

LIVING-LEARNING PROGRAMS FOR WOMEN IN SCIENCE AND ENGINEERING: WHAT WORKS AND WHAT DOESN'T

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Residential living-learning programs for undergraduate women in science, engineering and mathematics have become an increasingly popular retention approach. The University of Michigan Women in Science and Engineering Residence Program (WISE-RP), which started in the fall of 1993, currently has 120 first year and sophomore women living contiguously in a mid-size coed residence hall. The WISE-RP is a supportive and intellectually stimulating out-of-classroom environment and peer group for women in science, engineering and mathematics. WISE-RP encourages and supports women undergraduates in these non-traditional fields during a period of traditionally high attrition, while creating a climate conducive to academic progress and success. WISE-RP is a supportive community of women which provides inspiration and guidance, builds confidence and pride, and results in each individual attaining academic and personal success.

The overall goal of the WISE-RP is to increase the retention of women, including women of color, majoring and considering careers in science, engineering and mathematics by creating a living-learning environment with a supportive, serious academic climate within the residence hall which will complement and add to the in-class experience.

The immediate objectives of the program are:

- To decrease the isolation of female undergraduates in science, engineering, or mathematics while at the same time maintaining or increasing self-confidence and self-esteem levels.
- To create an integrated model of academic life with residence life by establishing special sections of introductory science and mathematics courses, with special attention to gender and pedagogy issues.
- To develop programmatic support efforts for WISE-RP students.
- To provide resources and linkages to enhance the undergraduate experience.
- To continually evaluate whether or not this sort of intervention effort significantly increases the retention of female students in non-traditional areas.

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Living-learning programs, however, are quite time intensive and expensive to conduct. Do they really make a difference in the retention rates of women in science and engineering? Do they have any significant impact on self-esteem and self-confidence levels? An extensive formative and summative evaluation, using a combination of both quantitative and qualitative techniques of the Michigan WISE-RP has been continuously conducted since the beginning of the program. Some preliminary results of these studies will be presented here.

RESEARCH STUDIES - DESCRIPTION & FINDINGS

Since its implementation in 1993, the WISE-RP has been both formatively and summatively evaluated using both quantitative and qualitative approaches. Of particular interest is whether or not women who are initially interested in science or engineering and are participating in the program are retained in the SEM education pipeline by the junior or senior years or are lost to other disciplines as compared to women who don't participate or to male students. A variety of approaches have been used and are described as follows:

End of Year Survey

In the spring of 1998 and 1999, an "End of Year" survey was sent to all first year WISE participants, as well as a control group of women. All control subjects were matched on incoming majors, high school grades, standardized test scores and race/ethnicity. In 1999, a similarly matched male control group was added. The survey asked, among other things, about student experiences; students' college-related thoughts and feelings; student perceptions about ability, confidence, and faculty/staff interactions; and student use of university support and academic services. T-tests and ANOVAs were used to compare WISE participants and the control group, followed by factor analysis and stepwise regression.

The analysis focused on the possible influences of WISE-RP participation on (1) knowledge of chosen field, (2) likelihood of changing major, and (3) dropping out of college. The latter are derived from one the of the major goals of WISE-RP, to increase the retention and academic achievement of women in SEM fields. The former, knowledge of academic field, arose from the analysis on women's attitudes toward staying in science and engineering at the University of Michigan. Preliminary findings on the 1998 End of Year survey indicate the following:

- Women in the WISE-RP are significantly more likely to indicate that they have made progress in working with faculty on research than other students, though engineering students are less likely to indicate an increase in their research skills.
- Women in WISE-RP are more likely to feel as though they have gained the ability to present their work and research to others.
- Women in the WISE-RP are less likely to change their academic major if experiencing difficulty.
- Women in the WISE-RP are less likely to indicate that people do well because they are smart.

Using factor analysis and stepwise regression, the following findings have emerged:

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- WISE-RP women are significantly more likely to make progress in “developing academically” than control group women. “Develop academically” is a factor that includes: working with a faculty member on a research project; understanding fundamental ideas about research in your field of interest; becoming familiar with new ideas and developments in your field of interest; and having the ability to present your work and research to others.
- Using stepwise regression analysis, we determined that even when we controlled for academic ability, student levels of confidence, student estimation of their innate academic and personal abilities, being in WISE-RP is a significant predictor of “developing academically”.
- Using stepwise regression analysis controlling for academic ability, student academic identity and faculty environment, WISE-RP women were significantly less likely to indicate that they may drop out of the university.
- Using stepwise regression analysis controlling for academic ability, student level of confidence, innate academic ability, WISE-RP women were significantly less likely to indicate they will change their major if they are having difficulty.

The data suggest that WISE-RP somehow affects student attitudes and perceptions of skill development. Given that we controlled for incoming ability, motivation to learn, self-confidence, and importance placed on academic performance, this suggests that the WISE-RP might contribute to the academic development and decreased likelihood to change major.

Retention Study

One of the primary concerns of the WISE-RP is our success in keeping women in the science and engineering pipeline. Starting with the original 1993-94 class, we have been tracking the rate of attrition from the University and from science and engineering majors for WISE-RP cohorts. In addition, starting with the 1994-95, the data for the WISE-RP students has been compared with matched control groups of women and men, as described above in the End of Year survey.

Our findings indicate the following:

- Of students in WISE-RP during the 1994-95 academic year, 85.5% remain in science or engineering, that is they have either earned a degree in a science or engineering field or are currently enrolled in a science or engineering degree program. This compares to 73.2% of women in our control group and 79.2% of men in our control group.
- Of students in WISE-RP during the 1995-96 academic year, 75.0% remain in science or engineering. This compares to 64.9% of women in our control group and 77.3% of men in our control group.

We have also calculated separate retention data for our students within the College of Engineering:

- Of engineering students in WISE-RP during the 1994-95 academic year, 91.7% remain in engineering. This compares to 79.1% of women in our control group and 56.8% of men in our control group.
- Of engineering students in WISE-RP during the 1995-96 academic year, 81.6% remain in engineering. This compares to 69.1% of the women in our control group and 79.2% of men in our control group.

Focus Group Data

Since the inception of the program, there has been a number of focus groups conducted with WISE participants as well as women and men controls. A number of interesting comments that capture the experience of living, or not living, in a residence hall based learning community. These include the following:

WISE-RP Participants

"I feel that this atmosphere has greatly helped me adjust to the University and has helped me academically. It's nice having people around you who study about the same amount and take similar classes. ...you know you're not the only one who studies in the wee hours; that others have the same interests, and that they're feeling the same way you are."

"...quite a few people were enrolled in schedules very similar to mine, so we were able to work together on the homework assignments and studying for tests."

"It is like a little community, so people helped each other with things they didn't understand."

"Since we're all science and engineering, I don't think we party as much (substance-free hall), so the dorm's pretty quiet. It's also socially acceptable to stay in on a Friday night and study."

"My friends motivate me to study harder because they set good examples. I see how hard my hallmates study every day. Also it's very convenient to be able to go next door or down the hall and talk to someone who has all my classes."

Control Students

"The problem is that no one else on my hall is an engineer, so they always get mad at me for studying and not doing things with them. They think I over-exaggerate the amount of work I have."

"If study groups were formed for each class (with students in the same hall), I'd be more motivated to do my work."

"I feel part of my hall's uncertainty and apathy about their academic future has hindered my ability to share my academic goals with them."

"Being in a dorm with primarily LS&A students, I find there is not comprehension of the amount of work an engineering student has."

“I am not used to this many distractions. So many people around to not study with.”

WISE Alumnae Survey

The WISE Alumnae Survey will be mailed this summer. The foci of the instrument include:

- students' experience with their undergraduate programs
- academic self concept
- self esteem
- post-graduate educational experiences
- post-graduate employment experiences

DISCUSSION

It is clear from these findings that WISE-RP has a strong influence on student beliefs. WISE-RP participants are more likely to indicate development in relation to skills and knowledge in their field of interest, are less likely to indicate they may change their major if facing difficulty, and are less likely to indicate that they might drop out of college. In addition, WISE-RP participants are more likely to be retained in science and engineering disciplines than are non-WISE-RP women.

We can only speculate as to the contributions of the WISE-RP to student attitudes and perceptions of skills development. It is likely that the informal workshops and seminars provided to WISE-RP participants may factor into academic development. The supportive residential living environment may help explain the finding that WISE-RP students are less likely to change their major if facing difficulty. It is possible that instead of changing their major, WISE-RP women can turn to their peers for support, encouragement, and academic assistance to which non-WISE-RP participants do not have ready access..

We are currently engaged in several retention and academic achievement studies to determine whether WISE-RP does, indeed, contribute to retention in the sciences. What is needed is to investigate whether students' beliefs of staying in the science and at the university translate into retention in the science and persistence at the university. Further more, it is our intent to identify the component of WISE-RP that may contribute to increases in students' knowledge of field, beliefs related to staying in their chose field, and beliefs related to persisting at the university. However, what we have found suggests that WISE-RP contributes positively to students perceptions of increases in knowledge and beliefs about staying in the sciences. The program was designed, in part, to do both, and it appears that it has been successful.

INFORMATION SHARING

A complete manual entitled *Women in Science and Engineering Residence Program: Overview and Guidelines for Creating Your Own Program* has been published and is available from the WISE-RP office. In addition, all survey instruments developed for these evaluation studies are available. Please contact:

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