Applying Research and Theory to Your Outreach, Recruitment and Retention Activities For Girls & Women in Engineering

JULIE P. MARTIN
Clemson University
Department of Engineering & Science Education
WEPAN Past President

Contact information: martin1@clemson.edu
Potential Theoretical Frameworks

- **Self-efficacy**
  - e.g. Bandura, 1997; Betz & Hackett, 1981; 2006

- **Social Cognitive Career Theory**
  - e.g. Lent et al., 1993, 2003, 2005, 2007; Trenor et al., 2008

- **Identity**
  - e.g. Pierrakos, et al., 2009; Beam, et al, 2009; Stevens, et al., 2008; Chandra, et al., 2008; Tonso, 2006; Chachra et al, 2008; Matusovich et al., 2008

- **Motivation**
  - e.g. Eccles, 2005

- **Social Capital**
  - e.g., Trenor, 2008, 2009

- **Student Engagement**
  - e.g. Astin, 1999

- **Stereotype Threat**
  - e.g. Aronson, Quinn & Spencer 1998; Spencer, Steele & Quinn, 1999; Steele and Aronson, 1995; Aronson, Fried & Good, 2002
Self-Efficacy

- Past performance accomplishments
- Vicarious learning
- Social persuasion (Encouragement and support)
- Physiological arousal (and affective reactions)

References:
Social Cognitive Career Theory (SCCT)

Person Inputs
- Predisposition
- Gender
- Race/ethnicity
- Disability/health status

Background Contextual Affordances (Env. Factors)

Learning Experiences

Self-Efficacy Expectations

Outcome Expectations

Contextual Influences Proximal to Choice Behavior (supports & barriers)

Interests

Goals

Actions

Thinking About Girls & Women in Terms of Social Cognitive Career Theory

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Contextual Influences Proximal to Choice Behavior (supports & barriers)
Lent’s Interventions Derived From SCCT

- Expanding vocational interests, esp. in high aptitude areas
- Clarifying career goals
- Strengthening self-efficacy beliefs
- Instilling realistic outcome expectations
- Managing environmental barriers
- Building environmental support systems

http://dels.nas.edu/bls/more/Lent.pdf
Network Theory of Social Capital

- Resources embedded in social networks
- Functions of Social Capital
  - Enhances the flow of information
  - May influence individuals with decision-making power
  - May offer necessary or desirable social credentials
  - Offers reinforcement of an individual’s identity and recognition

“Whereas economic capital is in people’s bank accounts and human capital is inside their heads, social capital inheres in the structure of relationships” (Portes, 1998)
Network Theory of Social Capital

- Heterogeneous networks are advantageous because they provide more variety and quantity of resources.

- Inequalities based on:
  - Gender
  - Ethnicity
  - Socioeconomic status
  - Family educational background

- Network redundancy

Family social capital varied with parental education and occupation and was related to the roles that family (particularly parents) played in students’ college major decisions.

When family capital was absent, students often relied on school personnel at the pre-college or college level for initial awareness of engineering, and information about choosing engineering as a college major. Engineering outreach, recruitment, and retention programs and personnel were key sources of information and support.

Students’ educational experiences and perceptions of support varied with accessed social capital. Peer groups played important roles in students’ perceptions of their educational experiences and supports.

Under-represented minorities and first generation college students were more likely to describe tenuous pre-college connections to engineering-related social capital, but yet found a way to access and activate social capital to varying degrees in making decisions to enter and persist in engineering at the undergraduate level.
Social Capital in Career Decision Making

- Students’ decisions to select and persist in engineering are influenced by available resources in their social networks, activation of resources.
- Under-represented students may utilize different mechanisms for developing & activating social capital.

Interventions Based on Social Capital

- Research in progress- don’t have all the answers yet!
- Opportunities for students to develop large and heterogeneous social networks with specific embedded resources pertinent to engineering academic/career decisions
- Opportunities for students to develop and mobilize sustained social capital rather than isolated interventions are preferred
- However, isolated interactions/interventions can “fill holes” in network and be key to academic & career decision making
Identity Theory

- People have multiple identities – [Stryker, Burke, Tajfel, Turner, etc.]
- People tend to choose behaviors whose meanings are congruent with their own self-meanings – [Burke, 1991]
- Social context determines group membership - A majority member might automatically form a strong sense of belonging, whereas the minority member instantly notices his/her minority status – [Spears, Doosje, Ellemers, 1997, 2002]

There are two layers of identity: personal and social. - Deaux [1993]

- Personal identity - “characteristics and behaviors that the person finds self-descriptive”
- Social identity - “roles or membership categories that a person claims as representative”

Slides content compliments of Olga Pierrakos, (PI) NSF Award # EEC – 0824337 – “BRIGE: Understanding Engineering Students through the Lens of Identity Theory – Implications for Recruitment and Retention of Underrepresented Students”
Female students were more likely to regard themselves as similar to other female students and less as science students, whereas male students were more likely to regard themselves as science students and less as males - [Lee, 1998 and 2002]

The majority of the engineering identity labels referred to males only and tended to be derogatory when referring to females – [Tonso, 2006]

Identity has been shown to play a large role in interest in engineering, thus contributing to perseverance – [Stevens et al., 2008]

Men and women express their degree of identification with engineering with a slightly different set of activities. – [Chandra et al., 2008]
Interventions Based on Identity Theory

- Engineering not having a strong presence in K-12 education seems to be a critical factor in students not having a strong identity to engineering.

- The first year is critical in educating students on the breadth of the engineering profession and what it means to be an engineer.

- We should educate students on the diverse aspects of engineering so they can see ties b/w engineering and other professional interests/roles.

- Engineering students have multiple identities and interests, so offering diverse and numerous engineering opportunities would be ideal.

- Gender differences in how students identify with engineering and what activities aid in shaping identity formation.

Slides content compliments of Olga Pierrakos

Student Engagement

- Quality of learning environment & level of student involvement is critical connection
- Excellent learning environment promotes high level of student involvement
- Student engagement: amount physical and psychological energy a student devotes to academic experience
  - Amount of energy devoted to studying
  - Amount of time spent on campus
  - Amount of participation in student organizations
  - Amount of interaction with faculty
  - Amount of interaction with other students

References:
Motivational Theories:

- “People will be most likely to choose a major that they think they can master and that has high task value for them”

- 4 categories of subjective task values:
  - Interest value - the enjoyment one gets from engaging in the task or activity
  - Utility value - instrumental value of the task or activity for helping to fulfill another long or short term goal
  - Attainment value - the link between the task and one’s sense of self-identity
  - Cost - defined in terms of either which may be given up my making a specific or the negative experiences associated with a particular choice

- “Critical issues...are the relative personal value of each option and the individual’s assessment of his or her relative ability and potential at the time the decision is being made.”

References:

Stereotype Threat

- Psychological burden of stereotypes related to race, ethnicity, gender, physical appearance may affect actual performance by self-conforming to a negative stereotype of about one’s group (i.e. “girls can’t do math”)

- Aronson, Quinn, & Spencer, 1998:
  - Arises from situational pressure, not actual acceptance of the validity of the stereotype
  - Those most affected are most concerned with poor performance in the domain

- Many studies have shown academic underperformance based on stereotype threat
Theoretical Elements of Stereotype Threat

- 3 theoretical elements (from Aronson, Quinn, & Spencer, 1998)

  - **Self threatening nature of negative stereotypes**
  - **Effect of self-threat on intellectual performance**
  - **Tendency to dis-identify with chronically threatened domain**

Undermine performance and motivation of women and minorities