College STEM Majors' Interest in People: Sex and Discipline Differences

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Women receive university degrees and are entering the work force in greater numbers than ever, yet they remain significantly underrepresented in most Science Technology Engineering and Math (STEM) majors and careers (National Science Foundation, 2009). The exceptions are in biology and medical fields where women have been well represented in recent years (Science and Engineering Indicators, 2012). Differences in the gender composition of different majors are likely due to a number of factors that influence career interests. In an attempt to explain the gender segregation in some careers, gender role theorists (e.g., Barth et al., 2013; Diekman & Eagly, 2008; Evans & Diekman, 2009) have implicated societal expectations for gender-based social roles and the associated life goals related to career and marriage. Gender roles influence career choices and major preferences because individuals tend to choose occupations that are consistent with gender roles (Diekman, Brown, Johnston, & Clark, 2010).

"Communal" roles related to caregiving and helping others are integral to gender role explanations in that women tend to adopt these roles more often than men. STEM careers are generally not perceived as being "helpful to others" or as having a positive social impact, and this is seen as an obstacle in attracting women to these careers (Jones, Howe, & Rua, 2000). Girls who continue in science often seek to use science in socially relevant ways (Jones et al., 2000; VanLeuvan, 2004), and women tend to enter scientific fields with a focus on helping people, rather than conducting pure research (NCRW, 2001). Yet, historical changes in the representation of women in traditionally masculine occupations suggest that this analysis of social impact goals has been too simplistic. For example, the National Center for Education

Statistics (Snyder, Dillow, & Hoffman, 2009) reports that in 2006-2007, women were granted 45% of the degrees in dentistry, 49% of medical degrees, and 41% of business degrees. Among these formerly male-dominated careers, dentistry and medical occupations might be aligned with "helping" goals, but it is difficult to see how business would align strongly with any communal goals.

An alternative explanation for gender differences in career choices is offered by Lippa (2005; 1998) and Graziano, Habashi, & Woodcock (2011) who suggest that gender differences in occupation preferences are related to interest in *people and things*. "People vs. thing orientation*"* captures the degree to which a person prefers an occupation that involves impersonal tasks (e.g., dealing with machines) relative to tasks that involve interacting with people (Graziano et al., 2011). In this framework "helping others" can be realized through the invention of "things," such as better wheelchairs, or through interactions with people, such as physical therapy. It is possible that fields in which there are a large proportion of women are those that are more people oriented, independent of whether they can be characterized as having a large social impact. For example, health occupations that rely heavily on biology such as medicine and nursing are usually perceived as being more people-oriented professions; however, traditionally engineering is not, even if the engineering field creates products that benefit society. We propose that both societal expectations for gender roles (and the degree to which an individual adopts those expectations), as well as gender differences in interest in people and things might explain why some STEM fields have more women than others.

In this study we focus on people and thing orientation and explore how it is associated with the choice of a STEM major. We compare women who are STEM biology majors to female STEM majors in other fields on their interest in people and things. We predict that

women who major in Biology will be more interested in people than women who major in other STEM fields. For theoretical reasons, we also include nursing majors, a traditionally feminine career, as a point of comparison for female STEM majors. It is expected that nursing majors would have a greater interest in people than women in any STEM major, but that biology majors would have a greater interest in people than STEM majors in other fields. Interest in things should be greater for non-Biology STEM majors compared to Biology Majors, and generally higher for men than women.

Method

Participants

The sample included 1596 undergraduate students who were recruited from STEM courses at two different public universities in the United States. The classes were those typically taken by STEM majors (e.g., Calculus, Engineering, Physics, Computer Science, Biology and Chemistry). The majority of the respondents were non-Hispanic White (80%), but also included 11% African American or Black, 3% Asian, and 1.4% Latino. Since data were collected from only STEM courses, not surprisingly, 58% of the respondents were men. Participants were at various stages in college, with about 30% in the first year, 30% in the second, 20% in the third, and 20% in the fourth year or more. With respect to age, 19% were 18 years or younger, 30% were 19, 21% were 21, and the remainder were 22 years or older.

Procedure

With the permission of course instructors, members of the research team went to regular STEM class sessions to administer the questionnaire. The researchers gave a brief overview of the purpose of the study and asked students to read the consent information on the first page of the questionnaire. Students wishing to participate in the study stayed after class to fill out the

questionnaire at their own pace. Most students were able to complete the questionnaire in 15 minutes. The questionnaire included several measures related to gender roles, life goals, and career interests; however, we only report on the measures included in this study.

Measures

Major. Students selected their major from a list of majors offered at the university they attended (e.g., Business, Social Work, Biology, Engineering, Nursing, and Math). There was also an opportunity for students to write in their own major or select more than one major. Students were grouped into four major groups: a) CEMP (Computer Science, Engineering, Mathematics, and physical sciences which further included Physics, Geology, Geography, and Chemistry), b) Biology, c) Nursing, and d) all other majors. Only students in CEMP, Biology or Nursing majors were included in the current analyses. See Table 1 for the number of participants in each major, disaggregated by sex. Eleven participants failed to provide a major and/or sex, leaving a sample of 1585 cases with useable data.

Table 1

Participant Characteristics by Major

Statistic	Major							
	CEMP		Biology		Nursing		Missing	Total
	Male	Female	Male	Female	Male	Female		
Frequency	667	195	187	264	63	209	11	1596
Percentage	41.8%	12.2%	11.7%	16.5%	3.9%	13.1%	0.7%	100%

Interest in people and things. Interest in people and things was measured by a shortened version of the *Person-Thing Orientation* scale (Graziano, Habashi, & Woodcock, 2011). Items asked participants to rate how much they enjoyed different activities that involved people (four items, e.g., "Make the first attempt to meet a new neighbor") or things (four items, e.g., "Stop to

watch a machine working on the street"). All questions were answered on a 5-point scale, 1 = not enjoy at all to 5 = enjoy very much. We included eight items from the original 13 items on this measure that had the highest factor loadings as reported by Graziano et al. (2011). The number of items was reduced on this measure as well as others included in the questionnaire so that a wide range of constructs could be evaluated in a short period of time. Factor analysis of the instrument confirmed two factors underlying the measure, Person Interests, and Thing Interests.

Demographic information. Participants were also asked to specify their age, sex, ethnicity, and year in college.

Results

A 2 (Sex) X 3 (Major) MANOVA was conducted with the two interest scores (Person and Thing) as the dependent variables. Wilks' Lambda tests indicated a main effect for Major, F (4, 1535) = 80.30, $p < .001$ and Sex, F (2, 1537) = 165.95, $p < .001$, but no significant interaction. Table 2 presents the means for these effects. A series of ANOVAs and Tukey post-hoc tests were then conducted separately for Person and Thing Interest to understand these effects.

Table 2

Mean Scores for Person and Thing Interest

	Person-Interest			Thing-Interest		
Major	Males	Females	Total	Males	Females	Total
CEMP	3.36	3.77	3.46	3.95	3.04	3.74
Biology	3.55	3.82	3.71	3.12	2.12	2.53
Nursing	4.11	3.83	3.87	3.09	2.08	2.21
Total	3.42	3.80		3.73	2.35	

Note. Scores range from 1 to 5.

The ANOVA for Person Interest revealed a main effect for Major, $F(2,1549) = 5.38$, $p < .005$, for Sex, $F(1, 1550) = 27.90$, $p < .001$, and for the interaction of major and sex, $F(2, 1549) = 3.30$, $p < .05$. Tukey post-hoc comparisons of the three majors indicate that the CEMP majors rated Person Interest significantly lower than Biology majors, $p < .001$, and significantly lower than Nursing majors, $p < .001$. Comparisons between the Biology and Nursing majors were not statistically significant. Additional comparisons indicated that women in all three majors showed no differences in their Person Interest scores, but men did. Thus, the differences between majors on Person Interest are primarily accounted for by men's level of interest.

The ANOVA for Thing Interest revealed a main effect for Major, $F(2, 1549) = 150.35$, $p < .001$, and for Sex, $F(1, 1550) = 266.74$, $p < .001$. Tukey post-hoc comparisons of the three majors indicate that the CEMP majors rated Thing Interest significantly higher than Biology majors, $p < .001$ and significantly higher than Nursing majors, $p < .001$. Comparisons between the Biology and Nursing majors were not statistically significant.

Summary and Future Procedures

This study is one of the first to compare interest in people and things for both men and women in different STEM majors. So far we have presented the results on how men and women from three groups of majors (CEMP, Biology, and Nursing) differ on Person and Thing Interest. Consistent with theories and previous studies, men rated their interest in things significantly higher than women; whereas women overall rated their interest in people higher than men. As for major differences, both men and women choosing a CEMP major were significantly more "thing-oriented" than their peers in Biology and Nursing majors. However, across all majors women had nearly the same level of interest in people. This is *not* consistent with the hypothesis that women who choose to major in Biology are more people oriented than other female STEM

majors. Interestingly, women in both Biology and CEMP majors were not different in Person-Interest ratings from their peers in Nursing, a traditionally feminine major. For women, it is interest in things that differentiated their major choices.

Our next step is to compare men and women in the three majors on a measure of gender role adoption using the Gender-Typical Self-Concept Scale (Diekman & Eagly, 2000) which was included in the questionnaire. This measure assesses the degree to which respondents believe that they possess the personality and cognitive characteristics consistent with agentic/masculine and communal/feminine stereotypes. Because CEMP fields are strongly stereotyped as masculine, we expect that women majoring in these areas will have higher scores on the masculine characteristics and lower scores on the feminine characteristics compared to women majoring in Biology and Nursing. A final set of analyses will examine the relative importance of gender roles and person/thing interest in explaining why women choose some areas of STEM more often than others.

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