Development and Impact of a Training Program for Undergraduate Facilitators of Peer-Assisted Learning

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In late 2011, we created a Peer-Assisted Learning (PAL) program focused on improving student performance in high-risk STEM courses. Our PALs are modeled after the Peer-Led Team Learning (PLTL) program, which has been shown to provide long- and short-term benefits to both students (Chan & Bauer, 2015; Gosser, Kampeier, & Pratibha, 2010; Lewis, 2011) and peer leaders (Gafney & Pratibha, 2007). The PLTL model often describes key qualities for student leaders, including excellence with content, independence, and an outgoing personality (Tien, Roth, & Kampmeier, 2004). However, after hiring our first team of PAL leaders, it became apparent that occasionally "independent" and "outgoing" translated into leaders who were the center of attention and resisted operating on the sidelines. As a result, we shifted our emphasis to training "facilitators" rather than "leaders." Students must still earn at least a B in the course they facilitate, but we now emphasize empathy, creativity, and approachability during recruitment, hiring, and training. Our program has resulted in an average 20% increase in pass rates for students taking a PAL course versus similar populations of non-PAL students.

Several of our high-risk STEM (science, technology, engineering, and mathematics) classes offer students the option of enrolling in a 1-unit Peer-Assisted Learning (PAL) course that meets twice weekly for 50 minutes and is graded pass/fail on attendance and participation. We define high-risk STEM classes as courses with over 50% repeatable grades. Currently PALs are available in preparatory and general chemistry, precalculus, Calculus I and II, human anatomy, molecular cell physiology, and systemic physiology. Each PAL consists of 15 students and one facilitator; this number of students is larger than the typical Peer-Led Team Learning (PLTL) model to cut down costs. As a result, in contrast to PLTL, we cluster students in groups of three to four, and the facilitator's attention is divided between groups. During the PAL session, students use whiteboards to collaboratively solve course-specific problems that have been written by the lead faculty members in the parent course. There is only one dry erase pen per group, and it rotates, so every member of the group assumes responsibility for solving problems. We have observed that when properly implemented, students quickly assume more independence under this model, and by midsemester, the facilitator is primarily walking around and observing, stopping only occasionally to offer probing questions to a group. In addition to their PAL course, facilitators also hold office hours (open to all students, whether or not in PAL), attend all lectures of the parent course, and participate in weekly PAL training (described next).

Our PAL facilitator interview process

We have more facilitator applicants than we have positions, so the process has become competitive and requires a faculty referral. During the 20-min-ute-long process, pairs of applicants meet with an interview committee consisting of one to two faculty members and one to two returning PAL facilitators. The purpose of including the veteran facilitators is to gain from their invaluable insight and to model for the interviewee the important role that students play in every facet of the PAL program.

On the basis of our first semester of observing facilitators working with their PALs (see Observation Process), we were concerned that several facilitators, even with extensive training, had not fully bought into the PAL model. They seemed to thrive off being the "expert" and answering student questions. To reduce this propensity for becoming the center of attention, we reformulated our hiring and training process to focus on facilitators who would thrive on the sidelines.

In addition to the standard "Why do you want to be a facilitator" type of question, we have also developed a number of scenarios we use during interviews that are based on real situations that commonly occur in PAL sessions and with which facilitators have struggled (see Table 1). In our experience, successfully navigating these scenarios required the skills we valued (e.g., empathy, optimism, approachability, problem-solving skills), and using these scenarios during the interview process has proven useful in identifying potential facilitators. We found that facilitators with these qualities created opportunities within their PAL sessions to listen to the struggles of their students and to work with them to find unique solutions to problems.

Students who are humble, with an authentic sense of service, worked out best because these qualities emerged in their concern for the success of their fellow students.

With a multicultural student body that reflects our diverse city (Stodghill & Bower, 2002), we have been successful in hiring facilitators who reflect our PAL participants (Figure 1). Not surprisingly, we draw facilitators primarily from those who participated in our program as students, and because student participants tend to be highly diverse, we see that diversity reflected in our facilitators, who serve as visible models of persistence and achievement. Our data also indicate that we hire more low-income, Pell-grant eligible PAL facilitators (65%) than we have on the campus at large (59%).

Our PAL facilitator training program

Our training program strives to develop student facilitators who em-body the PAL philosophy, who feel a sense of community within the PAL program, who are devoted to helping their students, and who feel empowered to contribute to the success and improvement of the entire PAL program in meaningful ways. To develop these qualities, we require a 1-year commitment on the part of the facilitators, and in return, we provide an extensive professional development sequence that includes an authentic research experience and the ability to promote and assume positions of leadership within the program. Our professional development sequence includes the following components:

- *Summer training*: We begin during the summer with a full, 8-hour day of training. Training topics include practical matters (timesheets, office hours), aspects of group facilitation (icebreakers, creating an inclusive environment, group dynamics, etc.), and a "run-through" of problems for the first week of PALs.

- *PAL class (NSM 197: Seminar in Peer Assisted Learning—2 units)*: Once the semester begins, each weekly meeting includes one hour of practice/preparation for the following week's worksheets, followed by 1 hour of discussion on teaching and learning in STEM. The PAL facilitators read articles from the primary literature related to student success in STEM. Topics include scaffolding problem solving, developing a growth mindset, and encouraging higher order thinking skills.

In addition to preparing facilitators to successfully oversee their PAL sessions, significant time during training is spent discussing their role as mentors and their importance serving on the "frontlines" with students who may be struggling in various ways

TABLE 1

Sample scenarios used during our interview process.

Interview scenario	What we looked for in responses	Responses that concerned us
How would you deal with a PAL student who you know is not doing well, and who seems to be giving up on the class based on their behavior in lecture (e.g., turning in assignments late).	• I would encourage them not to give up, and tell them "I've been there—you can do this, let's meet and go over stuff." • I would try to understand what's going on with this person—it might not even be the class—and then figure out how I can help.	• I would make sure they knew how important it was to spend time studying, and remind them of the assignments. • Some students you can't help.
You are trying to evaluate how well one of your quieter students (Sophia) understands the material. However, as soon as you approach the group, another student (David) interrupts and starts explaining what the group is doing. How would you address this situation?	• I'd let David finish his sentence and then stop him there, saying "that's great, thanks; Sophia, what do you think?" • I would let David finish speaking, and then ask Sophia to try applying the idea to a new context.	• I would tell David that I wasn't speaking to him, I want to know what Sophia thinks. • I would ignore David and instead look at Sophia and repeat that I'd asked her what she thought.
It's your first PAL session and you're walking around the room and checking on student progress. A student from one of the groups asks you a question that you can't answer. How would you handle this?	• I would ask other students if they had any ideas and try to go from there. • I would work with the group on what we knew, and brainstorm possible answers; if we still couldn't figure it out together, I'd make sure to talk to the instructor to learn a good approach for next time.	• I'd go online and look it up. • I'd find the solution in the book.

Note: PAL = Peer-Assisted Learning.
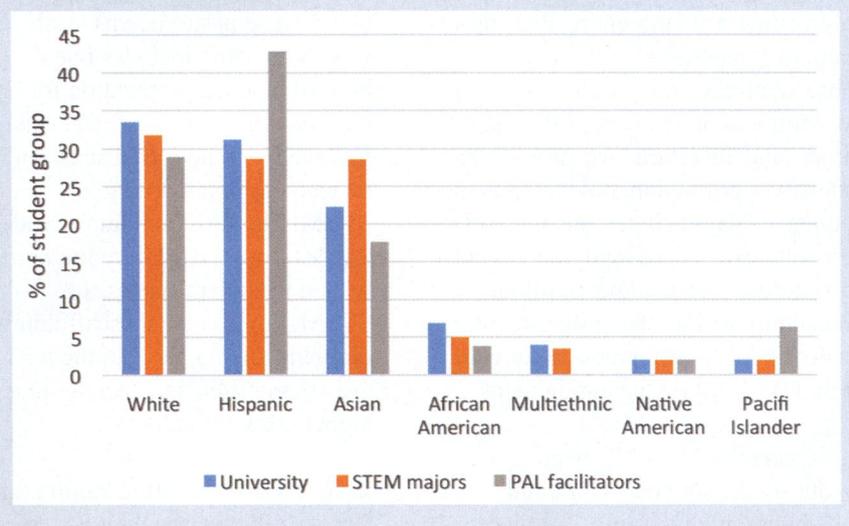
(one discussion topic: "it takes one person to save a student from dropping out—you may be that person for someone"). To support their role as liaisons to campus resources, we offer Safe Zone training (LGBT sensitivity) and ASIST training (suicide prevention), and we provide readings and discussion related to student confidence and morale, and the role these play in achieving success.

Our ongoing observation process

To ensure the integrity of the PAL model, and to provide facilitators with constructive feedback, all new facilitators are observed and debriefed at least twice each semester, and veterans at least once each semester. Specially trained veteran PAL supervisory facilitators (described next) assist in this process. On the basis of our desired outcomes (engaged students who have a shared responsibility for problem solving and who are focused on the process rather than the answer), we formalized an observation protocol that outlined our expectations for facilitator performance (see supplemental materials, available at http://www.

nsta.org/college/connections.aspx).

The observation protocol categories include items related to classroom management and demeanor (i.e., "Uses student names, or is actively working on learning student names"; "Maintains appropriate and professional boundaries with students"; and "Facilitates the use of whiteboards/chalkboards with all students participating") and several specifically tailored to our PAL model (i.e., "Uses guiding questions and scaffolding to help students achieve their own understanding rather than directly answering student questions"; "Whenever possible, responds to student questions by turning the question back to the group and getting students to help each other"; and "Allows students an appropriate amount of struggling"). Each observation is followed by a 30-minute debrief between facilitator and observer, during which they engage in conversation about specific points, brainstorm on the reasons for particular successes, and devise approaches for challenging areas. If a particular problem is noted, the observer and facilitator will work collaboratively to address the issue.

As mentioned earlier, the observa-

tion protocol also served a critical role in early program development by alerting us to issues. For example, one bright and articulate chemistry facilitator we were certain would be a model for the program had difficulty blending in during his PAL session. With a booming voice and facile knowledge base, he became the center of attention for everyone in the room, even when trying to speak with a single group. In his classroom, the PAL model wasn't working—students stopped struggling through problems and simply waited for the facilitator to help. With some intensive work, the facilitator was able to successfully reduce his presence in the class, and the PAL model successfully emerged within a couple of weeks. This was an important lesson—we are conscious that without constant effort and feedback, the model could easily become a tutorial session.
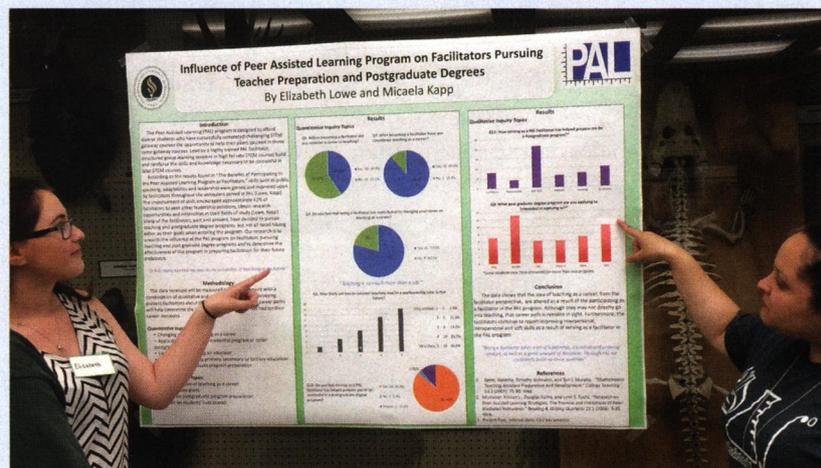
Developing student leaders

Incorporating the high-impact practice of undergraduate research (Kuh, 2008), our PAL facilitator training class incorporates a PAL research project. Late in the fall semester, after spending several weeks reading and discussing the primary literature related to topics such as student learning, barriers to success, and group dynamics, facilitators form interdisciplinary groups (two to five facilitators per group) and propose an action research project (Ferrance, 2000) related to student success or to the PAL program itself that they will conduct. They learn about the use of human subjects from our campus Institutional Review Board and compose full proposals with relevant background research and rough methodology for the fall "final exam" for NSM 197. In the spring, the second hour of each class is focused on the project itself and uses peer feedback on each other's projects, including: further background research, discussion of project outline, refining methodology, gather-

ing data, and interpreting their findings.

The facilitator research groups present their findings at a formal poster session that is attended by faculty and campus administrators (Figure 2). For 70% of facilitators, this represents their first experience with undergraduate research (data itself that was part of a 2015 project). Findings from several projects have been incorporated into the PALs on a permanent basis, thus empowering these students to invoke meaningful programmatic change. Examples of recent projects include: (a) timed practice with net ionic equations during the first 5 minutes of general chemistry PAL sessions to improve student efficiency and skill with problem solving on exams, (b) focusing calculus exam corrections on algebra mistakes to reduce these errors and improve calculus exam scores; (c) having students write practice exam questions specifically focused on higher levels of Bloom's taxonomy to improve performance on exams in physiology; and (d) using a group texting app to drive student conversations about chemistry outside of class, thereby reducing reliance on facilitators and improving student success within the course. When queried about the value of the PAL research project, 100% of facilitators said that the PAL research projects were "empowering." Anonymous surveys of facilitators yielded quotes such as the following: "Completing PAL research has helped define my career goals. It has opened the possibility of going to graduate school and completing research in academia, specifically within the STEM disciplines," and "The research component is important for the PAL program because many of the research projects' results have led to innovations in the program." In addition to presenting their work in campus student research competitions, several students have presented their projects at national discipline-specific conferences, and a small number have teamed with faculty to present

FIGURE 2

Peer-Assisted Learning (PAL) facilitators present their research poster.

work at national conferences like the American Association of Colleges and Universities.

We are also conscious of supporting these emerging student leaders as they develop connections within the program and polish skills they will take with them when they graduate. The PAL program is almost entirely student run. Undergraduates are employed at every level of the program, garnering increasing responsibility as they promote. Those interested in further leadership may serve as:

- *PAL lead facilitators*: In addition to managing their own PAL, lead facilitators steer run-throughs of problems and coordinate course-wide review sessions, connect with and support each facilitator within their class group, and arrange and/or serve as a model session facilitator for new hires who might want to observe a "veteran" in the classroom.

- *PAL supervisory facilitators*: These experienced facilitators may or may not still have their own PAL to run but are adept at problem-solving issues that arise in PALs and serve as the first point of contact for any facilitator requiring

advice about a situation. These students are trained to complete PAL observations and give feedback to their peers using our observation protocol. They also play major roles in program management (assisting with interviews, coordinating office hours for the entire program, and working closely with faculty on data analysis and program evaluation).

- *PAL social directors*: These facilitators use social media to keep everyone involved and spearhead a number of social events for the group, including holiday parties, intramural teams, an end-of-year picnic, and summer events. They become devoted to their "PAL family," and it is no surprise that a recent poll indicated that 100% would opt to return to the program if possible (and if they weren't graduating, etc.).

The leadership development of facilitators who begin in PAL has been extraordinary. Last year's ASI (Associated Students, Inc.) president and vice president were both former PAL facilitators, as is the current ASI representative for the college.

Most student club and council leaders within the STEM colleges have passed through the PAL program. This student engagement has reaped tremendous rewards for the PAL program, with ASI passing a formal resolution calling on the campus leadership to fund the program once grant monies ran out and keeping the work of PAL in the public eye of the university.

The development of leadership and related qualities was illuminated by a recent facilitator survey. Facilitators answered "what did you gain by serving in the PAL program?" in the following way (all of these answers were reported by the majority of those surveyed): adaptability, group management, leadership, public speaking/communication, planning, flexibility, and teamwork. Specific feedback included: "I can present ideas and communicate to people in a way that is more professional"; "Being a PAL facilitator takes a lot of leadership, a positive mindset, as well as a great amount of discipline"; and "PAL has helped me to perfect my ability to multitask, which will be essential to success in a post graduate degree program."

Preliminary findings

In addition to the extensive benefits that we have shown our program has on PAL facilitators, we are also convinced that our PALs are having the intended impact on the students taking PALs. Although it is too early to have longitudinal retention data, our results show that we are closing the achievement gap in that underrepresented minority (URM) students who are in a PAL meet or exceed the performance of non-URM students who are not in a PAL. Our specific PAL model has been shown to increase both course pass rates and earned course grade by an average of 20%. Additionally, campus data analytics experts independently used propensity score matching to analyze whether our data were impacted by self-selection bias and found that the improvements in course performance were not simply due to "better" students selecting into the PAL sections. Student criteria that were analyzed included: age, gender, ethnicity, parents' education, on-campus housing, Pell-grant eligibility, high school GPA, SAT scores, college GPA, units, class level, major, first-year seminar, AP scores, and time between high school and college remedial status.

Conclusion

Training undergraduates to work effectively in peer programs requires more thoughtfulness in approach and implementation than might be initially assumed. High standards, a supportive environment, and respect for what students can contribute to the program are essential in producing professional, engaged, and committed peer leaders. ∎

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