

**Wellness Strategies for Women Engineers: An Interdisciplinary Course Designed to Help Women Engineers Succeed**

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Introduction

A primary issue for undergraduate women in engineering is their status as a minority in their chosen field of study. Despite concentrated efforts women, at latest count, comprise approximately only 20% of undergraduate engineering school enrollment nationwide and approximately 8.5 % of the United State's engineers<sup>5, 8, 13, 21</sup>. This imbalance creates an environment where two factors are primary and too often defining: A gender-based isolation that is compounded by the challenge of operating in an environment designed by and for males. These factors can negatively impact a student's ability to persist and perform well. More important, these factors are frequently not identified by women as explicit factors in their success. Rather than acknowledging the challenges inherent in their study and work environments and devising successful strategies to meet these challenges, female students tend to blame their own lack of talent or aptitude or decide that the discipline, rather than the environment, is not for them. Typical consequences of these behaviors can be a lack of persistence in the major and/or the development of counterproductive coping strategies. This internalization of failure can create a highly stressful situation, particularly when coupled with a demanding curriculum<sup>8, 16, 17</sup>.

To address this issue we created an upper level course, Wellness Strategies for Engineering Women, that combines a required general education course requirement in health and physical activities with career development activities and an exposure to gender literature. The primary course design was developed by author Mary Ellen Litzinger (an instructor in Penn State's Department of Kinesiology) in collaboration with the Penn State Women in Engineering Program. Two facets of this course, the career development and gender literature components, were developed by author Barbara Bogue, director of the Women in Engineering Program.

Several factors fed into the development of the course. Undergraduate engineering students are generally unaware of gender issues and gender-related research is rarely if ever integrated into how engineering and engineering related course offerings are developed and implemented<sup>1, 11, 14</sup>. As noted by Indira Nair and Sara Majetich, "In designing classroom instruction, we need to recognize and correct the factors that lead large numbers of students, especially women and minorities, to turn away from the subject.(pg. 25)."<sup>16</sup> Another factor that influenced the development of the course was anecdotal evidence gathered through the Women in Engineering Program that female students consistently fail to connect wellness issues with their ability to perform well. Finally, kinesiology research points to the fact that exercise and physical activity

*Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition  
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can lead to improved self esteem, thus providing a sound platform for addressing the engineering-related factors. (Kinesiology is the study of movement). We hypothesized that (1) A better awareness of career opportunities and planning tools would encourage female students to develop more effective success and stress management strategies; that (2) women who developed a clearer understanding of their goals and the attendant rewards would be able to more effectively cope with the challenges inherent in their situation; and (3) that women who understood and integrated wellness strategies into their student lives and subsequent careers would be more successful as measured by persistence and increased self esteem. Finally, we believed that an all woman class for engineers focused on a non-technical topic would offer women the opportunity to build community and develop a more realistic concept of their own experience and performance in the curriculum.

This paper describes the pilot offering of this class and outlines the preliminary results of our assessment program. Specifically we hope to address the following research questions over time:

1. Do engineering undergraduate women who participate in this course evidence a greater awareness of their work and study climate?
2. Do these women develop improved success strategies, including more focused career goals?
3. Do they demonstrate an improved awareness of overall health issues and their impact on performance both inside and outside their classrooms?
4. Are they retained at a higher rate?

#### Summary of Literature on Relationship of Exercise Participation and Self-Esteem

One of the most consistent beliefs about the influence of exercise and physical activity on psychological outcomes is that regular activity can have an influence on self-esteem.<sup>19, 6</sup> It is this belief, in part, that guided the design of this course, especially given the potential for the “non-typical” female engineering student to experience instances inside and outside the classroom and laboratory where her self-esteem could suffer.

Self-esteem is the value or worth that an individual places on the descriptors that are used to describe one’s self<sup>18</sup>. These descriptors are accumulated through multiple experiences such as daily living activities, classroom and laboratory experiences, and extra curricular experiences (e.g., summer camp, church or youth group activity). One common component shared by many perceptions of self-esteem is the influence of social interaction<sup>4, 7, 10, 11</sup>. Cooley emphasizes the important role that social interaction and the evaluation of others play in the development of self-esteem. Cooley coined the term “looking-glass self” to describe the process by which individuals develop their self-image in terms of how others perceive them. It seemed to us that the role of “looking-glass self” might figure prominently in how a female engineering student might view herself. In fact, several of our students commented on how challenging it is to maintain a positive self-esteem when one is “outnumbered” by men in the classroom. One student enrolled in the class explained her feelings in this way:

“I just felt out of place. I felt, ‘I knew this wasn’t for me. I can’t do this’ instantly. Then, we had a lab and we got randomly paired up with partners. My partner is literally a cowboy who barely said a word to me, luckily there was an odd number, so I grabbed the

extra boy for my group to help avoid the evil stares of the cowboy. If I asked a question the cowboy simply rolled his eyes. It took me three weeks of lab to prove to him that I'm capable of being in the lab and fully understand what is going on and intend to be an engineer and complete two minors."

Research recently completed at Penn State<sup>22</sup>, involving both male and female undergraduates chosen from several majors, reinforces the strength of the relationship between exercise participation and self-esteem. In a study which analyzed the responses of 427 subjects (61% of whom were female) to a battery of normative instruments, it was determined that physical self-worth accounted for 30% of the variance in self-esteem for the female sample of respondents. When combined with social self-concept, physical self-worth accounted for 42% of the variance in self-esteem regardless of gender. Interestingly, male respondents reported that they exercised at higher intensity and for longer periods than females, perhaps reflecting a differential socialization of males and females regarding involvement in sport and physical activity participation. These results reinforced our desire to counter the notion that exists among young women in some class and cultural groups that developing one's muscles or working up a sweat are unfeminine pursuits.<sup>10, 15</sup>

Student self efficacy, as distinct from self esteem, is an important measure for engineering students. Self efficacy, a distinct psychological construct grounded in social cognitive theory is defined by Albert Bandura as referring<sup>3</sup>, "to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p.3). Again, this speaks to student belief in the ability to complete a difficult curriculum as a factor in persistence<sup>17</sup>. Complementary to that is understanding that they are not alone in perceiving it as difficult and that support from peers also makes an impact on persistence.

### Course Description

"Wellness Strategies for Women Engineers" is an interdisciplinary course that offers female engineering students an introduction to wellness by combining traditional and non-traditional physical activities with current research in gender communication and career development. This three-credit course (which satisfies the health and physical activities general education requirement at Penn State and is included in the calculation of a student's overall GPA) provides the information that students need to plan and integrate a wellness-based lifestyle into a demanding curriculum and into the development of their career plans. Integrated throughout the course is a recognition that engineering as a course of study presents women students with specific challenges: (1) The rigor of the curriculum, which impacts all students; and (2) Their position as a "minority" and "non-typical" student in a curriculum and profession that has developed historically as male and which continues to be male dominated. (Approximately 20 percent of the undergraduate engineering population are women, at Penn State and nationally.)

The centerpiece of the course is a series of lectures, small group discussions, and physical activity sessions that address common concerns such as stress management, time management, weight management, and physical fitness coupled with sessions about gender communications, gender literature and career development. These topics are enhanced by discussions about specific health issues such as alcohol and tobacco use, sexually transmitted diseases, fertility

control, pregnancy; and parenthood. This content reflects a belief that the challenges of studying and practicing a demanding profession can be most effectively addressed by: (1) Developing an awareness of the pressures affecting professional performance and general wellness; (2) Devising effective strategies to address these pressures; (3) Creating a perspective that allows students to put challenges and set backs in context; and (4) Developing an ability to set and pursue goals. The underlying outcomes of the course, which continue beyond the course itself, are the (1) The development of a body that is healthy and well nourished; (2) A mind that is open to new ideas and concepts; (3) Emotions that help one to perceive the world realistically and cope with the problems of everyday life; and (4) A development of a personal spiritual outlook that fosters a balance between one's inner needs and the demands of the rest of the world.

This content is supported by a series of reflective journaling assignments that encourage students to examine unique aspects of their lifestyle and develop solutions to manage them more effectively. These essays ask students to: (1) Identify the rewards and challenges of being a female engineering student and determine how they help or hinder the development of a healthy life; (2) Describe persistent emotional stressors and develop new strategies for managing them; and (3) Identify risky physical behaviors and develop a plan for changing these behaviors.

Students are also required to collect data sets to help them to analyze their responses to specific situations. The Time Management Log project asks students to record how they spend their time each day for 7 days. Based on these data, students evaluate how effectively their daily activities support their long term personal and professional goals. Using this information as a guide, they develop a new time management plan to address the discrepancies that they uncover. The Food Log project asks students to record the food they consume for one weekday and one weekend day. Students then compare this data with nationally recognized eating plans such as the USDA Food Pyramid and the Mayo Clinic Healthy Weight Pyramid and develop a new eating plan to address the discrepancies they find.

A third kind of assignment asks students to use pictures, drawings, or single words or phrases to respond to a series of questions about their "inner life" (e.g., "What inspires or calls you?"; "What lessons did you learn from your achievements?"; "What people give you a sense of community?"). Using the information uncovered in this exercise, students then determine how well they are balancing the demands of their every day life with their long-term needs, values, and desires.

Finally, each student is given the opportunity to design a 10 week extended program that addresses a unique physical or behavioral need. This need is identified by completing the Wellness Inventory, a 120-question instrument that identifies wellness needs in areas such as self-responsibility, eating, moving, and communicating. Each student keeps a diary of her progress during the semester and evaluates the success of her plan at the conclusion of the course.

The introduction of career development information and gender literature helps students connect the dots between wellness and success in their studies and future careers. Integrating career goals and wellness goals into their future personal and career planning also addresses one of the factors identified as characteristic of "switchers", or those students who switched out of engineering, by

Seymour and Hewitt: Underlying concerns about career prospects.<sup>17</sup> Accordingly, the class explored gender communications and how gender can impact how professional skills are perceived and evaluated.

## Methodology

### Subjects

Subjects were thirty undergraduate women studying engineering who enrolled in and completed the pilot offering of Wellness Strategies for Women Engineers. Students enrolled in the course through the on-line registration system. The pilot course registration was restricted to women students and cleared through the registrar as a research-based class. Subsequent classes have no restrictions. Thus far, male students haven't found the title enticing.

### Approach

This research project aims to determine the impact of the course on: (1) Student retention in the engineering major; (2) Individual ability to develop strategies to cope with the stresses inherent in the discipline and in their status as an underrepresented group; and (3) Individual ability to make effective choices. Information derived from the research will be used to improve the course offering and develop additional strategies to increase the retention and development of women engineering students.

Student progress was assessed in three ways:

- 1) Scores on the Wellness Inventory (3<sup>rd</sup> edition), a 120 question questionnaire published by Wellness Associates. The results of this self-scored instrument provide a clear picture of the balance that the respondent has given to the dimensions of wellness in her life. This Inventory was during the second week of the course.
- 2) The completion of a "Wellness Empowerment Project." This project consists of 4 parts:
  - The creation of a behavioral goal whose achievement will enhance the student's well-being.
  - The development of a program of specific strategies and actions that will help the student change her wellness behaviors to meet these goals.
  - A mid-semester assessment of individual progress in working through this program.
  - A final assessment of the project's goals and program strategies and actions, and individual student progress.
- 3) Bi-weekly journal entries are reflective short essays (350 words) that respond to a question pertinent to one of the wellness areas discussed in the course

Long-term impact will be measured through tracking of individual students for retention in the major and data derived from the AWE Longitudinal Assessment of Engineering Self Efficacy survey (LAESE).<sup>2</sup>

The quantitative data collected in the Wellness Inventory and the qualitative data contained in the individual journal responses and in the Wellness Empowerment Project assessments will help us assess the validity of these hypotheses:

**Hypothesis 1:** A wellness intervention (in the form of focused information delivery, instruction in specific wellness strategies, and reflective journaling) will provide the cognitive and affective support that will encourage female students to *remain in the engineering curriculum*.

**Hypothesis 2:** A wellness intervention (in the form of focused information delivery, instruction in specific wellness strategies, and reflective journaling) will provide the cognitive and affective support that will encourage female students to *remain in the engineering profession*.

**Hypothesis 3:** A wellness intervention (in the form of focused information delivery, instruction in specific wellness strategies, and reflective journaling) will cause students to *reassess current personal and profession management strategies and develop and implement improved strategies*.

## Discussion

Since this is a pilot offering of the course, many of the data are preliminary or, in the case of longitudinal data, have yet to be collected beyond the first year. Below we offer initial results.

### Selected Descriptive Results from a summary of responses to the Wellness Inventory

Each student enrolled in Wellness Strategies for Women Engineers completed the Wellness Inventory, a 120-statement instrument that assesses the value each respondent places on 12 areas of wellness (e.g., self-responsibility and love, breathing, moving, eating, and communicating). Each wellness area is represented by 10 statements which range from the practical and concrete (e.g., “I wear a safety belt when I ride in a vehicle”) to the transcendent (e.g., “I believe there are dimensions of reality beyond verbal description or human comprehension.”) Students were asked to evaluate the relevance of each statement to their lives by checking 1 of 3 possible answers on a Likert-scale of responses (yes, usually; sometimes, maybe; no, rarely). The responses for each 10-statement area are averaged to produce a score for that area. At the conclusion of the Inventory, the scores are compared to determine where imbalances exist in one’s “wellness life.”

While the number of completed Inventories in our sample (N=24) is too small to draw meaningful and valid conclusions, we found that a few interesting patterns emerged. Only one question was unanimously answered “Yes, usually:” “I am always sober when driving or operating dangerous machinery.” Other statements that were almost unanimously answered “yes, usually” were: “I am a nonsmoker,” and “I wear a safety belt when I ride in a vehicle.” We attribute these responses to the extensive educational campaigns against alcohol and tobacco use that our students receive during their high school years and at Penn State. Statements that received the fewest “yes, usually” responses were: “I take time out for deep breathing several times a day,” “I do some form of stretching/limbering exercise for 10 to 20 minutes at least 6 times per week” and “I run at least three miles 3 times per week (or equivalent aerobic exercise)”. (Similar statements such as “I run at least one mile 3 times a week” and “I do some

form of stretching/limbering at least 3 times per week” received slightly higher scores.) Based on these responses, we included several physical activity periods in the course that featured breathing, meditation, and yoga instruction. These classes were among the most popular and well received of the course.

When we analyzed the section-wide aggregate averages of the students, we found that the highest scoring section (1.45 out of 2) was Self-Responsibility and Love while the lowest scoring sections were Breathing (.88 out of 2), Moving (.90 out of 2), and Eating (1.11 out of 2). These responses indicate a belief system that was repeated in individual essays and class discussions throughout the course: Attending to one’s physical needs is a luxury that can be ignored when the crush of lab reports, exams, and papers makes it difficult to exercise or eat well. It was heartening to read in our end of course evaluations, however, that several students now believe that “health is more important than grades” and “We are better able to focus on things other than studying (health, activities, etc).”

#### Qualitative data gathered through an end of semester focus group

Students universally indicated frustration with typical and persistent experiences in their engineering classes: low expectations of their abilities to perform on teams, lack of respect, and a feeling of “standing out” in their learning environment (with both positive and negative consequences). At the end of the course they reported that their perceptions of the challenges inherent in their learning environment and their coping strategies had changed. They reported being able to handle pressure better: “I am able to focus on things other than studying (health, activities, etc.)”, “I have better time management skills,” “Can let go of bad grades/experiences,” “I understand that everyone has problems too – you aren’t the only one stressed.” One student reported that, “The challenges are the same – the way we handle them is different. I have more of an ability to handle them and can look at the bigger picture.” “I can stop worrying about stuff because in the big picture it isn’t that big of a deal.” Another said that she now sees her engineering career as a Rubik’s cube: “I know all the pieces are there, I just have to line them up.”

Speaking to the issue of isolation, students consistently responded that they found that participating in a class *with other female engineers* “where we talk about personal stuff” allowed them to pursue other questions more openly and freely (“Before we wouldn’t have asked some questions and would have held back.”). Students also noted that their prior experience with “female only” groups was limited to gatherings composed primarily of non-engineers, a situation that carries its own stressors. They noted that in our class “it was nice that everyone understands the demands of [engineering] homework/work” and that class participants “can relate to each other by understanding what each other is going through.” In fact, one of the lessons of this pilot class seems to have been that our students learned that they can enjoy the company of women and of themselves. Participants reported that they had started “Ladies Night” with their fellow female engineers and were setting aside “Time for me.” They reported that the multicultural make up of the class had allowed them to cross color barriers and that they were forming new friendships as a result.

Finally, they reported that they now perceived personal health as an issue. (“Health is more important than grades.” “I’m tending to my family and spiritual needs; it’s not all about grades and money.” “We control how healthy we are.”)

One of the most interesting responses was that students expressed greater empowerment in their other classes: “Because you always asked us if we had specific questions about the topics in advance I really felt a part of the class;” “I now feel like I can ask questions in other classes and even suggest changes;” and “I understand now that I have choices, that I don’t just have to take it as it comes.”

## Conclusions and Future Directions

Twenty-four undergraduate women engineering students participated in the pilot offering of the course. Data gathered from the instruments described above will be combined with retention tracking and results from participation in AWE Longitudinal Assessment of Engineering Self Efficacy survey (LAESE)<sup>2</sup> to determine how effective the course is in reaching its objectives. Early data indicate that the course is successful in the short term with students indicating an increased awareness of their environment and ability to develop appropriate success strategies. The larger question becomes whether or not these attitude changes will hold over a period of time. We are using the gathered data to enhance the next offering (Spring 2004) and will continue to collect longitudinal and comparative data to test the research questions and to determine whether an intervention of this sort can have long term impact.

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