Factors that Influence STEM-Promising Females' Decision to Attend a Non Research-Intensive Undergraduate Institution

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Abstract

Non research-intensive institutions of higher education are effective at narrowing STEM gender gaps in major selection and persistence to degree completion, yet the decision to attend such a setting is likely seen as counterintuitive when such institutions typically have lower levels of research, financial resources, and total student enrollments in the sciences. This case study identifies institutional factors reported by 'STEM-Promising' females, defined as females who completed at least one Advanced Placement (A.P.) STEM course in high school, as influencing their decision to attend their non research-intensive undergraduate institution. Using a quantitative, cross-sectional research design and original survey, 23 out of 45 factors were reported to influence their college choice. Significant differences between STEM and non-STEM majors were noted in the influence of undergraduate research opportunities, faculty reputation, graduate/professional school admission, presence of academic support/tutoring, and the graduate program available at the institution. For STEM majors also admitted to research-intensive universities, only university size and average class size at the non research-intensive institution were reported as superior to the research-intensive. Additional non research-intensive undergraduate institutions are encouraged to repeat this study at their own institutions and tailor their institutional marketing and admissions materials to reduce the STEM gender gap.

Keywords: undergraduate university choice; STEM education; females; gender effects

Introduction

The 'leaky STEM pipeline', gender differences in STEM enrollments and attitudes, and underrepresentation of females in STEM professions in the United States have been explored from a variety of perspectives for greater than two decades (cf American Association of University Women, 2010; Beede, et al., 2011; Blickenstaff, 2005; Brainard & Carlin, 1998; Ceci, Williams, & Barnett, 2009; Cunningham, Hoyer & Sparks, 2015; Morgan, Gelbgiser, & Weeden, 2013; Riegle-Crumb, Grodsky, & Muller, 2012). Unfortunately, these perplexing issues continue to exist and are perceived at a national level as threats to the United States' ability to compete in the global economy (National Academy of Sciences, 2006; National Science Board, 2007; President's Council of Advisors on Science and Technology, 2012).

This study explores the pivotal entrance point to the postsecondary STEM pipeline for females: the decision regarding which undergraduate institution to attend. With limited information and experience, all students must choose to attend a specific university where they may, or may not, ultimately study in a STEM field. Twenty-five years ago, analysis of the high school to college linkage was recommended to understand ways in which the STEM pipeline could be augmented (Maple & Stage, 1991; p. 56). More recent studies of university and college major choice identify factors of influence for students of both genders from various demographic backgrounds, as well as how college females choose to major in STEM or non-STEM subjects (Engberg & Wolniak, 2013; Wang, Eccles, & Kenny, 2013; Wang, 2013). However, there is little extant research that examines how 'STEM-Promising' females – defined here as those who have shown aptitude and ability in STEM through completing Advanced Placement (A.P.) STEM courses in high school – weigh various institutional factors when making their college choice. Paying such attention to high achieving females' college selection process, as undertaken in this case study, has been specifically recommended to contribute to closing the STEM gap and patching the pipeline (Everett, 2012).

We hypothesize that a portion of the subsequent leakage along the STEM pipeline for such high aptitude females may be explained by their *choice* of postsecondary institution, rather than academic ability, interest, or wider societal issues such as gender stereotyping. The competitive nature of STEM courses at large research institutions reportedly deters some women from choosing or remaining in a STEM major (Shapiro & Sax, 2011); studies also suggest females may require equally rigorous undergraduate programs augmented by academic support and faculty interaction (Griffith, 2010; Mann & DiPrete, 2013). Thus, a factor contributing to female underrepresentation in STEM may be their choice to attend postsecondary institutions that do not fulfill their interdisciplinary and non-academic interests or have learning environments that are not supportive of their needs. Finally, non research-intensive universities, which reportedly provide a supportive environment for females in STEM (Griffith, 2010; Huang, Taddese, Walter, & Peng, 2000), are not necessarily employing targeted female recruitment efforts to strengthen the STEM pipeline, even though it has been recommended (Cho, Hudley, Lee, Barry, & Kelly, 2008).

This case study was conducted with 103 STEM-Promising female undergraduate students attending one private, midsized non research-intensive university with high female undergraduate student enrollment, which offers over 50 STEM and non-STEM majors. The purpose was to identify the institutional factors most pertinent to their decision to attend this non research-intensive university. We propose such a choice is counterintuitive for STEM-Promising students, if research-intensive institutions' profiles of higher levels of faculty research productivity, institutional financial resources for research, and total student enrollment are perceived as indicators of successful environments for STEM education. This case study offers an original survey tool and specific method of analysis that additional non research-intensive universities may use to investigate the impact of institutional factors on their STEM-promising female student population's decision to attend. Such investigation can yield methods for targeted recruitment of STEM-Promising women to these non research-intensive institutions: a new approach to improving the national issue of the leaky STEM pipeline.

Review of the Literature

While the gender gap in STEM has been described in the literature countless times as a persistent and progressive problem (Cronin & Roger as cited in Blickenstaff, 2005), the current body of literature no longer attributes continued low female participation rates in STEM fields to lack of academic ability (Brainard & Carlin, 1998; Mann & DiPrete, 2013; Morgan, et al., 2013; Wang, et al., 2013). Small liberal arts colleges, community colleges, and historically black colleges and universities – labeled in our work as *non research-intensive settings* – have been reported to contribute strongly to narrowing the gaps related to gender or race/ethnicity in major selection and graduation (Huang, et al., 2000). Although females were still far less likely to enter STEM majors than males at these institutions, once they are enrolled they performed better than their male peers, which is posited to be due to close interactions between faculty and students and increased opportunities for undergraduates in research in non research-intensive settings.

Female and minority students were found to be *more likely* to persist as STEM majors at institutions with a higher undergraduate to graduate enrollment ratio and *less likely* to persist as STEM majors at institutions whose resources and funding are driven primarily by graduate programs and research (Griffith, 2010). It was proposed institutions with a greater focus on undergraduate teaching, as opposed to graduate research, that have led to greater persistence rates for females and minorities in STEM and have suggested that "the sorting of women and minorities into different types of undergraduate programs has a significant impact on their persistence" (Griffith, 2010; p. 911). To provide the retrospective of practicing STEM professionals on the factors important to their career preparation, interviews were conducted with 205 females working in science, math, or engineering; 68% responded choice of appropriate institution contributed to their persistence in STEM as a career (Kondrick, 2002).

Factors reported in national surveys to affect students' choice of institution were grouped into four general areas: (1) location-related, (2) reputation/school related, (3) price-related, and (4) influence related (Choy, Ottinger, & Carroll, 1998). A meta-analysis of over 50 studies of factors affecting choice of institution found the most frequently cited influential factors (not including cost and financial aid) included academic reputation, location, quality of instruction, availability of programs, quality of faculty, reputable program, and job outcomes, with safety of the campus substantially more important to females than males (Hoyt & Brown, 2003). First-generation and female students were shown to be most sensitive to the influence of psychological factors, such as perceived safety, social climate, and having friends present on campus. They rated academic quality considerations higher than any other scale, even financial, in the college choice process (Cho, et al., 2008). In contrast, non first-generation males rated academic quality considerations lower than any other demographic group, leading to the conclusion that university recruitment strategies need to be tailored to the specific population being targeted for admission, rather than a 'one-size fits all' strategy (Cho, et al., 2008).

Little research surrounds the topic of targeted female college recruitment in STEM (Tsui, 2009). Everett's study (2012), conducted at 15 different private colleges of varying size and prominence, recommended "more attention should be paid to the college selection process for *high-achieving female students* (emphasis added), with a special focus on what is driving their [college] decisions and whether males and females weigh these factors differently" (p. 38). In order to follow the recommendations to create successful targeted recruitment programs and capitalize on the success of females in STEM at non research-intensive universities, we must first identify what is most important to prospective female STEM students when choosing a non research-intensive postsecondary institution.

Research Methods

This case study employs a quantitative, cross-sectional research design involving development of an original online survey (see https://goo.gl/J0AOHD) to identify institutional factors most pertinent to the decision to attend a non research-intensive university by a STEM-Promising female undergraduate student. Research questions explored in this article include

1. Which institutional factors influence the decision of STEM-Promising females to attend the non research-intensive university, *regardless of major*?
2. In what ways do institutional factors that influence the decision of STEM-Promising females to attend the non research-intensive university differ *between STEM and non-STEM majors*?
3. For STEM-Promising female *STEM majors who were accepted to the research-intensive but instead enrolled the non research-intensive university*, which institutional factors about the research-intensive university *negatively* influenced their decision to attend?

Sample

The subject population for this case study consisted of female, full-time undergraduate students enrolled in Spring 2014 at one non research-intensive private university, considered by Barron's to be "highly competitive" in terms of student selectivity and rated #7 in its regional classification out of approximately 130 schools by *U.S. News and World Report's* "America's Best Colleges" (2013 statistics). Publicly available institutional data showed that 57% of the 5,681 enrolled undergraduate students were female and 22% of freshmen identified as first-generation college attendees. The average freshman SAT score for admission was 1860 and the average high school GPA (unweighted) was a 3.68 on a 4.0 scale.

As previously discussed, inclusion in the study was specifically limited to STEM-Promising females, defined as those who reported completing at least one Advanced Placement (A.P.) STEM course during high school. Use of high school A.P. STEM course completion as a specific inclusion criterion was based, in part, on Hoepner's (2010) study on the role of A.P. coursework in preparing students for STEM majors. We recognize this is a narrow definition of STEM Promise, but believe such a national, standardized criterion (in contrast to grades received in a wider variety of high school STEM classes) is an appropriate measure to utilize at this stage of research, and it follows Everett's recommendation (2012) to study high achieving female students. Participation was voluntary; students were recruited for participation using posted flyers with the survey link (URL) and brief presentations of the study and URL during classes in a variety of departments. It is estimated the 103 completed surveys captured 11% of the eligible subject population (females with at least one A.P STEM course completed in high school), based on institutional data on A.P. STEM courses submitted for credit by students enrolled in 2013-14.

Both STEM and non-STEM majors were solicited for participation in the study, in contrast to much of the prior educational research on STEM pathways, which is narrower and strictly defines as a specific set of STEM majors or courses that lead to STEM careers. Morgan, et al. (2013) suggests pathways into STEM fields for women may not be as clearly defined as for men. For example, students could complete prerequisite coursework for medical school while formally majoring in a non-STEM field and, therefore, should be considered to be in the STEM pipeline as well. Forty-nine (49) participants reported being STEM majors in disciplines within biological, physical, health, environmental, earth, and computer sciences and mathematics; 54 participants reported being in non-STEM majors within the humanities, arts, languages, education, business, communications, and advertising. Participants were also given an opportunity to report their major as Undeclared, or to write in a customized major within the category "Other".

Survey instrument

An original electronic, online survey (see https://goo.gl/J0AOHD) was administered using the open source survey application LimeSurvey. Participants accessed the survey URL at any time during the three-week survey period. While the survey was not timed, it was designed to take less than 30 minutes. All questions required a response in order to proceed; however, participants could opt-out at any time by simply closing the page and were able to choose "Prefer Not to Answer". Surveys started, but not completed, indicated a respondent withdrew participation (n=4).

The survey began by verifying inclusion criteria, followed by demographic and college major information for all participants. The survey then asked participants to read statements regarding the influence of a factor on their decision to attend the non research-intensive university. Participants were instructed to consider only the knowledge available to them *before* making the decision to attend the university, not after. Each statement had four response options: Agree, Disagree, Not Applicable/Not Known, or Prefer Not to Answer. The statements were grouped by themes suggested by the 1998 National Center for Educational Statistic Report *Choosing a Postsecondary Institution* (cited in Choy, Ottinger, & Carroll, 1998). Themes included location-related, University/campus-related, social/activity-related, reputation-related, major/department/courses-related, admissions-related, other university-related (i.e., student health and freshman orientation programs), and influence-related (parents, high school personnel, and friends). Although tuition cost and availability of financial aid may significantly affect many students' choice of institution, students participating in this study were already enrolled, therefore questions regarding cost or aid were not included. Sources of inspiration for the statements regarding each specific factor of influence include the 2014 CIRP Freshman Survey (Higher Education Research Institute of UCLA, 2014) and the Admitted Student Questionnaire (ASQ) PLUS Sample Questionnaire (The College Board, 2012). Participants considered two to eleven statements within a theme on each page of the survey, for a total of 45 factors. At the end of the themed question sets, participants typed their top three reasons for choosing their institution in a free response text box.

Participants who identified as STEM majors (n=49) were asked, upon completion of the themed question sets, whether or not they were also accepted into any research-intensive institutions. They were also given the Carnegie Basic Classification (Carnegie Commission on Higher Education, 2005) definition of what was considered a research-intensive institution and access to a URL link with a comprehensive list. If the respondent answered "Yes" (n=25), an additional section of the survey opened wherein she was asked to consider each statement as it pertained to her decision *not to attend* the research-intensive university(ies) to which she was accepted. An example was, "The [research-intensive] University's distance from home was undesirable compared to my current institution"; options included Agree, Disagree, and Not Applicable. At the end, participants typed their top three reasons for *not choosing to attend* the research-intensive institution in a free response box.

Internal and external controls

Using alternate forms reliability (Creswell, 2012), for all participants we first compared the free response "top three reasons" all participants (STEM and non-STEM majors) listed as being the most important in terms of their decision *to attend* their current institution (a non research-intensive university) with their responses to the factor statements earlier in the survey, to see if responses were internally consistent. Second, for the STEM majors also admitted to research-intensive institutions, internal consistency was evaluated by comparing an individual subject's responses regarding their decision *to attend* a non research-intensive university with their responses regarding their decision *not to attend* the research-intensive. Additionally, we chose a dichotomous binary response (Agree or Disagree) to each statement, instead of a Likert scale, to eliminate uncertainty that comes with responses that are difficult for participants to quantify. It also included the option "Prefer Not to Answer" because some statements queried highly-personal factors such as family influence, which may have caused some students discomfort in reporting. Finally, as an external control, we verified through the institution's admissions office that they conducted no specific marketing or recruitment efforts toward females to major in STEM or to those who showed STEM Promise based on standardized test scores nor high school course enrollment. Therefore, we believe student knowledge of institutional factors prior to admission was obtained through a similar process for all females who applied to the institution, regardless of their intended major.

Data analysis

After the online survey period concluded, data were exported into Microsoft Excel for processing. For each statement about a factor's influence on the college decision, frequency counts of Agree and Disagree responses were auto calculated and the likelihood, or odds, that participants agreed versus disagreed with each statement were calculated. Odds (and odds ratios) are frequently used to represent likelihood of outcomes (Rudas, 1998). An odds value of 1.0 indicated participants were equally likely to agree as they were to disagree the factor influenced the decision; the greater the magnitude above 1.0, the greater the likelihood (odds) the factor influenced the decision to attend the university.

Disagreement odds, represented by odds values *less than 1.00*, indicated participants were more likely to *disagree* than to agree the factor influenced their decision. It is important to note how disagreement odds (values<1.0) relate to agreement odds (values>1.0). In order to compare the magnitude of agreement v. disagreement, one must calculate the reciprocal of the disagreement odds. For example, disagreement odds of 0.25 (1/4) is equivalent in magnitude to an agreement odds value of 4.0 (4/1), but merely in the other direction (in this case, disagree versus agree). Finally, factors were ranked by their odds values from largest to smallest, indicating strongest agreement (rank of 1) to strongest disagreement (rank of 45) that the factor influenced students' choice to attend the non research-intensive institution.

To compare responses between STEM and non-STEM majors, odds ratios were calculated for each factor. The *odds ratio* in this study shows how many times more likely *STEM majors* agreed a factor influenced their decision than *non-STEM majors.* In order to compute the odds ratio for each set of responses, frequency counts (agree/disagree) for each statement by group (STEM and non-STEM) were input into a 2X2 contingency tables using VassarStats: Website for Statistical Computation (Lowry, 2014) . The Fisher Exact Test was used to determine statistical significance because of the dichotomous response variables and anticipated small cell frequencies (Trapp & Dawson, 2004); odds ratios and p-values were recorded in separate tables for each statement and any factors that resulted in a p-value below 0.05 noted.

Results

Factors influencing stem-promising females' choice to attend a non research-intensive institution

Twenty-three (23) of 45 institutional factors have odds values greater than 1.0 (see Table 1), indicating they influenced STEM-Promising females' decision to attend the non research-intensive university. The top seven factors influencing the decision to attend the non research-intensive university, with odds noted, were average class size (19.6), campus environment (18.6), a visit to the campus (12.71), university population size (9.0), job/career opportunities for graduates (6.23), major/department offered at the institution (6.07), and weather/climate (5.13).

It is important to note how the odds values below 1.0 indicate greater *disagreemen*t than agreement with the factor's influence on the decision to attend the institution; taking the reciprocal of the odds indicates the magnitude. As shown in Table 1, "Academic Facilities & Equipment" (odds=4) *influenced* STEM-Promising female undergraduate students' decision to the same extent that "Intramural Sports" (odds= 0.27) *did not influence* the decision. Though this study aims to identify and discuss only those factors whose odds are above 1.00, all 45 factors were included in Table 1 for future comparison purposes.

Differences between STEM and non-STEM majors' influential factors

For STEM majors there were 26 institutional factors and for non-STEM majors there were 20 institutional factors reported as influencing their decision (odds>1.0) to attend the non research-intensive university (see Table 1). The resulting odds of each factor and rank order are displayed in Table 1, with statistically significant differences ($p<0.05$) noted. A positive value for rank order difference in Table 1 indicates the factor was more important to STEM majors; a negative value indicates the factor was more important to non-STEM majors. STEM majors reported undergraduate research opportunities (2.18/0.08; $p<0.0001$), faculty reputation (3.80/0.90; $p=0.002$), graduate/professional school admission (3.0/0.74; $p=0.002$), academic support/tutoring (1.94/0.76; $p=0.02$), and graduate program available (1.09/0.39; $p=0.02$) as more influential on their decision than did non-STEM majors. Odds for intramural sports (0.45/0.14; $p=0.03$) and off-campus housing (0.26/0.06; $p=0.04$) were also significantly different between STEM and non-STEM majors; however, these factors had odds values less than 1.0, meaning both STEM majors and non-STEM majors were more likely to *disagree*

Statement	All Majors Combined		STEM Majors		Non-STEM Majors		Rank Diff.
	Odds	Rank	Odds	Rank	Odds	Rank	(+/-)
Average Class Size	19.60	1	12.50	2	48.00	1	-1
Campus Environment	18.60	2	24.50	1	14.67	3	2
Visit to Campus	12.71	3	11.0	4	15.00	2	-2
University Population Size	9.00	4	9.40	5	8.60	4	-1
Jobs for Graduates	6.23	5	11.75	3	3.78	8	5
Major/Department Offered	6.07	6	7.83	6	4.75	6	0
Weather/Climate	5.13	7	5.38	8	4.88	5	-3
Institution's Academic Reputation	4.39	8	7.50	7	2.83	11	4
Academic Facilities & Equipment	4.00	9	3.82	11	4.22	7	-4
Campus Safety	3.84	10	4.44	9	3.30	10	1
Clubs/Organizations	3.08	11	4.10	10	2.36	13	3
Course Variety	2.59	12	2.00	20	3.60	9	-11
Close to Home	2.45	13	2.92	14	2.06	14	0
On Campus Housing	2.35	14	2.29	16	2.42	12	-4
A.P. Credit Accepted	1.94	15	2.38	15	1.53	18	3
Major/Department Reputation	1.93	16	2.27	17 (tie)	1.60	17	0
Faculty's Reputation (p=0.002)	1.84	17	3.80	12	0.90	23	11
National University Rankings	1.73	18	1.78	22	1.67	16	-6
Ease of Changing Major	1.70	19	1.61	23	1.80	15	-8
Graduation Rate	1.66	20	2.27	17 (tie)	1.20	19	2
Graduate/Professional School Admission (p=0.002)	1.51	21	3.0	13	0.74	27	14
Early Action	1.26	22	1.37	24	1.16	20	-4
Academic Support/Tutoring (p=0.02)	1.24	23	1.94	21	0.76	25 (tie)	4
Parent Influence	1.00	24	1.17	25	0.85	24	-1
Students Met on Campus Tour	0.88	25	1.0	27	0.76	25 (tie)	-2
Friend/Role Model Influence	0.83	26	0.76	30	0.92	21 (tie)	-9
Alumni Network	0.81	27	0.98	28	0.65	30	2
On/Off Campus Employment	0.81	28	0.71	32	0.92	21 (tie)	-11
Freshman Orientation	0.76	29	0.77	29	0.74	27	-2
Undergraduate Research Opportunities (p<0.0001)	0.70	30	2.18	19	0.08	44	25
School Traditions/Spirit	0.69	31	0.72	31	0.65	29	-2
Graduate Program Available (p=0.02)	0.68	32	1.09	26	0.39	32	6
Teacher/Counselor Influence	0.44	33	0.38	37	0.52	31	-6
Honors Program	0.38	34	0.47	33	0.29	33	0
Sororities	0.35	35	0.45	34	0.25	35	1
University Athletic Teams	0.33	36	0.45	35	0.22	37	2
Ability to Enroll Undeclared	0.28	37	0.33	38	0.23	36	-2
Intramural Sports (p=0.03)	0.27	38	0.45	36	0.14	41	5
Relative Influence	0.27	39	0.28	40	0.27	34	-6
Religious Affiliation	0.22	40	0.27	41	0.18	40	-1
Female Professors	0.20	41	0.20	44	0.21	38	-6
Diversity of Campus Population	0.18	42	0.18	45	0.18	39	-6
Living Learning Communities	0.18	43	0.23	43	0.13	42	-1
Student Health Program	0.17	44	0.24	42	0.10	43	1
Off Campus Housing (p=0.04)	0.16	45	0.28	39	0.06	45	6

Table 1. Factors Influencing STEM-Promising Female Undergraduates' Choice to Attend a Non Research-Intensive Institution

than agree that these factors influenced their decision to attend their university.

Factors influencing female STEM majors' decision not to attend a research-intensive institution

Table 2 shows the results regarding STEM majors who were admitted to both non research-intensive and research-intensive universities, but chose to enroll at the non research-intensive setting. These 25 participants responded to 17 statements querying the specific factors that influenced STEM majors to choose their current institution (a non research-intensive) over the research-intensive. Surprisingly, only two factors were reported to influence their decision *not to attend* a research-intensive university to which they were accepted. STEM majors were 11.5 times more likely to *agree* that the research-intensive university size was undesirable compared to the non research-intensive. They were also 5.25 times more likely to report that the research-intensive university's average class size was undesirable. STEM majors admitted to both institutional settings were more likely to *disagree* that all 15 other factors were preferable at the non research intensive institution, meaning these 15 remaining factors *were equal to or better at the research-intensive* than at the non research-intensive.

Discussion

Findings in relation to prior research

There are many specific factors that STEM-Promising female undergraduate students report as influencing their decision to attend a non research-intensive university that support findings of prior research. Hoyt and Brown's meta-analysis (2013) examining the most frequently cited factors that influence student choice of institution (regardless of gender or type of postsecondary institution) ranked the top seven factors, in order, as academic reputation, location, quality of instruction, availability of programs, quality of faculty, reputable program, and job outcomes. Only job outcomes, identified as "jobs for graduates" in this study of females at non research-intensives, and were found among our top seven factors with those of Hoyt and Brown. Three of the top seven factors in this study (class size, campus environment/aesthetic, and size of institution), however, were located within Hoyt and Brown's top 20. Further, in contrast to their findings, STEM-Promising female undergraduate students here were more likely to disagree that student employment, social-related factors, admissions requirements, and availability of graduate programs influenced their decision. Because Hoyt and Brown's study measured influence on *both* genders at *all* types of institutions, and this study is specific to *females at a non research-intensive*, these differences may be based on gender or on type of institution attended. Specifically with regard to females, when Hoyt and Brown analyzed factors for statistically significant differences among various demographic groups, they identified campus safety as being markedly more important to females than males. This study supports that finding; campus safety was ranked as the 10th most important factor out of 45 (odds=3.84) in this study of females.

The results of Cho, et al. (2008) demonstrated first generation female college students were more sensitive to psychological or social, non-academic factors, such as perceived safety, social climate, and having friends present on campus. They recommended additional research be conducted to improve university recruitment and marketing strategies. Four of the top seven factors STEM-Promising female undergraduate students, regardless of major, reported as influencing their decision, were categorized as non-academic factors (campus environment/aesthetic, visit to campus, university population size, and weather/climate). This, in combination with other results shown in Table 1, demonstrates STEM-Promising females at this non research-intensive university weighed the importance of non-academic factors as high, or higher, than many critical academic factors. Based on the findings, females at this non research-intensive setting, in fact, do appear to be considering a wide range of academic and non-academic factors when making the decision to attend the university.

New findings adding to the conversation

When STEM majors at the non research-intensive institution, who were also accepted to a research-intensive university, were asked to report which factors negatively influenced their decision whether to attend a research-intensive university, only two factors of 17 were reported. The research-intensive university's population size – a non-academic factor – and the research-intensive university's average class size – an academic factor – were

Statement	Odds	RANK
The university's size was too large/too small, compared to my current institution.	11.50	1
The university's average class size was undesirable, compared to my current institution.	5.25	2
The university's distance to my home was undesirable, compared to my current institution.	0.60	3
I did not think transferring majors, if it became necessary, would be easy.	0.57	4
The housing options were undesirable, compared to my current institution.	0.38	5
The diversity of the university's population was less desirable, compared to my current institution.	0.29	6 (tie)
This university's academic facilities and equipment were undesirable, compared to my current institution.	0.29	6 (tie)
The university's social offerings (clubs/organizations, religious affiliation) did not appeal to me, compared to my current institution.	0.25	8
The university's honors program was not available or attractive to me.	0.18	9
The university did not offer the specific STEM major/department in which I was interested.	0.17	10
The university did not offer research opportunities for undergraduates.	0.16	11
The university did not have a graduate program in the field I wanted to study in the future.	0.10	12
The university did not have a variety of courses that appealed to me.	0.10	13
The university's athletic offerings did not appeal to me, compared to my current institution.	0.06	14 (tie)
I believed I would have more female professors if I attended my current institution.	0.06	14 (tie)
The university did not accept my A.P. course credit.	0.05	16
I was not able to enroll undeclared.	0.00	17

Notes: Odds=1.00 equal likelihood agreement/disagreement; Agreement Odds>1.00; Disagreement Odds<1.0.

Table 2. Factors Negatively Influencing the Decision Whether to Attend a Research-intensive Institution by STEM-Promising Female STEM Majors

undesirable compared to the non research-intensive institution. This provides further evidence that female STEM majors at this non research-intensive institution are heavily concerned about their surrounding environment and social interactions, as well as their academic experience. The magnitude of the odds relating to these two factors (11.5 and 5.25, respectively) deserves careful attention. All other 15 factors at the research-intensive were rated as either *equal to or better than* the non research-intensive institution, yet these STEM-promising female students chose to attend the non research-intensive institution instead. It is clear how powerful the impact of university population size and average class size is on these STEM-Promising female STEM majors' decision to refuse acceptance to the research-intensive institution in favor of the non research-intensive. We believe this is a major finding for this study.

When examining persistence rates, Brainard and Carlin (1998) concluded academic difficulties and low grades contributed to females leaving STEM majors within their first two years of enrollment. Interestingly, in this study, STEM majors (odds=1.94) were nearly three times more likely to report than non-STEM majors (odds=0.76) the availability of academic support and tutoring at the non research-intensive university influenced their decision to attend. We propose these female STEM majors may have anticipated facing a rigorous program of study and possible academic difficulties, potentially affecting their chances of graduate school admission (ranked as 13 of 45, with odds 3.0 for STEM majors), and/or may have been influenced by the historical stereotyping of females being less capable in STEM fields than their male counterparts. Based on this finding, it can be inferred these female STEM majors sought a postsecondary institution that would provide an environment where they could easily find the academic support they may need to succeed.

Other research has hypothesized close interactions between faculty and students existing at non research-intensive institutions leads to increased opportunities and therefore improves persistence of women and minorities in science and engineering (Griffith, 2010; Huang, et al., 2000). Two findings from this case study support this idea. First, STEM majors were significantly (p=0.002) more likely than non-STEM majors to report the faculty's reputation as influencing their decision. This means the promise of working closely with esteemed faculty members was an important consideration for female STEM majors. Second, the most significant finding (p<0.0001) of this study was STEM majors were more likely than non-STEM majors to report undergraduate research opportunities as influencing their decision to attend their non research-intensive institution; we believe this study to be the first to offer this statistical evidence for females, parsed by major, in a non research-intensive setting.

Based on previous research of Wang, et al. (2013) and Mann and DiPrete (2013) suggesting females have more balanced math and verbal abilities, we anticipated finding course variety influenced students' decision; however, we did not anticipate it to be less important to STEM majors (odds=2.0) than non-STEM majors (odds=3.60). We offer two possible explanations. First, given the non-STEM majors in this study are considered to be 'STEM-promising', course variety may be more important to them because they have been engaged in both STEM and non-STEM fields of study. As well, these non-STEM majors have the potential to enter the STEM pipeline at a later point in their postgraduate education, as suggested by Morgan, et al. (2013), so course variety (such as the ability to take STEM courses while a non-STEM major) may be more important to non-STEM majors for this reason. Second, we hypothesize STEM majors who choose to attend a non research-intensive university likely have a strong commitment to studying STEM, may understand a large number of courses are prescribed for graduate school admission, and therefore may be less concerned with course variety. Further research is warranted to substantiate these hypotheses.

Recent attention in public media regarding the importance of female mentors and role models resulted in our anticipating the presence of female professors would influence the decision of the participants, particularly in STEM majors, to attend the non research-intensive institution. In contrast, we found STEM-Promising female undergraduate students across majors reported having female professors *did not* influence their decision (odds=0.20) to attend a non research-intensive university. As well, STEM and non-STEM odds were nearly equal (0.20/0.21, respectively). Additionally, STEM majors admitted to research-intensive and non research-intensive settings reported strong disagreement odds (0.06) with the statement, "I believed I would have more female professors if I attended my current [non research-intensive] institution." This repudiates the proposition that female faculty are key to female student recruitment into STEM programs. This finding warrants further study at a larger scale, given recent attention and implications for expectations on faculty for mentorship in STEM fields. It is possible STEM-Promising females identify mentorship as important (and is supported by STEM odds=3.80 for faculty reputation influencing college decision), but that they are not concerned with gender-affinity in their mentor relationships.

The lack of reported influence (odds=0.18) of the university's Living Learning Communities program (referred to as LLC's or LLP's in the literature), where students "live together in the same on-campus residence location, share academic experiences, and have access to resources provided directly to them within the residence hall" (Grays, 2013; p.14) on the STEM-Promising females' decision of which university to attend, is also in contrast to prior research findings. In a national study examining the effect of such programs on women's plans to attend graduate school in STEM fields, Szelenyi and Inkelas (2010) demonstrated female-only STEM LLPs influenced STEM graduate school aspirations, compared to co-ed STEM LLPs, other LLPs, and traditional residence halls. It is possible that the participants in this survey, at an institution that utilizes the LLC paradigm, were not aware of the evidence supporting STEM females at the time that they made their college decision, given no targeted recruitment or marketing of females in STEM is conducted at this institution.

Recommendations and Conclusions

As shown in this case study, STEM-Promising females appear to be considering a wide range of academic and non-academic factors when choosing to attend a non research-intensive institution. Given the differences in the influence of specific factors between STEM and non-STEM majors, despite all students having been classified as STEM-Promising, we concur with the recommendations of Everett (2012) and Cho, et al. (2008) that recruitment efforts be personalized for maximum effectiveness in raising the number of females who successfully enter STEM majors and professions. For example, recruitment materials can cite the research shows that smaller average class sizes at non research-intensive institutions leads to increased student-faculty interactions and potential for involvement in undergraduate research opportunities, which has the greatest significant difference in influence between STEM and non-STEM majors. As well, admissions representatives can highlight opportunities for academic support and tutoring, shown here to be significant in these female STEM majors decision-making, which are provided at the institution. Further, better communication of the *academic* advantages of what may be perceived by a prospective student as a *non-academic* factor, such as a Living Learning Community/Program (LLC/LLP), likely needs to be clearly articulated during the decision process of prospective female STEM majors for this influence of this factor to rise. However, despite this call for personalized recruitment and marketing strategies tailored to each institution and with an emphasis on female-specific factors, we are *not* recommending separate admissions and marketing materials be produced and distributed by gender. Instead, we propose all materials developed and recruitment activities undertaken by non research-intensive institutions should highlight the factors shown to be of influence to female STEM majors.

We find most encouraging the prior research that suggests non research-intensive institutions 'naturally' present supportive environments for females in STEM and that they possess several of the key supports (such as smaller class size and greater student-faculty interaction) for their success, without having to create or increase expenditures on new programs specifically designed for female STEM students. This emphasis on communicating the existing strengths of the non research-intensive postsecondary setting on female student success in STEM seems to be a highly strategic and cost-effective measure for non research-intensive institutions, which typically have less STEM-specific marketing funding to deploy than larger research-intensive universities.

As the case study results reported here are for only one institution, we encourage use of the survey created for this study by additional institutions that wish to conduct research into their students' enrollment decision process, modifying the instrument appropriately to include dimensions unique to their institutions and to their student populations. Future research also should be expanded to include female STEM majors attending research-intensive universities, but also accepted to non research-intensive ones (the opposite of the condition in this case study), to determine how STEM-Promising females in these larger institutions and settings report the factors that influenced their decision.

Moving forward, we encourage postsecondary institutions to evaluate the impacts of their targeted marketing and recruitment efforts and to publish their findings. Rather than being a 'best kept secret' in STEM education, it would seem it is time to share non research-intensive institutions' success more broadly among their applicant pools and the public media. If these non research-intensive postsecondary institutions that reportedly provide a more supportive learning environment for females in STEM undertake such efforts, they may address not only closing the gap between genders in representation in STEM careers, but also more substantially patch the leaky STEM pipeline and attend to the national concern regarding the perceived weakness in global economy.

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