Work in Progress – A Practical Model for Achieving Gender Parity in Undergraduate Computing: Change the System, Not the Student

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***Abstract* - This paper presents a systemic change model of undergraduate computing for accomplishing gender parity. Rather than view women as needing to be modified or repaired to fit the system, this model advocates changing the system to fit the needs of a wider range of students. Changing the system is a more sustainable approach to creating gender parity than providing extra support to students with less experience or background or students who are less likely to feel that people like themselves belong in computing. The systemic change model is founded in research specific to computing education, research on undergraduate retention in general, research on conceptions and misconceptions of computing careers, and research, theory, and practices of communication. The parts of the model and examples of practices that can change the system in ways consistent with research are presented.**

Index Terms – Gender, Retention and Recruitment, Systemic Change, Women

INTRODUCTION

Many undergraduate computing departments seek to increase women's representation among enrolled and graduating students. These departments seek gender parity to access strong students from a large applicant pool; contribute to the profession's future viability and the improved innovation brought by diverse teams [1]; improve the educational experience for all their students; and to fulfill their ethical commitment to diversity.

Departments hoping to increase overall enrollments and proportion of women must act deliberately and strategically. Based on research specific to computing education, research on undergraduate retention in general, research on conceptions and misconceptions of computing careers, and research and practices of communication, the authors developed a model for increasing participation of women in computing.

WHY SYSTEMIC CHANGE?

Systemic change in higher education is advocated because it moves beyond the focus on an individual and problems addressed one at a time and takes instead a systemic view. The parts of the whole and their interrelationships are taken into consideration. These "parts," in the context of higher education, include various stakeholder groups (e.g., students, administrators), policies (e.g., basis of promotion for faculty), typical practices (e.g., teaching, extracurricular activities), curriculum, and other elements experienced directly and indirectly by students [2].

Research supports systemic reform as effective for accomplishing certain student outcome goals. In the 1980s and 1990s, systemic change was implemented in postsecondary institutions across the U.S., focusing on increased student involvement, increased student-faculty interaction, and increased community service [3].

SYSTEMIC CHANGE AT THE DEPARTMENT LEVEL

Our model of systemic reform in undergraduate computing, developed as part of our work as Senior Research Scientists for the National Center for Women & IT (NCWIT), includes a focus on the events and practices women experience directly and those that indirectly affect their outcomes. Some experiences of women in computing are distinct from those of their male peers. For example, women have less tolerance than men for low grades that appear to confirm stereotypes about their lack of aptitude for computing [4] [5], have lower access to peer networks, and are more likely to experience both explicit and implicit sexism.

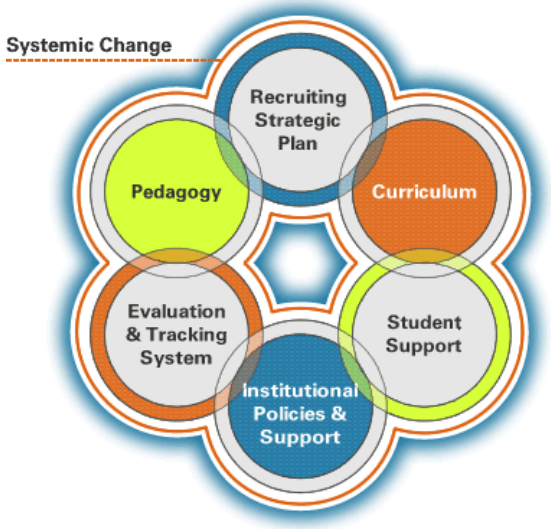
The components of the model shown in Figure 1 derive from research on women in undergraduate computing, research on change in higher education, and research and theories of communication and marketing. The components include recruitment, pedagogy, curriculum, institutional policies, evaluation, and student support. Each of these components can affect the others in one way or another and should therefore be assessed when trying to increase women's representation. For example:

- Recruitment efforts may be a poor investment of scarce resources without simultaneously considering retention.
- Policies that penalize faculty for outreach and diversity efforts must be changed (e.g., counted toward service), or these efforts are likely to be short-lived.
- Making assignments interesting and personally meaningful is necessary, but not sufficient for cementing women's intention to complete the major. If women have no natural opportunities to develop peer

networks or feel a sense of belonging, they are unlikely to stay.

- Evaluation provides the evidence of success that helps with obtaining internal and external support. It also identifies what works, what doesn't, and what is causing greater harm.
- Recruiting conducted by undergraduates (e.g., in "road shows") can also serve to retain the students who do it.

FIGURE 1
SYSTEMIC CHANGE IN UNDERGRADUATE COMPUTING



When the system is changed, new routine behavior, based in habit and policy, become just "how things are done around here" rather than the hit or miss efforts of an individual faculty member. A systemic approach to reform is mainstreamed, affecting all students, not just those who choose to join a support group, for example. Thus, a systemic view is crucial for successful, sustained organizational change.

PROJECT STATUS

This project is in its second year of working with consultants (14) and undergraduate computing departments at 34 institutions (clients) to accomplish gender parity and increased enrollment of a more diverse body of students. While using our research-based approach to sustain change in undergraduate computing, our trained consultants provide free customized services to "client" departments that seek to recruit and retain more women students. One goal of this project is to show our clients' progress in each step of the systemic reform change process:

- Charging a diversity or other committee with responsibility for leading the change process.
- Developing a strategic plan that addresses all the components in our systemic model.
- Implementing and assessing the interventions included in the strategic plan.
- Reporting and disseminating results.

CONCLUSION

What counts as gender parity in undergraduate computing? Parity in an undergraduate computing department could be measured by:

- The percentage of women in the department equals the percentage of women at the institution as a whole.
- Men and women are retained in the major at similar rates.
- Time to degree is similar for men and women.
- Men's and women's occupational choices upon graduation are similar.
- Men's and women's participation in honors programs, research experiences, internships, student groups (e.g., ACM student chapter), and other extra-curricular programs is similar both in rate and roles taken on.
- Men's and women's experiences as teaching assistants, lab monitors, and other positions in the department are similar.

In order to reach gender parity, a systemic approach to recruiting and retaining women is needed.

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