Gender Disparity in Engineering: Results and Analysis from School Counselors Survey and National Vignette

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Abstract— **In an earlier paper by our group [1] we presented statistical analysis based on 30 years of ACT data illustrating gender disparity in engineering majors and career choices. Obtained results also revealed the presence of a large number of students who are interested in engineering but who may not be adequately prepared to pursue a successful career in this discipline. Because of the role of school counselors as "gate keepers" of both academic information and career planning options, further understanding of the role of school counselors in the longstanding gender disparity in the engineering field has been established as an important avenue for interventions to help reverse a continued declining trend of female participation in STEM related fields. This paper describes results of a survey that is specifically targeted school counselors and their knowledge of engineering and the social influences that may affect their guidance approach for female students. To help delve further into the attitudes of school counselors regarding the issue of gender disparity, a vignette was developed for national distribution, and results from this effort will also presented in this paper.**

I. INTRODUCTION

The demand for a more diverse engineering workforce is consistently high and employment potential in this field continues to grow. Most labor force experts agree that continued growth in national productivity will require a supply of engineers who are highly competent in mathematics and science, and who are adaptable to the needs of a rapidly changing profession [2]. Unfortunately, continued need for engineers is now being recognized as a potential threat to the economic competitiveness of the U.S. as the country continues to be outpaced in producing engineering graduates. In 1970, for example, half of all science and engineering doctorates in the world were Americans; however, by the year 2010, Americans only held 15% of doctorates in these fields. Further, as many Asian countries, specifically China, Japan and Korea, increased their engineering graduates between 40% and 100% in the last 20 years, the number of U.S. engineering graduates declined by an alarming 20% during that same period [3] and expressed interest in engineering has declined by over 30% in the U.S. [3]. Perhaps even more disconcerting is the disproportionately low representation of females in these fields. Recent data suggests that female interest in engineering is on the decline from a peak in 2000 and currently only about 17% of females express interest in engineering major [4]. Despite previous interventions, recruitment tools such as scholarships, subsidized/supported education, and the lure of making a substantial living directly out of college, female participation in engineering has only marginally increased and the gender disparity has been persistent for decades [5]. An example of the gender disparity in engineering can be seen through historical data related to the number of female freshman with intent to major in engineering [1]. In 1982, only 16% of women expressed interest in the major and this percentage dropped to 14% in 1989 and continued at this level until 1998 [5].

The disparity between male and female interests has been observed for almost one hundred years [6], and though the root of these differences in interests has been of great debate, differences still remain. Over 40 years of research has established self-efficacy beliefs as determinants of behavior and success. To this end, elementary and secondary school counselors are in a position to positively influence the academic and career choices of the students they advise through encouraging course enrollment, through career guidance curriculum and exploration, and as liaisons to parents and teachers. School counselors may play a role in the gender disparity puzzle that continues to elude researchers and thwart policy maker's efforts. This and the fact that results from our earlier study [1] also suggested interventions may need to be directed at those who influence students' career making decisions, specifically school counselors.

II. SURVEY AND VIGNETTE DEVELOPMENT

The study utilized a mixed methods design (survey and vignette) to help understand the effects of school counselors' knowledge and values about engineering on the gender disparity in the engineering fields. Research questions for this study were based on the knowledge that there is a substantial gender disparity in engineering fields and the fact that school counselors may have an effect on students' career and major choices. In the survey and vignettes, two primary research questions were asked in the survey to better understand the school counselor-student choice relationship. The first question is what are specific areas of growth and progress that school counselors should have to allow for less gender biased counseling sessions with their students? This question was

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answered through qualitative data analysis of both a survey and vignettes. The questions regarding female participation in engineering field and their associated hypotheses will be described in the presentation.

The second question is what specific knowledge do school counselors need to provide more accurate counseling to students regarding careers and majors in engineering? This question was answered through quantitative analysis of a set of questions prepared in a survey. A detailed list of survey questions, vignettes and their associated hypotheses will be described in the presentation.

III. Results

Results from preliminary analysis of the aforementioned survey suggest there is both a quantitatively different perception of male and female engineers and that different qualities, values and attributes are associated with each gender. Further, results demonstrate a somewhat alarming lack of understanding about the field of engineering itself and the criteria necessary to successfully become an engineer. Detailed results will be presented graphically and discussed in the conference.

IV. Summary and Observations

Results from our prior publications [1] which analyzed 30 years of ACT data show that these is a large number of high school students who expressed interest in engineering but were less than adequately prepared for a successful path in this area and that social stereotypes regarding women's role in society might contribute to lack of expressed interest in engineering by female students. This placed a focus on school counselors as a possible missing piece in the puzzle of gender disparity and lack of female interest in engineering. This paper addresses this issue by conducting a survey and implementing a vignette to critically examine these issues. Results from this research will be summarized and presented in the conference.

References

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