

## **Lowman's 2D Model of Effective College Teaching: Justifying the Need for Faculty Diversity**

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## **Introduction**

According to the National Science Foundation, National Center for Science and Engineering Statistics (NSF, NCSES, 2015), women represent 50.2% of the US Resident population, 12.9% of the engineering workforce, and 24.7% of the mathematics and computer science work force in 2015. The percentage of employed females, ages 16-75, in science and engineering was 47.6% and included full-time, part-time, and post doc employment (NSF, NCSES, 2015). A 2015 US News and World Report article notes that, despite a national focus supported by federal government funding to encourage women and minorities to study science, technology, engineering and math (STEM), the STEM workforce is no more diverse than it was in 2001. The discussion of the lack of women in STEM academia follows the same discussion as the lack of women in STEM. The issue is challenged and addressed by researchers across the country. For example, the NSF ADVANCE (Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers) Program has been in existence for approximately 15 years seeking solutions to these issues.

Despite these statistics and the national focus on diversity, work to improve diversity of faculty in institutions of higher learning, particularly in STEM, is questioned. Justifications for the need for faculty diversity in STEM is usually justified by because (1) it is the right thing to do, (2) females represent at least 50% or more of the college population but the percentage is not reflected in STEM, (3) including females in the process of design adds dimensions to the design, improving the solutions ability to serve society, just to name a few. However, these reasons do not resonate with all members of an academic community and other theory based and evidence based approaches need to be made to justify the need for diversity of faculty in STEM areas. As such, this paper will use Lowman's 2-D Model of Effective Teaching to justify the need for diversity and inclusion of faculty in STEM higher education classrooms. Interpersonal rapport is one dimension within Lowman's 2-D Model and is defined as the instructor's care and concern for the student as a learner and includes effective motivation of student learning. To help a student learn in the classroom, the faculty must know and understand their students. Diverse classrooms require diversity in thinking and knowledge about the world, which can be supported by a more diverse faculty population especially in STEM classrooms. Diversity in higher education can be defined to include gender and ethnicity; however, this paper will focus on gender diversity with a particular emphasis in STEM fields. The paper will conclude with tips to build interpersonal rapport with students, creating a more inclusive classroom.

## **Lowman's 2-D Model**

Joseph Lowman developed the 2-Dimensional Model of Effective Teaching after observing a group of exemplary instructors and conducting research on faculty teaching award nominations (Lowman, 1995). Over the course of three years, over 500 applications were submitted for the

Chancellor's teaching awards at University of North Carolina, of which 80% of the nominations were made by students. The gender of the students was equally split male and female. Researchers coded the adjectives and descriptive phrases written in the nomination, tallied and the thirty-nine words appearing 10 or more times were selected for analysis. From this analysis, Lowman Developed two dimensions which were published originally in 1984 (Lowman, 1984), and further refined and published in 1995. Within each dimension, Lowman describes a low, medium and high level of achievement. To be an exemplar, the instructor should be high in Intellectual Excitement and can be low, medium or high in Interpersonal Rapport.

### *Dimension I: Intellectual Excitement*

Dimension I, Intellectual Excitement (IE), consists of two components. The first component focuses on the ability of an instructor to clearly present the subject material, while the second component considers the instructors stimulating and emotional impact on the student. From this description, clarity is how the material is presented and the stimulating emotional impact is the delivery of the material. To be clear, the instructor must have command of the subject matter. Unless stated otherwise by the instructor, students generally assume the instructor has command of the subject matter due to the credentials (graduate degrees and/or equivalent years of experience) the instructor possesses. However, clarity alone is not just facts, rather the ability of an instructor to know the subject from a variety of angles and dimensions and make connections to other academic material. The IE Dimension is slightly more important of the two dimensions in achieving exemplar-level college teaching (Lowman, 1995).

### *Dimension II: Interpersonal Rapport*

Interpersonal Rapport (IR) is comprised of the dimensions that deal with the emotional connections within a college class that connects to the teacher's role, student types (Mann, 1970; McKetchie and Svincki, 2013), and the patterns within the class. To have high IR, instructors are aware of the emotional conditions within the class and possess the communication ability to increase motivation, enjoyment and independence of the learner. In fact, an instructor skillful with IR is able to decrease the negative energy in the classroom while increasing the positive energy in the classroom by responding to each student as an individual. Moreover, the instructor is able to visualize the student as capable of performing well. IR is also not only restricted to the classroom. IR can be demonstrated within and outside of the classroom and is especially important in individual student-instructor interactions (Lowman, 1995). True IR exemplars demonstrate personal concern of the student and effective motivation. Table 1 includes the descriptors that Lowman (1995) identified in his research study to describe Interpersonal Concern and Effective Motivation and these categories are noted in italics.

Many of the Interpersonal Concern descriptors can be used to describe a nurturing person or a nurturing environment. In fact Lowman (1995) himself notes that the emotions created through IR, as described by the descriptors, have the ability to increase a student's self-efficacy, which in

turn will result in an increase in student performance, motivation to learn, and ultimately a positive class atmosphere.

Table 1. Descriptors Categorized by Lowman (1995) to describe Intellectual Excitement and Interpersonal Rapport

<b>Intellectual Excitement</b>		<b>Interpersonal Rapport</b>	
		<i>Interpersonal Concern</i>	<i>Effective Motivation</i>
Knowledgeable	Stimulating	Concerned	Helpful
Inspiring	Creative	Caring	Encouraging
Humorous	Lectures Well	Available	Challenging
Interesting	Communicative	Friendly	Fair
Clear	Enthusiastic	Accessible	Demanding
Organized	Engaging	Approachable	Patient
Exciting		Interested	Motivating
Prepared		Respectful	
Energetic		Understanding	
Fun		Personable	

### **Impact of Gender in Classroom**

Generally, gender is perceived as a negative for women in the classroom as it pertains to students' perceptions of instructor effectiveness, as reflected in student evaluations. For instance, MacNeill et al. (2014) found that students rated an instructor with a male identity higher than female instructor possessing a female identity for online courses regardless of the instructor's actual gender. When female faculty are not in alignment with the expected perception of how a female should behave, such as be approachable, more fair and nurturing, student demonstrate the faculty member's deviation from the stereotypical behavior by scoring the faculty lower on faculty evaluations.

However, the purpose of this paper is not to debate the impact of gender on student evaluations, which then affects female faculty advancement in academia. Rather, the purpose of the paper is to show how the stereotype may be leveraged to improve student learning. Gender bias exists in the classroom, but the bias should be used to increase diversity in STEM faculty.

Studies describe the stereotype of women to be nurturing and caring in the classroom and are typically rated higher than men for instructor-student interaction (Basow and Martin, 2012; Basow et al., 2013). Basow and Martin also note that women often fulfill that stereotype. As such women are deemed to be fairer than male instructors and provide a comfortable environment (Basow and Martin, 2012).

Overall, keywords describing the female stereotype fit within the Interpersonal Care and Effective Motivation of the IR dimension. Nurturing means to support and encourage. Encourage and fair is a descriptor Lowman used to describe Effective Motivation. It is important

to note that male faculty members may exhibit the same IR traits as female faculty members, but the basis of the stereotype is that women generally uphold the stereotype and the stereotype is an asset in the classroom.

### Impact on IR on Student Learning

For high, medium and low IR, Lowman (1995) describes the behaviors of the instructor in exhibiting IR in the classroom as well as the impact of IR on student learning. Table 2 provides a comparison of the high to low dimension in describing the instructor’s behavior and the impact to student learning.

Table 2. The Impact of Instructor Demonstrations of IR on Student Learning

<b>IR Level</b>	<b>Instructor Demonstration of IR</b>	<b>Impact on Student Learning</b>
High	Acknowledges student feelings about class policy and polls their preference; encourages students to ask questions and values their input in discussions; open/subtle communication that student understanding of material important; instructor encourages to be creative and independent in dealing with the material	Students know the instructor cares, may identify with the instructor, are highly motivated to do their best; believe the instructor has confidence in their learning
Low	Instructor does not know names or recognize them outside of class; sarcastic and disdainful about students and their performance; class policies are announced and is defensive if questioned; teacher is inconsistent and unpredictable	Students may believe the instructor dislikes them; believe the teacher has low opinions about their success in the course; afraid to ask questions; students motivated to work by fear and ridicule; may dread studying a subject once passionate about; uncomfortable in the instructor’s presence

Clearly, if the student has dread for the subject matter or is fearful of asking questions, the students are less likely to excel in the course, which leads to non-mastery of the course material. Self-efficacy is described by Bandura as individuals’ beliefs in their capabilities to plan and execute activities to achieve an outcome (Bandura, 1986). Marra et al. (2009) notes that self-efficacy is important in achieving a desired outcome and overcoming barriers, which in engineering can include negative stereotypes, active discouragement by peers and faculty or poor performance in classwork. In a self-efficacy longitudinal study, women perceived engineering academic environments as not inclusive, which may be due to deliberate or inadvertent social cues given by faculty and fellow students (Marra et al., 2009). The Marra et al. (2009) study

included 196 participants located at five different institutions representing multiple geographic regions of the US (Eastern, South Central, Southwestern, Southeastern, Midwestern). Those social cues include the actions of instructors in the classroom pertaining to IR as listed in Table 2. Moreover, studies have documented that women who leave engineering have less self-confidence than the men and women who stay, despite performing at the same level or higher (Jackson et al., 1993; Brainard and Carlin, 1998), highlighting the importance of self-efficacy and the actions of an instructor to promote positive self-efficacy.

## **The Need for Diversity**

Thus the logic is as follows. The female faculty stereotype is that female faculty are nurturing, which female faculty often fulfills the stereotype. The descriptors of nurturing match the actions of instructors exhibiting high IR, and IR increases student performance in the class due to increases in self-efficacy. As such, the need for faculty diversity in the STEM fields, particularly STEM classrooms can be based on a desire to improve student learning and academic success rather than diversity being justified as the right thing to do.

## **Diversity and Inclusion Classroom Best Practices**

Social scientists seek to improve diversity and inclusion in STEM education and industry. Miyake et al. (2010) applied value-affirmation as an approach to reducing the gender gap in a physics classroom. The intervention was not tied to course material. In fact, the students wrote about personally important values (family and friends). Yet the intervention positively influenced females who endorsed the gender stereotype and female students performed more positively on in-class multiple exams and a standardized test. Having the students reflect on the values and the instructor showing care and concern about the students' performance and their values, matches the IR Dimension in Lowman's 2-D Model. Miyake et al. (2010) concludes that a combination of instructional methods and social-psychological factors may work best to improve student performance, which precisely reflects the two domains of Lowman's 2-D Model.

## **Conclusion**

The purpose of this paper was to provide an alternative justification to why college faculty should be diverse and to support the need for more female faculty in the classroom. Placing value on it is "the right thing to do" or because we do not have parity with the general population does not seem to be sufficient arguments for male colleagues to become allies. An alternative approach to advocating for STEM faculty diversity may be achieved by connecting to the need to improve student performance. Leveraging the female stereotype of nurturing, collaborative, fair, caring, etc. to connect to students in the classroom can increase the student's self-efficacy. Female faculty stereotypes are directly reflected in the IR Dimension, specifically addressing Effective Motivation and Interpersonal Concern. Lowman's 2-D Model of Effective Teaching is a new justification for increasing STEM faculty diversity.