Learning Assistant Alliance.

5. Workshop Abstract

Collaborative problem solving is a critical skill needed to solve real, cross-disciplinary challenges. However, not every social interaction is effective in merging perspectives and co-generating solutions. Scaffolding peer interactions that help students learn is a key outcome of the Learning Assistant (LA) Model in which knowledgeable peers facilitate and guide problem solving sessions in STEM college classrooms. The LA Model, recognized by the 2019 Excellence in Physics Education award (American Physical Society), provides structures and resources for faculty to transition traditional lecture-centered STEM (Science, Technology, Engineering, and Mathematics) college classrooms into collaborative and inclusive learning environments. The model was developed at University of Colorado Boulder in 2003 and has expanded to over 100 colleges and universities in the US and internationally, which are now supported by the Learning Assistant Alliance. The key agents of change within the model are undergraduate Learning Assistants (LAs) who prepare to facilitate collaborative team work through a specialized pedagogy course – often taught by science education faculty – and a weekly planning meeting with course instructors. The adaptive model is used successfully to improve student outcomes, recruit secondary STEM teachers, and develop partnerships between STEM university faculty and Education Researchers. We will introduce the LA Model and discuss the theoretical lens used to understand classroom interactions, student engagement, and development of science identity. Participants will analyze videos of student interactions, discuss the roles that LAs can take in class, and work together to define next steps for designing and/or researching learning environments that are collaborative and rich in effective peer interactions. We will all learn more about our different contexts, including secondary and university education systems, that can inform possible synergies around the implementation and research of LA programs in different countries.

6. Workshop Description

The Learning Assistant (LA) model, at its core, seeks to improve the educational experience of all Science, Technology, Engineering, and Math (STEM) students. It does this at the university level by partnering science educators and science education researchers with STEM faculty to design and implement active learning approaches and to use inclusive teaching practices in their undergraduate courses. In order to facilitate collaborative groups in their active learning classes, faculty work with one or more undergraduate Learning Assistants (LAs) who have recently been students in the course. Some of these LAs either know, or discover through the process of being an LA, that they want to pursue math or science teaching at the secondary level. Both the experience of being a student in the active learning classroom and being an LA (and learning how to facilitate active learning) helps prepare future secondary math and science teachers to use active learning approaches in their classrooms while also increasing their content knowledge. Thus, the LA Model provides an opportunity to take a systemic approach to improving educational experiences and outcomes for science and math students at all levels of education.

The LA Model has been adopted in, and adapted to, various institutional contexts in the USA, including within large research universities and small community colleges, and is now spreading to other countries including Ireland, Norway, Turkey, Japan, and South Korea. As the model spreads, there is increased need to generate a shared understanding of core features of the model and how they may be adapted to work within various educational systems and university settings.

At its core, the LA Model seeks to improve the educational experience for all students, a goal that we believe is shared among participants in the 2019 ESERA Conference. Specifically, this workshop will:

1. Introduce science education researchers, STEM teacher education faculty, and STEM disciplinary faculty to the LA Model for undergraduate STEM course transformation and teacher recruitment.
2. Develop shared understanding of key aspects of the model among participants, to inform discussions of how the model might be adapted to their particular contexts (i.e. their country's pre-university education system, or college/university settings)
3. Highlight two theoretical frameworks that guide implementation and research on current LA programs, and draw on participants' expertise to consider other perspectives that may be useful.

Overview of the LA Model and its Outcomes

The LA Model was developed at University of Colorado Boulder (USA) in 2003, focusing on three main goals: (1) recruiting top math and science undergraduate students into secondary school teaching, (2) providing support and training for university STEM faculty to innovate and use more active learning approaches in their courses, and (3) partnering science education researchers with disciplinary faculty to engage in discipline-based education research (DBER), all towards an ultimate goal of broader systemic and institutional change. Beginning in 2007, faculty from diverse institutions have collaborated with the core LA team at University of Colorado Boulder to create the international Learning Assistant Alliance (LAA). The LAA supports more than 100 institutions worldwide that are running their own LA Programs, each of which include key elements of the LA Model adapted for their particular context and needs. Science education faculty from Norway, Ireland, Germany, Turkey, Czech Republic, Canada, Brazil, Japan, and South Korea have participated in the International Learning Assistant Conference or have visited University of Colorado Boulder to learn more about the LA Model in order to adapt it to their context. We have engaged in rich conversations about similarities and differences in the education systems in these different countries, and we are now forming international partnerships to consider how the LA Model can be used to create effective and inclusive collaborative learning environments across these widely varied contexts. One goal of this ESERA workshop is to facilitate a dialogue among participants regarding their own classrooms, institutions, and educational goals and to invite participation in the emerging international collaboration.

Systematic research has shown dramatic increases in student achievement in LA-supported courses in multiple departments (Pollock, 2009; Otero, 2015) and decreased failure rates in STEM gateway courses, particularly among students from groups that are traditionally underrepresented in college and in STEM degree programs (Alzen et al., 2018; Close et al., 2018; Van Dusen & Nissen, in press). Research at Texas State University has also demonstrated that participation in the LA program develops students' identities as scientists (Close, Conn, & Close, 2016). At University of Colorado Boulder, the number of science and math students completing the teacher certification program nearly tripled following the implementation of the LA Model (Otero, Pollock, & Finkelstein, 2010).

Theoretical perspectives that frame the LA Model and research

Vygotsky's Zone of Proximal Development (ZPD) provides a broad understanding of how the addition of LAs to a learning environment can enhance learning by growing the Zone of Proximal Development (ZPD) when new social interactions are introduced. In our research, we think about designed environments that allow for learning through individual experiences and social interactions in which LAs are positioned to facilitate discourse. A recent study points to the dual cognitive and affective role that LAs play and the effect on students' metacognitive awareness as well as their disciplinary identity (Kornreich-Leshem, Benabentos, Hazari, Potvin & Kramer, 2018).

Close et al. (2016) examined the transformative nature of the LA experience on the LAs themselves, using the theoretical lens of Communities of Practice theory (Lave & Wenger, 1991; Wenger, 1998). A well-functioning community of practice is defined by "mutual engagement, a joint enterprise, and a shared repertoire" (Wenger, 1998, p. 73); participation in a community of practice continuously shapes individuals' identity as well as their day-to-day practices. The LA program contexts gives LAs an authentic low-stakes role in the community of STEM faculty, allowing for legitimate peripheral participation and enhancing LAs' sense of belonging in the STEM community. Wenger defines community membership as an important element of identity development.

Workshop schedule and activity description (3.5 hours)

Part 1 (30 min) - Introduction, LA Model and examples of implementation from three universities in the US. Brief framing with theoretical frameworks, summary data.

Part 2 (1 hour and 30 min) - Video analysis in groups; Examples of interactions in classrooms and in weekly preparation meetings.

Part 3 (30 min) – Discussion about the impact of the LA experience on students, LAs themselves, department cultures, and institutions.

Part 4 (45 minutes) - Design / planning next steps and creating an action plan; exploration of resources.

Closing (15 minutes)

Activities for all participants

The first part of the workshop will ask participants to describe or imagine **collaborative learning environments in university** and the roles that undergraduates can take in facilitating student learning ("what would you like to be able to do if you had more help with your classroom and could teach in a different way?"). We will discuss how the LA Model can be implemented in different contexts and on different scales and will give specific examples from three universities in the US. We will discuss the impact of each program on students, faculty, departments, and the institutions.

The second part will introduce the **foundations of the LA Model** (practice, pedagogy, and weekly content preparation meetings). The session will use these essential elements to help participants think about how they can design and implement this model in their contexts. The roles of LAs, faculty, curricular materials, and programmatic structures will be highlighted as participants analyze videos of

LAs working with students. Participants will engage in video analysis of interactions between students and LAS as LAs elicit student ideas and scaffold guidance.

Next, participants will be introduced to the **weekly preparation meeting of Faculty-LA teaching teams**. This element provides LAs and faculty with opportunities to reflect on past classes, refine instruction, and clarify learning goals. The weekly preparation meeting brings together the pedagogy and the content needed to effectively guide student learning. LAs often say that they are always surprised to see the 'behind the scene' side of teaching. Participants will watch short video examples of weekly preparation sessions from different institutions and will analyze these videos in small groups with facilitation by the workshop presenters. They will compare meeting structures and LA-faculty interactions and relate them to potential preparation scenarios at their own institutions. Workshop presenters will share best practices for Faculty-LA interaction. Participants will also discuss the pedagogical purposes of possible activities for the weekly content preparation sessions.

In the last phase of the workshop, participants will have time to design their own instructional settings with rich peer interactions or think of how they might be able to partner with other faculty at their institutions to do so. The outcome of the workshop will be an action plan that fits what participants need, from modifying a unit to flipping a class and even to changing department practices. LA Alliance resources will be shared.

Expected roles of participants

Participants will take an active role and engage in working together during most of the workshop, e.g., analyzing video of LA interactions, and discussing ways to incorporate active learning and LAs into their instructional contexts. Often, participants will have an opportunity to think individually about a question and then discuss with a neighbor or a team.

List of references & literature relevant to the workshop

Alzen, J. L., Langdon, L.S., & Otero, V.K. (2018). A logistic regression investigation of the relationship between the Learning Assistant model and failure rates in introductory STEM courses. International Journal of STEM Education, 5:56. https://doi.org/10.1186/s40594-018-0152-1

Close, E. W., Conn, J., & Close, H. G. (2016). Becoming physics people: Development of integrated physics identity through the Learning Assistant experience. Physical Review Physics Education Research, 12(1), 010109. https://doi.org/10.1103/PhysRevPhysEducRes.12.010109

Close, E. W., Mailloux-Huberdeau, J.-M., Close, H. G., & Donnelly, D. (2018). Characterization of time scale for detecting impacts of reforms in an undergraduate physics program. In L. Ding, A. Traxler, & Y. Cao (Ed.s), *AIP Conference Proceedings: 2017 Physics Education Research Conference*, 88-91, doi:10.1119/perc.2017.pr.017

Kornreich-Leshem, H., Benabentos, R., Hazari, Z., Potvin, G. and Kramer, L. (2018), *Paper in review*.

Lave, J., & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation.* Cambridge University Press, Cambridge, England.

Learning Assistant Alliance, https://learningassistantalliance.org/.

Otero, V. (2006). Who Is Responsible for Preparing Science Teachers? Science, 313(5786), 445–446. https://doi.org/10.1126/science.1129648

Otero, V. K. (2014). Nationally scaled model for leveraging course transformation with physics teacher preparation. In C. Sandifer & E. Brewe (Eds.), *Reaching Students: What Research Says About Effective Instruction in Undergraduate Science and Engineering* (pp. 107–116). College Park, MD: American Physical Society. https://www.phystec.org/webdocs/EffectivePracticesBook.cfm

Wenger, E. (1998). *Communities of Practice: Learning, Meaning, and Identity*. Cambridge University Press, Cambridge, England.

Materials or artefacts needed:

A room with white boards and markers would be appreciated. We will bring other materials with us.