

Facilitating Success for Women in STEM through Living-Learning Programs

White Paper prepared for the National Conference
of the Women in Engineering Programs and Advocates Network
Pittsburgh, PA

June 2006

Dawn Johnson
Matthew Soldner
Karen Kurotsuchi Inkelas
University of Maryland

This research was supported by a commissioned grant
from the Association of College & University Housing Officers International
Research Foundation.

Please contact:

Karen Kurotsuchi Inkelas
Assistant Professor
Dept. of Counseling & Personnel Services
College of Education
University of Maryland
3214 Benjamin Building
College Park, MD 20742
kinkelas@umd.edu

Facilitating Success for Women in STEM through Living-Learning Programs

What are Living-Learning programs?

Living-learning programs are a particular educational intervention that falls within the broader category of “learning communities,” which include programs such as residential colleges, linked courses, and first-year interest groups (Shapiro & Levine, 1999). They are distinct from other learning communities because they: a) group students in the program in a discrete portion of a college residence hall, b) offer participants a common academic experience, c) involve students in co-curricular activities, offered both in and out of the hall, that are related to the program’s learning outcomes, and d) provide access to unique resources not typically available to other resident students (Inkelas et al., 2004). Although many types of living learning programs exist, a unique subset explore the science, technology, engineering and mathematics (STEM) fields. These include The University of Michigan’s Health Sciences House, The Pennsylvania State University’s Engineering House, and Purdue University’s Wood, Water, & Wild Wonder program.

The Benefits of Living-Learning programs

Faculty and peer interactions. Of the many benefits espoused by living-learning programs, some of the most consistently offered are those that relate to increased faculty and peer interactions. In many living-learning programs, faculty members teach courses directly in students’ residence hall. In doing so, opportunities for both formal and informal interaction are maximized (Pike, 1999). Similarly, because program participants are housed together in the same portion of the residence hall, and program co-curricular opportunities are often offered to

students where they live, peer interactions and involvement with the co-curriculum have been shown to be more prevalent among living-learning participants than those who do not (Inkelas & Weisman, 2003).

Student learning outcomes. Importantly, living-learning programs also have demonstrated a positive effect upon more objectively academic outcomes. Stassen (2003) found that participants had higher first-semester GPAs, tended to persist more readily from the first to the second year, and reported higher levels of institutional commitment and integration with the institution's academic systems than non-participants. Pike (1999) found gains in intellectual development, a point further supported by Inkelas and Weisman (2003) who noted living-learning participants reported greater gains in critical thinking skills and greater enjoyment of challenging intellectual pursuits than resident students who were not participating in a living-learning program.

The Benefits of Living-Learning programs for Women in STEM

Unfortunately, the body of literature examining the influence of participation in living-learning program on women in the STEM fields is very limited. Readers are encouraged to review the work of Gandhi (1999) and Hathaway, Sharp, and Davis (2001) as exemplars in this nascent area of research. Gandhi's work found that living-learning participation supported women's retention in all STEM majors studied, while Hathaway et al. documented a more limited relationship, finding a positive influence only for women in science. In their work, Hathaway et al. found no significant difference in the retention of women in engineering between living-learning participants and those who did not participate.

However, the limitations of the existing literature are not insubstantial. First, all previous studies were conducted at single institutions, making generalization to other settings difficult. Additionally, most studies have focused on only a single type of living-learning program, limiting our ability to draw comparisons between different program types. Finally, the research questions and related constructs explored in each study tended to be idiosyncratic. Even those concepts which were (on face) analogous across research endeavors employed differential operationalization and measurement. As such, broad generalizations about the influence of living-learning programs on women in STEM cannot readily be made.

The 2001-2005 National Study of Living Learning Programs (NSLLP)

Funded by the Association of College and University Housing Officers-International (ACUHO-I), the 2001-2005 NSLLP collected data about 268 living-learning programs at 34 institutions from 24 states and the District of Columbia during Spring, 2004. Approximately 24,000 students responded, 49% of which were participating in a living-learning program and 51% of which were part of a matched comparison sample of non-living-learning residents. The overall response rate was 32%, which is typical for web-administered surveys of college students.

College environments and activities. The NSLLP asked students to report on their involvement and participation in a wide range of college environments and activities. Students who participated in living-learning programs were more likely to report that their residence hall was academically and socially supportive than those who were not in living-learning programs, and they reported a greater number of discussions with their peers around academic and social issues than non-participants. Interestingly, living-learning participants reported more frequent

instances of faculty mentorship than those students who were not in living-learning programs, but there was no statistically significant difference between either group in the area of course-related faculty interaction. Finally, living-learning participants more frequently expressed an intention to go on to complete practica or internships, study abroad, engage in research with a professor, or write a senior thesis (or other capstone experience) than their non-participant peers.

College outcomes. Students were also asked to respond to items designed to assess their attainment in a wide range of college outcomes. Living-learning students reported a smoother transition to college than non-participants, but no statistically significant difference existed between either group's growth in academic self-confidence. The self-reported gain in critical thinking ability of living-learning participants was greater than non-participants, but no such statistical difference existed in either group's gains in cognitive complexity, liberal learning, or development of a personal philosophy. Finally, although living-learning participants reported higher levels of commitment to civic engagement than their non-living-learning peers, no difference was found between the groups' appreciation for racial and ethnic diversity.

NSLLP Women in STEM Analysis (preliminary)

We have only just begun to examine the 2001-2005 NSLLP data vis-à-vis the experience of women in STEM. This is for two reasons: a) targeted analysis of women in STEM was not among the study's initial purposes, and b) students' college of enrollment, not major, was solicited, which required us to craft very narrow parameters for inclusion in the analyses to ensure we were not erroneously including non-STEM participants (this likely resulted in substantially underestimating our STEM population). Our preliminary analyses involved 948 first and second year women in the STEM fields. A subset of 233 participated in living-learning

programs, with 121 involved in women-only (WISE) programs, 91 involved in co-educational programs, and 21 in non-science related programs. The remaining 715 women were randomly selected from the NSLLP control group.

To understand the magnitude and direction of differences between each of the four groups (WISE, co-ed, non-science, and control), multiple analyses of variance (MANOVAs) and appropriate post-hoc tests were conducted. Results of the MANOVAs indicated that women in STEM majors who participated in any type of living-learning program reported greater use of residence hall co-curricular resources (i.e. study groups, career workshops, social activities) and found the residence hall climate to be more academically supportive than those who were not in any living-learning program. Women who participated in co-ed STEM programs reported more faculty mentoring, greater ability to apply something they learned in one course to topics in another course, and greater enjoyment of intellectual pursuits that were challenging. Our analyses also revealed some interesting non-significant differences between groups. There were no differences found among the different types of living-learning programs in the areas of peer discussion of academic and career issues, ease with the academic transition to college, or academic self-confidence. Results are presented in more detail below, in Table 1.

Table 1.**Differences in Outcome by Type of Program**

Outcome	WISE (n=121)	Co-Ed (n=91)	Non- Science (n=21)	Control (n=715)	Significance	Post-Hoc
Faculty mentorship	7.43	7.96	7.70	7.29	*	2>4
Use of residence hall resources	9.28	9.08	10.31	8.06	***	1,2,3>4
Residence hall academically supportive	18.19	17.22	17.38	15.99	***	1,2,3>4
Application of coursework	18.60	19.15	19.09	18.29	**	2>4
Enjoy challenging intellectual pursuits	9.00	9.14	8.14	8.77	**	2>4

* = $p = .05$, ** = $p = .01$, *** = $p = .001$.

Both our significant and non-significant results prompted us to examine structural differences, if any, between different types of living-learning programs. Chi-square analyses indicated a few such differences among the different types of living-learning programs: for the co-ed programs, there was greater faculty involvement and the programs themselves encompassed a greater portion of the residence hall than women-only STEM programs. In WISE programs, directors more frequently were attached to academic departments, compared to co-ed program directors who came from a variety of administrative areas on campus.

The preliminary NSLLP analyses indicate that co-ed programs appear to be stronger in facilitating intellectual outcomes, which may attributed in part to the greater involvement of

faculty in these programs. Women-only STEM programs do not appear to facilitate a better transition to college or greater self-confidence. It may be that differences in self-confidence were not observed because this study compared women to each other, and not to men, where prior research has shown these differences to occur. Based on these findings, it may be the case that the benefits of a women-only peer group, such as those found in WISE programs, become muted in a co-ed setting. After all, these women students are not likely to be in women-only math and science classes, such as those found at women's colleges. Thus, perhaps the unwritten, less tangible benefit of co-ed programs may be that they help women learn to "hold their own" among their male peers. Such programs are reflective of the reality that the STEM fields in which these women will find themselves working are male-dominated environments.

Future Questions and Directions

Not surprisingly, our preliminary analyses yield as many future questions as they do present answers. Specifically, we remain interested in:

1. What are the long-term effects of living-learning program participation on student outcomes?
2. Does ongoing trend data on living-learning programs suggest continued patterns of success?
3. What specific facets of living-learning programs are most facilitative of positive student outcomes?

We also have several new questions related to the experience of women in STEM fields, including:

1. Do living-learning programs significantly improve rates of retention in college, persistence in STEM majors, and desired learning outcomes for women in STEM majors?
2. What specific living-learning environments are most strongly related to the above outcomes for women in STEM majors?
3. What is the long-term impact of living-learning participation on the persistence and learning outcomes of women in STEM majors?

To answer these questions, we will soon begin the 2005-2008 National Study of Living Learning Programs, funded by National Science Foundation Award # 0521762. The 2005 NSLLP will include a follow-up of our 2004 respondents, allow for the collection of new baseline data for institutions or programs that did not previously participate, and will include site visits to campuses that help women in the STEM fields achieve distinctive results. This next generation of the NSLLP will include several new constructs, including:

1. A focus on important college environments, such as: a) interactions with faculty and peers, b) help seeking behaviors, c) perception of supportive climates, and d) faculty, staff, and industry mentors and role models, and
2. Measurement of STEM- and student-focused outcomes, such as: a) retention in STEM, b) STEM self-confidence and self-efficacy, c) intermediate and long-term vocational plans, and d) students' transition to college and sense of belonging.

Through these efforts, we hope to answer the questions identified above and add to a growing base of knowledge about how colleges and universities can best serve women in science, technology, engineering, and mathematics. For more information about the NSLLP, please visit

www.livelearnstudy.net, or contact Karen Inkelas, whose contact information appears in the front matter of this white paper.

References

- Gandhi, C. M. O. (1999). A longitudinal evaluation of factors associated with retaining women in science and engineering. *Dissertation Abstracts International*, 60 (11), 5833B. (UMI No. 9950087)
- Hathaway, R.S., Sharp, S., & Davis, C. (2001). Programmatic efforts affect retention of women in science and engineering. *Journal of Women and Minorities in Science and Engineering*, 7(2), 107-124.
- Inkelas, K.K., & Associates (2004). *National Study of Living-Learning Programs: 2004 report of findings*. Retrieved February 27, 2005:
http://www.livelearnstudy.net/images/NSLLP_2004_Final_Report.pdf
- Inkelas, K.K., & Weisman, J.L. (2003). Different by design: An examination of outcomes associated with three types of living-learning programs. *Journal of College Student Development*, 44, 335-368.
- Pike, G. (1999). The effects of residential learning communities and traditional residential living arrangements on educational gains during the first year of college. *Journal of College Student Development*, 40, 269-284.
- Shapiro, N. S., & Levine, J. H. (1999). *Creating learning communities: A practical guide to winning support, organizing for change, and implementing programs*. San Francisco: Jossey-Bass.
- Stassen, M.L.A. (2003). Student outcomes: The impact of varying living-learning community models. *Research in Higher Education*, 44, 581-613.

Appendix A

Comments and Questions from Session Participants

Following our initial presentation of results, discussants were asked to share with the presenters what they wished would be assessed about living-learning programs and their contributions to facilitating the success of women in STEM. After removing duplicates, their verbatim responses included:

- Is the learning part necessary or is the living enough? (That is, do you need to have academic content alongside co-curricular components?)
- Are there issues of bias around self-selection in to programs?
- Is there a ceiling effect?
- Be sure to track retention in major and time to graduation.
- Are there differences between selective and non-selective programs?
- Are there differences in programs that have student-driven versus administrator-driven programmatic efforts?
- How many will be pursuing graduate degrees?
- Is there a difference between programs that are “first-year only” versus multi-year?
- What is the impact of amenities or the living space itself on outcomes?
- How are programs funded?
- Are there differences in “mandatory” programs (like those linked to scholarships or admission) and “volunteer” programs?