

The Women in Science and Engineering Residence Program: A Model Living-Learning Program at the University of Michigan.

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INTRODUCTION AND GOALS

The underrepresentation of women in the sciences and engineering is a serious national problem. Nationally, the percentage of students majoring in fields of science, mathematics, and engineering declines from 28.7 to 17.4 between the freshman and senior years.¹ Women receive only 30% of the science and engineering bachelor's degrees, although they earn more than 50% of the total baccalaureate degrees awarded.² Studies indicate that a student-centered pedagogy and peer groups with high intellectual self-esteem are two important factors related to the retention of students in science and engineering.^{1,3}

In order to address the problem on the institutional level, the Women in Science and Engineering Program (WISE) and University Housing at the University of Michigan developed the Women in Science and Engineering Residence Program (the WISE-RP). WISE-RP is a living-learning program for undergraduate women who are interested in academic majors and careers in the sciences, mathematics, and engineering.

The major goal of the WISE-RP is the retention of women in the sciences and engineering. A supportive peer groups plays an integral role in the retention of students in the sciences. The WISE-RP aims at creating a supportive academic environment for women outside of the classroom by housing students with similar academic interests together in the same residence hall. Participants can share their academic experiences and career goals on a daily basis, thus reducing the sense of isolation many women feel in male-dominated science and engineering classes. The peer groups have a common understanding of the academic and time demands involved and the barriers women may face as they pursue majors and careers in the sciences and engineering.

All WISE-RP participants live contiguously on a floor of Couzens Residence Hall, a moderately sized (600 residents) coed facility. The pilot program in 1993-94 consisted of 57 first-year students. In 1994-95 the program expanded to include 86 students, 21 of whom were returning sophomores. In 1995-96, the program expanded once again to a total of 110 participants, 8 of whom were returning sophomores and juniors. These groups represented a roughly equal distribution of science/mathematics (College of Literature, Science and the Arts) and engineering (College of Engineering) majors.

The goals of the WISE-Residence Program are the following:

- To increase the retention of women at the undergraduate level in mathematics, science and engineering.
- To provide opportunities for women to meet others with similar academic interests.
- To create a smaller, supportive living/learning environment for university students in engineering and the sciences.
- To provide resources and linkages to enhance the undergraduate experience.

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PROGRAMMATIC COMPONENTS

The following paragraphs provide more detailed information about the various WISE-RP components:

Contiguous Living Arrangement: In order to create a small, close-knit living environment, WISE participants are housed together on a floor of Couzens Hall. A residential community of students with similar academic interests together facilitates the formation of supportive peer groups, both academic and social. WISE students experience an intellectually stimulating environment outside the classroom because their roommates and hallmates share many of the same classes, academic interests, and career goals.

Formal and Informal Study Groups: The WISE-RP offers formal study groups for mathematics and chemistry. In addition, WISE-RP encourages students to form informal study groups on their own by providing them with a list of other WISE students enrolled in the same classes, in areas such as foreign languages, history, etc.

Academic and Career Workshops: In order to provide role models for its participants, the WISE-RP invites women faculty, professionals, and graduate students in the sciences and engineering to share their experiences. Panels such as "A Day in the Life of a Physicist, a Biologist, and a Physician" help students learn more about career possibilities in the science and engineering. "Combining Career and Family" addresses students' concerns about managing both a successful career and a meaningful personal life.

Academic Advising: A special academic advisor with a background in science works with WISE students in the residence hall.

Course Sections: Special sections of science and mathematics courses are designated for WISE-RP students, allowing participants to take classes with other women in the program. The purpose is to reduce the sense of isolation many women feel when they are one of only a few women in a science or engineering class. Also, taking classes with their hallmates facilitates collaborative learning and the formation of informal study groups among WISE-RP students.



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Research Opportunities: WISE-RP has created linkages with the Undergraduate Research Opportunity Program which provides first and second-year students with the chance to participate in research activities with faculty in their areas of academic interest.

Mentoring Program: The WISE-RP Mentor Program pairs first-year students with second-year participants. As science and engineering majors, mentors understand the demands of pursuing a career in these field. Mentors help new students adjust to university life by providing valuable information about the resources at the University as well as the surrounding community.

Laboratory Tours: Special tours of campus laboratories and facilities in science and engineering are arranged for students. Tours of the Human Genome Laboratory and the Atmospheric, Oceanic, and Space Science Laboratory, for example, give students a taste of the exciting research projects and quality facilities at the University.

Social Activities: In addition to academic and career-related programming, WISE-RP sponsors a variety of social events each year in order to foster a sense of support and community among its members. Social activities have included study breaks, games nights, a Halloween party, pizza parties, and shopping trips. An outdoor challenge ropes course in the fall and a winter retreat focus on team-building and the development of leadership and communication skills.

Residence-Life Staff: Three resident assistants live on the WISE-RP hall. As science and engineering majors, the RAs can assist new students with the transition to university life and understand the demands of pursuing a career in the sciences or engineering.

EVALUATION DESIGN

The WISE-Residence Program is currently being evaluated using a variety of quantitative and qualitative measures. There are currently three cohorts: the 1993-94 WISE participants and control group; the 1994-95 WISE participants and control groups, and the 1995-96 WISE participants and control group. Each cohort is being tracked longitudinally throughout their undergraduate years at Michigan.

A survey is filled out at the beginning of the academic year by WISE participants and by a control group of other first-year students, both male and female, interested in mathematics, science or engineering, living in other U-M residence halls. Similar surveys are filled out by former participants and the corresponding control groups at the beginning of their sophomore, junior and senior years.

A survey is also administered only to WISE-RP women at the end of each year, asking participants to evaluate the various individual components of the program.

Focus groups are conducted with the various cohorts and their corresponding control groups in order to gather qualitative data on students' experiences.



Academic Measures: The various academic parameters measured in the students evaluation include the following:

- Retention rate.
- Grade point average
 - overall and in subject areas
- Course load
 - cumulative credit hours
 - lower and upper division credits
- Course selection patterns
 - related to academic interest
(i.e., science, engineering, pre-med, nursing)
- Choice of career and further schooling

Psycho-Social Measure: The various psycho-social parameters measured in the student evaluation include the following:

- Perceptions of campus climate
 - perceptions of barriers
- Academic cognition/self-concept
 - Confidence in skills and abilities, both intellectual and scientific
 - Values and expectancies about grades
 - Future schooling
- Academic stressors and coping strategies
 - Anticipated and experienced difficulties at college
 - Help-seeking behaviors
 - Academic support network
- Social networks
 - Peer group influences
 - Teacher and family influences
- Personal well-being
 - Self-esteem
 - Depression and other psychosomatic complaints

PRELIMINARY RESEARCH FINDINGS

The data from the first three cohort studies is currently being analyzed. However, preliminary research findings from the fall 1993 survey results include the following:

- 1) WISE-RP and control women are more likely than men to say they prefer to work with a study group and to talk with members of that group if they experience academic difficulty.
- 2) Women are more confident than men that they will pursue a successful career in their chosen field.
- 3) Men and WISE-RP women are more confident in their math ability than control women.
- 4) Control women and WISE-RP women are more likely to say that discrimination is a problem that could discourage them from pursuing science and engineering interests.
- 5) Having friends in their field of choice, supportive study groups, tutoring, smaller classes, and avoiding anonymity in a large student body are benefits of a residential science program that are more important for WISE-RP women than for control women and men.
- 6) Men express more confidence in their intellectual ability and are more likely than WISE women and control women to expect to do very well at the University of Michigan.
- 7) Control women appear to be more concerned about the aggressive atmosphere in science and engineering classes than are WISE-RP women.

Over the 1993-94 academic year, this first-year cohort had the following changes:

- 1) WISE-RP women, compared to control women, were more likely to deal with a difficult class by changing how they prepared for tests, discussing their difficulties with tutors or study groups, making sure they attended class more regularly, and seeking a professor's help.
- 2) WISE-RP women gained more confidence in their ability to do science.
- 3) From fall to spring, WISE-RP women saw an increase in how much their friends encouraged them to study science and engineering.
- 4) WISE-RP women became more aware of two possible barriers to their attendance in graduate school: the aggressive nature of engineers and scientists, and the discrimination against women.

QUALITATIVE DATA

The focus groups, as well as open-ended questions on the surveys, offered interesting insights into the day-to-day experiences of University of Michigan students, from both the WISE-RP and the control groups.



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."

"There's always someone who has been through the class you're taking. It keeps my spirits up to see other women in science and engineering having the same problems and being able to talk. We're always studying so the distractions are minimal."

"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

"My hall is quiet, therefore I can get a lot of work done. 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."

CONCLUSION

The WISE-Residence Program has been an exciting and rewarding intervention effort, both for participants and program directors. It is still too early, however, to determine the overall effectiveness of this effort, both in terms of retention and psycho-social measures. The additional issues of cost-effectiveness must also be considered. Nonetheless, qualitative measures indicate that this particular program is popular and meaningful to the students. The increasing numbers of participants applying for the freshman year and reapplying for the sophomore year is also impressive.

¹ Astin, A.W., and Astin, H.S. (1991). Undergraduate science education: The impact of different college environments on the educational pipeline in the sciences. Los Angeles: Higher Education Research Institute, Graduate School of Education, University of California.

² Alper, J. (1993). *The pipeline is leaking women all the way along*. Science 260: 409-411.

³ Manis, J.D., Thomas, N.G., Sloat, B.F., and Davis, C.S. (1989). Factors affecting choices of majors in science, mathematics and engineering at the University of Michigan. Report #23, Center for the Education of Women, University of Michigan.