

Peer-to-Peer Mentoring: How It Fits into the Statistics Living Learning Community at Purdue



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The Statistics Living Learning Community (STAT-LLC) launched at Purdue University in August 2014. This program is funded by a \$1.5 million grant through the National Science Foundation's Mentoring Through Critical Transition Points in the Mathematical Sciences program. In Purdue statistics, we have unified the undergraduate academic, research, residential life, and professional development programs for a cohort of 20 sophomores per year. Our program will have 100 sophomores involved altogether, over the life of the five-year grant. (We have one of the largest undergraduate statistics programs in the United States, so we plan to expand the number of students involved in the STAT-LLC in the future.)

When students apply to the program, they are still in their first year of college. In general, universities provide a broad spectrum of activities to help students navigate the transition from high school to the first year of college. Only a fraction of those activities seem to be discipline-based (or connected with a discipline at all). Many first-year activities are geared toward professional development, acclimation to the university, and perhaps a brief introduction to career possibilities in a discipline. That makes sense when we recognize that many first-year students have not (yet) settled on a major program of study or career choice, nor are they (yet) taking courses in the core of their discipline.

During the sophomore year, students are tackling the core courses in their major. For those of us in statistics departments, this often means students are studying probability theory, statistical theory,

and/or data analysis. They also are searching for their first research experiences with a faculty mentor. They are applying for internships and trying to find their niche in the statistics discipline or one of its many areas of application.

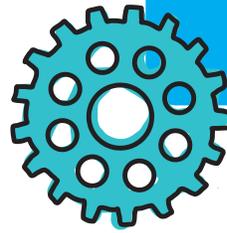
Goals

Some key goals for our department, in launching the STAT-LLC, have been to bolster the students' self-confidence, improve their understanding of the statistical materials and tools learned in class, broaden their view of the discipline, and have some fun along the way. We have hopefully begun to accomplish several of these goals.

In large part, we have been able to do this by inter-relating the seemingly disparate aspects of the sophomore year college experience. The peer mentoring aspect—as students support and uplift each other—has been a crucial part of this new effort. The students do a magnificent job of helping each other through many of the experiences that would be much more challenging if faced alone.

Sophomores often experience the “sophomore slump” to various degrees. To clarify, this is not just a regression toward the mean. The sophomore slump (in this context) refers to the fact that universities typically have fewer resources devoted to sophomores than first-year students, and students tend to have lower performance during their second year than their first year of college. For example, Dan Berrett observed in a May 11, 2012, *Chronicle of Higher Education* article that only “13% [of four-year institutions nationwide] offered seminars to sophomores and juniors. More than 90% provided seminars to freshmen and seniors.”

By creating a much more welcoming environment for our undergraduate students, our department hopes to retain more females, minorities, persons with disabilities, first-generation students, etc.



Criteria

The only criteria for students to be admitted to the STAT-LLC are that they complete the third semester of calculus before the start of their sophomore year. This requirement is necessary so students satisfy the prerequisite for the probability course they take during the first semester of their sophomore year. The students do not need to have any particular knowledge of computing languages or environments. We introduce students to all of the necessary material in the courses.

Also, the students do not need to be pursuing a major in statistics. They simply need to have an interest in learning more about statistics and data analysis, particularly how the tools from these areas will be helpful and relevant in their own chosen majors of study—and in their professional careers after college.

Our Approach

The support of peers, staff, and faculty can help alleviate some of the sophomore slump. With this in mind, we have created a supportive environment at Purdue. Aspects of the STAT-LLC include the following:

I. We register all the STAT-LLC students in the same sections of their courses in probability and data analysis (fall) and statistical theory (spring). These courses are the most fundamental in the statistics major. In particular, probability theory is a prerequisite for almost all the rest of the coursework in the major. Our intention is to use this method of block-registration so students feel more like a cohort, facing the same challenges and reaping similar rewards. The probability and data analysis courses are both team oriented. The students work together every day on problem solving (in the probability course) and data-oriented projects (in the data analysis course). The team-oriented structure of the courses encourages students to communicate with their peers constantly about the tasks at hand.

II. The students all take a one-credit per semester professional development seminar. It takes place one time per week. Guest speakers include successful alumni, staff who support diversity initiatives on campus, scholarship and study abroad coordinators, practicing statisticians from various industries, and current graduate students in statistics.

III. The students all live on the same floor of the same residence hall. This living arrangement



The Statistics Living Learning Community class of 2014 from Purdue University

naturally induces a great deal of camaraderie. I serve as the faculty fellow for the floor, which means I work with the resident assistant to plan activities for the students. We have coordinated movie nights, pumpkin carvings, study breaks, excursions, etc. I eat regularly in the residence hall with the students. My wife and five children periodically join us, and occasionally the students eat dinner at our home, as well. Last month, roughly half of the students in the STAT-LLC spent the weekend camping at Mississinewa Lake (an Indiana State Park) with my family and me. We camped in tents, cooked food on the grill throughout the weekend, hiked, and survived a torrential downpour. The residential life events enable the students to feel more at home during their sophomore year of college. Moreover, the students get to know my family and me in a less formal environment, so they can better understand how a scientist can manage to have a research-oriented career and (at the same time) a family life. This makes the path to a career in statistics seem more feasible.

IV. Unlike many undergraduate research experiences that last for an eight-week or 10-week summer session, each of the students in the STAT-LLC has a 12-month research experience with a faculty mentor, starting in August at the beginning of the sophomore year and lasting through August of the junior year. The students pick the projects they work on, including their own faculty mentor. We have several dozen available projects already predefined and outlined

Outreach

I would be delighted to help other statistics departments establish similar programs with some combination of academics, research, residential life, and professional development. Students appreciate anything faculty and staff can do with regard to unifying these aspects of the undergraduate experience ... especially during their sophomore year. I would love to see many universities start their own living learning communities in statistics and am dedicated to helping partners start their own initiatives. Please feel welcome to contact me at mdw@purdue.edu.

The STAT-LLC has recently been discussed in the context of new initiatives in data science across the country. See the article "Data Science in the Statistics Curricula: Preparing Students to 'Think with Data,'" by J. Hardin, R. Hoerl, N. J. Horton, D. Nolan, B. Baumer, O. Hall-Holt, P. Murrell, R. Peng, P. Roback, D. Temple Lang, and M. D. Ward, *The American Statistician*, volume 69 (2015), 343–353.

(contributed by faculty drawn from throughout the university system). We also welcome new projects according to the needs of the students. We selected research projects for which data analysis is a key aspect of the investigation; the faculty member has experience working as a mentor; and the faculty member has a research team the sophomore can get involved in. This way, the students have layers of mentoring from peer undergraduate students, as well as graduate students, postdocs, and faculty members (in addition to the primary faculty mentor).

Another unique aspect of our program is that we introduce the students to the need to work with very large data sets at an early point in their careers. This leads to a paradigm shift in the students' thinking, as they work with data sets that are too large to open (for instance) in a spreadsheet. They need to learn how to use R, visualization, pattern matching, SQL, UNIX shell, and XML parsing with an emphasis on how to use such tools in tandem. As the students become more familiar with the tools necessary for dealing with large data, they are better prepared for the data-driven methods of discovery they need in their research projects, as well as in graduate school and the workforce.

Outcomes

As a key outcome of having participated in the STAT-LLC, the students will better understand how statistics and data analysis are used and, in particular, how these tools better prepare them for potential future careers. Since the students have research projects from a variety of disciplines—with many faculty mentors—they learn from each other about the different approaches to scientific problems and

the different ways in which statistical tools are leveraged by faculty within different areas of expertise.

The peer mentoring aspect of the STAT-LLC environment is central to our success. Sophomores often feel "abandoned," "forgotten," and "invisible to the institution." These are all actual phrases used in the literature about the sophomore year experience nationwide. In contrast, in the STAT-LLC, our students commiserate with each other while studying for courses and completing research tasks. They learn they are not alone in their struggles and uncertainties. Friendships help bolster the students' self-confidence in their ability to become budding early-career scientists, particularly statisticians, mathematicians, data analysts, biologists, health care professionals, consultants, policy analysts, and atmospheric scientists.

Students also have the freedom to (occasionally) fail in various tasks, but not to be defeated by the failure. Moreover, they feel the freedom to change their career direction without feeling they have let themselves or their families down. For instance, one student aspired to be an actuary before joining the STAT-LLC in 2014, but then worked with a professor of atmospheric science and had a research experience in Denali National Park and an internship at Procter and Gamble. The student is now considering a career as a data analyst. Another student was determined to join the military after college, but after participating in the STAT-LLC, decided to take graduate courses and will soon apply for graduate school, with plans to become a scientist or consultant.

Loran Carleton Parker (our evaluator for the grant) and I plan to write a paper in the near future with preliminary results of the first few years of the STAT-LLC. Informally, we are delighted to share some of the outcomes based on student feedback. Among the 20 student participants in the STAT-LLC for the 2015–2016 year, the students' understanding of research increased significantly, according to a pre/post survey in which the students self-reported on their experience. There were significant gains in more than half the indicators in the evaluation. In particular, students reported an increased understanding of the following:

- How to plan and conduct a research project
- The nature of the job of a researcher
- The research process
- A research paper/journal article
- Following and documenting a research procedure
- Observing and collecting data
- Organizing data into a spreadsheet



The Statistics Living Learning Community (STAT-LLC) class of 2015 from Purdue University

- Statistically analyzing data using computer software
- Writing the results of an experiment/research
- Orally communicating the results of research projects
- Preparing research for poster presentation and publication

Overall, 85% of the participants rated their research experiences as very valuable or extremely valuable. Students also reported an increased understanding of how statistics is applied in interdisciplinary ways. They emphasized an improved understanding of what to expect in both graduate school and their future career opportunities. Regarding their

undergraduate experience, they reported significant gains in working with others in studying, meeting other students with similar interests, locating campus resources, etc. Loran told me that, during her focus group interviews with the students, they repeatedly emphasized how they greatly benefitted from living and learning in a community-oriented environment.

At the end of the 2015–2016 academic year, I was selected as the Most Outstanding Faculty in this year's university-wide Favorite Faculty program. I interpreted this as a sign of success for the whole department of statistics at Purdue University and for our many partners across campus who have helped make the Statistics Living Learning Program such a success. ■

MORE ONLINE
For more information about Purdue's Statistics Living Learning Community, please see <http://llc.stat.purdue.edu>. All the materials developed for this initiative are freely available there.

The Department of Statistics at Texas A&M University
Invites Nominations for the
Emanuel & Carol Parzen Prize for Statistical Innovation



To promote the dissemination of statistical innovation, the Emanuel and Carol Parzen Prize for Statistical Innovation is awarded in even numbered years to a North American statistician whose outstanding research contributions include innovations that have had impact on practice and whose Ph.D. degree is at least 25 years old. The Parzen Prize is awarded by the Department of Statistics at Texas A&M University and is selected by the members of the Parzen Prize Committee (consisting of three internal faculty members and two external faculty members). The prize consists of an honorarium of \$1000 and travel to College Station to present a lecture at the ceremony.

Nominations for the 2016 Parzen Prize should include a letter describing the nominee's outstanding contributions to high impact innovative research in statistics, a current curriculum vita, and two supporting letters. Nominations should be submitted by August 15, 2016 to the Chair of the 2016 Parzen Prize Committee:

Professor Thomas Wehrly
Department of Statistics
Texas A&M University
3143 TAMU
College Station, Texas 77843-3143.

For more information on the Parzen Prize, please visit our website at www.stat.tamu.edu/events/parzenprize/index.html.