

# COLLECTIF:

## Examining the Value and Utility of a Women's College Education in North America

IN PARTNERSHIP WITH THE  
WOMEN'S COLLEGE COALITION

## **COLLECTIF:**

# Examining the Value and Utility of a Women's College Education in North America

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## FORWARD

2020 IS A HISTORIC YEAR for both Mount Saint Mary's University and women's advancement writ large. Here at the Mount, we're celebrating 95 years of educating women in Los Angeles. Nationwide, 2020 marks the 100th anniversary of the passage of the 19th Amendment, guaranteeing and protecting women's constitutional right to vote. In the 1960s, women of color marched and protested to ensure these theoretical rights became reality for all disenfranchised Americans. Today, we're starting to see local and national leadership better reflect the rich diversity of our country—including the first woman vice president in American history, Kamala Harris.

These milestones remind us that our work toward gender equity today has a long lineage. Suffragettes, women who were excluded from the early feminist movement, their male allies, and their successors created ripples, and then waves, that have impacted every industry and every generation of leadership in America. Women's colleges and institutions are, in part, responsible for creating these tides of change as they have empowered leaders across generations. Now, the question is: How will our women's colleges effect change in the generations to come?

In this, the third volume of *Collectif*, the Center for the Advancement of Women at Mount Saint Mary's and the Women's College Coalition come together to investigate questions related to the relevance and utility of women's universities today. Fifty years ago, 230 women's colleges and universities thrived across the United States; today, fewer than 40 remain. The Women's College Coalition of 37 women's college and universities in North America understand the importance of our work in the landscape of higher education. Our members are singularly focused on gender equity and creating the next generation of women who will lead. That's why, in this joint volume, we investigate the modern "value add" of women's universities (both qualitatively and quantitatively) and showcase specific institutional initiatives that are advancing the gender equity agenda.

### **In this volume**

The volume begins with Kathryn A. E. Enke's quantitative study, titled *Access and Opportunity at American Women's Colleges: Contemporary Findings*, that compares access and opportunity at American women's colleges to co-ed liberal arts colleges and public universities. Her findings reveal that women's colleges and universities continue to advance women's social and economic opportunity by providing access and achieving positive outcomes for women who are often underserved by higher education. Rather than relying on anecdotal evidence to suggest women's colleges and universities bring value, Enke's work provides a contemporary, data-driven exploration of student demographics and outcomes at American women's colleges.

Two articles focus on academic degrees or programming created at women's colleges to ensure there is fair representation in nontraditional settings like Science, Technology, Engineering, and Mathematics (STEM) and entrepreneurial contexts. The first, by Audrey J. Ettinger, Jennifer D. Hayden, and K. Joy Karnas, explores how establishing specialized scientific majors at Cedar Crest College impacted the later career choices and experiences of their graduates in an article titled *Research Experiences Kick-Starting Careers: The Next Generation of Scientists Starts Here*.

The authors examine the history of specialized majors at the College and analyze interviews and surveys with faculty and alumnae who pursued either traditional careers in scientific research or other research-informed careers. The authors conclude that specialized majors and research experiences at a women's college may grow the number of women who persist through the STEM pipeline.

Similarly, in *Who, Me? Increasing High School Girls' Entrepreneurial Self-Efficacy, Knowledge and Intentions*, Melissa Jean and Colleen M. Sharen provide a case study of two female-only entrepreneurship education programs designed by Brescia University College faculty to address the gender gap found in women's participation in entrepreneurial activities. Findings reveal that the gender-specific programming effectively increased entrepreneurial self-efficacy and that each program significantly increased both objective and self-perceived knowledge of entrepreneurship. The authors conclude that the female-only educational interventions helped to transform adolescent girls' sense of entrepreneurial possibilities.

The volume closes with Jonathan M. Green's investigation, titled *Exploring Writing Center Work in a Women's College*, which combines primary and secondary research to assess the benefits, challenges, and opportunities presented by doing writing center work at a small women's liberal arts college. The project synthesizes the existing research on the "feminization" of the writing center with interview responses from tutors at the Cottey College Writing Center. The project concludes that while writing tutors at single-sex institutions may have advantages when it comes to building solidarity with students who use the writing center resources, they may also contend with certain gender stereotypes that are exacerbated by the single-sex nature of their institution.

This collection of articles focused on women's colleges, along with programming specific to women and girls developed in these contexts, suggests that there is significant value in these institutions. For those of us who work at women's colleges, these results aren't surprising. However, the more we can educate others about the important work coming out of these institutions, the more likely that the 37 North American institutions will continue to flourish. We hope this volume will be useful to all who advocate for women's colleges and universities in conversations with prospective students, donors, employers, and policymakers across North America.

Emerald Archer, PhD

Director

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## Access and Opportunity at American Women's Colleges: Contemporary Findings

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**Abstract.** American women's colleges were founded to create access and opportunity for women in higher education, and 36 continue to operate toward that mission in 2020. While historical and anecdotal evidence shows the value of women's colleges, contemporary research about student demographics and outcomes at American women's colleges is limited. This study is designed to fill this gap in literature. It uses quantitative research methods to compare access and opportunity at American women's colleges to liberal arts colleges and public universities. The findings reveal that women's colleges are enrolling students similar in demographic profile to public universities (enrolling those who have been historically less well served by higher education) and achieving completion rates like liberal arts colleges (statistically higher than public universities). Women's colleges, then, continue to advance women's social and economic opportunity by providing access and achieving positive outcomes for women who are often underserved by higher education.

**Biography.** Kathryn A. E. Enke is Chief of Staff and Lead Title IX Coordinator at the College of Saint Benedict, a college for women. In this role, she ensures effective execution of presidential priorities and initiatives and provides strategic and confidential guidance to the president on a diverse range of institutional matters. She coordinates the work of the college's Board of Trustees and its committees, and, as lead Title IX coordinator, she oversees the college's policies, practices, and training related to sexual misconduct and sex discrimination. Enke earned a BA in history from the College of Saint Benedict, and an MA and PhD in educational policy and administration from the University of Minnesota, Twin Cities, with a specialization in higher education. Her research focuses broadly on the ways that individuals' identities mediate their experiences in higher education.

## INTRODUCTION

Historically, women's colleges played a vital role in providing higher education pathways for women in the United States. At a time when higher education was restricted to men, American women's colleges were founded to create access and opportunity for women in higher education. Today, women's colleges globally continue to educate hundreds of thousands of students every year, providing access in places where educational opportunities for women are few, creating welcoming campus climates for women, developing women leaders, empowering students and communities, and symbolizing women's potential (Renn, 2014). However, the contemporary narrative around American women's colleges is one of decline (e.g., Jaschik, 2017; Garsd, 2015), noting the waning number of women's colleges and questioning their ongoing relevance given that most college students are women.

As of 2020, there are 36 American women's colleges, down from 46 just six years ago,<sup>1</sup> and about 230 women's colleges in 1960 (Women's College Coalition, 2020). Many of the holdouts have updated their mission: to serve transgender students, to admit men in certain programs, or to partner or merge with other nearby men's and coeducational institutions. A complete list of American women's colleges as of October 1, 2019, is shared in Table 11.

This quantitative study explores the contemporary role of American women's colleges in providing access to and opportunity within higher education. As an alumna and employee of a women's college, I was frustrated by the lack of available data and the reliance on outdated and anecdotal evidence in making the case for single-sex higher education. And, as a scholar of women's experiences in higher education, my commitment to improving women's education—in all educational contexts—informed the research design. The purpose, then, is not a narrow defense of women's colleges in response to the narrative of decline, but instead to analyze and share quantitative data about the contemporary women's college experience.

## A BRIEF REVIEW OF LITERATURE

As the number of American women's colleges has declined, the research, too, around American women's colleges has been in decline. While significant positive effects of attending a women's college—including higher educational and occupational achievement among women's college graduates—are noted in multiple studies (e.g., Kim & Alvarez, 1995; Riordan, 1994; Smith, 1990; Solnick, 1995; Tidball, Smith, Tidball & Wolf-Wendel, 1999), these studies are now decades old. More recent attention focuses on women's colleges globally (Fischer, 2019; Renn, 2014) or the contemporary arguments against single-sex colleges (Miller-Bernal & Poulson, 2011). Research in K-12 educational settings generally conclude that gender-segregated schooling has negative rather than

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<sup>1</sup> Since 2014, eight women's colleges began admitting men into their daytime undergraduate programs: Columbia College (South Carolina) in 2020; University of Saint Joseph (Connecticut) in 2018; Midway University (Kentucky) in 2016; College of Saint Elizabeth (New Jersey) in 2015; Saint Mary-of-the-Woods College (Indiana) in 2015; Chatham University (Pennsylvania) in 2014; Pine Manor College (Massachusetts) in 2014; College of New Rochelle (New York) in 2016 (and merged into Mercy College in 2019). Since 2014, two women's colleges closed: Lexington College (Illinois) in 2014; Colorado Women's College ceased admitting students in 2015.

positive effects, including gender stereotyping (Fabes, Martin, Hanish, Galligan & Pahlke, 2015), heteronormativity (McCall, 2014), and institutional sexism (Halpern et al., 2011).

Limited recent research on experiences at American women's colleges finds that students at women's colleges are more engaged in their education than women at coeducational colleges and that transfer students, in particular, are more engaged at women's colleges than at coeducational colleges (Kinzie, Thomas, Palmer, Umbach, & Kuh, 2007). Reinforcing those findings, additional research suggests that faculty at women's colleges have significantly greater contact with students, diverse classroom interactions, and emphasis on intellectual skills than faculty at coeducational colleges (Laird, Niskodé-Dossett, & Garver, 2009).

### **Comparative Alumnae Research Study**

A Comparative Alumnae Research Study conducted in partnership with the Women's College Coalition (Hardwick-Day, 2012) used interview data to compare the experiences of alumnae from the graduating classes of 1990-2006 from women's colleges to alumnae from those same class years at four-year liberal arts colleges and a public university group. Within this study, women's college alumnae were more likely than their peers at the comparison colleges to report that they earned a bachelor's degree in four years or less, earned a graduate degree, and were "completely satisfied" with the overall quality of their education. The results indicated that alumnae of women's colleges graduating between 1990 and 2006 view their education positively and point to practically significant ways that their women's college experience positively impacted their lives, leadership, and worldviews.

These data, while compelling, are self-reported, and may be impacted by alumnae nostalgia about their women's college experiences and defensiveness about those experiences given the public narrative around the decline of the sector. In addition, the study notes several meaningful differences in experience that were attributed to women's colleges but could also be replicated in coeducational environments: for example, women's college alumnae indicated they were more likely than alumnae in the public university group to have lived on campus all four years, an experience positively correlated with other kinds of engagement on campus (Pascarella & Terenzini, 2005).

The comparison groups used in the Comparative Alumnae Research Study are notable. Public universities provide a relevant comparison because of the important ways they differ from both women's colleges and liberal arts colleges: in size, institutional control, graduation and retention rates, and institutional focus. Given these factors, we might expect to observe differences in access and opportunity between institutional contexts. And, four-year liberal arts colleges provide a relevant comparison group because nearly half of remaining women's colleges (16 of 36) are classified by The Carnegie Classification of Institutions (2015) as Baccalaureate Colleges: Arts & Science Focus. We might expect access and opportunity at liberal arts colleges and women's colleges to be somewhat similar given these factors.

## **Liberal Arts Colleges**

Liberal arts colleges are strictly defined based on the number of students who pursue certain subjects of study. In practice, liberal arts colleges are committed to undergraduate education in small residential living and learning environments. Liberal arts colleges generally enroll between 500 and 3,000 students each. They stress the importance of student-faculty relationships; faculty members are committed to their teaching and advising roles and class sizes are small (Annapolis Group, n.d.). Liberal arts colleges generally require a set of core courses that are deemed essential to a broad-based education. An emphasis on liberal education is not exclusive to liberal arts colleges, but such an emphasis is most likely to occur at liberal arts colleges (Impacts, 2005).

It is clear from decades of research that liberal arts colleges provide distinctive benefits to students (Astin, 1999; Canada, 1999; Impacts, 2005; Kuh & Umbach, 2004; Pascarella & Terenzini, 2005; Pascarella, Wolniak, Cruce, & Blaich, 2004; Umbach & Kuh, 2006). For example, after controlling for confounding influences, Pascarella et al. (2004) determined that liberal arts colleges performed significantly better than research universities and regional institutions on nearly all Chickering and Gamson's (1991) good practices for undergraduate education during a student's first year. As an overlapping subset of colleges, though, there is little updated information about the distinctive benefits (or disadvantages, for that matter) of women's liberal arts colleges.

## **Access**

As noted above, women's colleges' historical missions were to provide access to a group of students underserved by other sectors of higher education. While women students are no longer underrepresented in higher education—the number of women in higher education has exceeded the number of men for five decades (U.S. Department of Education, 2019)—there are plenty of women that continue to be underserved, including women of color, nontraditional aged college students and low-income students. For the purposes of this study, then, I considered the demographic and academic characteristics of women at American women's colleges compared to other types of colleges in the United States, including variables like race/ethnicity, age, socioeconomic status, and SAT and ACT scores.

## **Opportunity**

Further, to extend the findings of the Hardwick-Day (2012) study, I sought quantitative data that would not rely on alumnae self-reporting to measure the opportunity effects of college. Retention and completion rates are one measure of opportunity: that is, the full advantages of college are not fully realized until a student persists in and completes a degree program. In addition, women have historically been underrepresented in science, technology, engineering, and mathematics (STEM) fields, and this has been an area of national interest in recent years. One might expect women's colleges to play a role in closing that gender gap, as a way of expanding opportunity for women.

Social mobility rankings provide another measure. Opportunity Insights (Chetty, Friedman, Saez, Turner & Yagan, 2017), in part, provides estimates about which

colleges in America contribute the most to intergenerational mobility. Opportunity Insights, a non-partisan non-profit at Harvard University that uses “big data” to inform policy changes to improve economic mobility, estimates and makes publicly available statistics on students’ earnings in their early thirties and their parents’ incomes. The “mobility rating” of each college, accounting for the percent of students who have parents in the bottom 20% of the income distribution and reach the top 20% of the income distribution after graduation, is a particularly useful way to assess the ways that colleges contribute to social mobility and opportunity. This study uses the Opportunity Insights data set provided publicly at <https://opportunityinsights.org/> to interrogate, specifically, the role that American women’s colleges play in advancing women’s success and economic opportunity.

## METHODS

This study uses quantitative research methods to provide more contemporary information about access and opportunity at American women’s colleges. | It focuses on two primary research questions: (1) What role do American women’s colleges play today in providing access to higher education? and (2) What role do American women’s colleges play today in advancing women’s success and economic opportunity? (See Table 1 for primary and secondary research questions.)

**TABLE 1. RESEARCH QUESTIONS**

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What role do American women’s colleges play in providing access to higher education?

- How do students at American women’s colleges compare demographically to women at other types of colleges in the United States (i.e. race/ethnicity, age, socioeconomic status)?
- How do students at American women’s colleges compare academically to women at other types of colleges in the United States (i.e. SAT and ACT standardized test scores)?

What role do American women’s colleges play today in advancing women’s success and economic opportunity?

- How do retention and completion rates at America’s women’s colleges compare to retention and completion rates at other types of colleges in the United States?
  - How do retention and completion rates of students from traditionally underrepresented groups compare (i.e. Pell Grant recipients, American Students of Color)?
  - How do the number of degrees conferred by women’s colleges in STEM fields compare to the number of degrees conferred to women in STEM fields at other types of colleges in the United States?
  - How do women’s colleges’ social mobility ratings (percent of students who have parents in the bottom 20% of the income distribution and reach the top 20% of the income distribution) compare to mobility ratings at other types of colleges in the United States?
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## Procedures

I used publicly available data to compare the demographic and academic characteristics of students at American women's colleges to students at two other groups of educational higher education institutions. I constructed two comparison groups following on the example of Hardwick-Day (2012): I defined a population of "liberal arts colleges" to include all four-year institutions classified by The Carnegie Classification of Institutions (2015) as Baccalaureate Colleges: Arts & Science Focus (N = 226). These colleges emphasizes undergraduate education, award at least 50% of their degrees in fields classified as liberal arts and are ranked as National Liberal Arts Colleges by the *U.S. News Best College* rankings. And, I defined a "public universities" group to include all four-year public nonprofit institutions that are not fully online (N = 556). The group includes baccalaureate, master's and doctorate institutions, as well as special focus schools and tribal colleges that offer baccalaureate degrees or above.

I extracted 2017-18 data for 34 American women's colleges and the above-described comparison groups from the Integrated Postsecondary Education Data System (IPEDS; U.S. Department of Education, 2019). The two additional existing women's colleges (Douglass Residential College of Rutgers University and Russell Sage College of the Sage Colleges) reported data only as part of larger systems, so relevant data was not publicly available. I also extracted mobility ratings from Opportunity Insights (Chetty et al., 2017); mobility ratings were calculated for over 2,200 colleges and universities, including 27 of the 36 women's colleges.

I used one-way analyses of variance (ANOVAs) to examine whether American women's colleges differ from liberal arts colleges and/or public universities with respect to the following research variables: student age; student race and ethnicity; student socioeconomic status; student standardized test scores; retention; completion; degrees earned in STEM fields; and social mobility rating.

The Shapiro-Wilk test for normality (Shapiro & Wilk, 1965) indicated that not all variables were normally distributed for the women's college and comparison groups, and *Levene's F* test (Levene, 1960) indicated that the variances of some variables were not homogenous. As such, *Welch's F* test (Welch, 1947) was used to assess statistically significant main effects, with an alpha level of .05 for all analyses. Post hoc comparisons using the Games-Howell post hoc procedure (Games & Howell, 1976) were conducted to determine which pairs of colleges differed significantly. Within this paper, results focus on the differences between women's colleges and one or both comparison groups.

These procedures lead to findings that are contemporary (using the most recently available data), easily replicable (using standardized and publicly available data) and easy to understand (using simple statistical methods), thus maximizing study validity.

## FINDINGS

### Access

Analyses show that students at American women’s colleges differ demographically from women at liberal arts colleges nationally, and are, on average, more comparable in selected demographic characteristics to students at public universities. See descriptive statistics in Table 2. Academically, students at American women’s colleges are not significantly different than students at liberal arts colleges or public universities.

**TABLE 2. DEMOGRAPHIC CHARACTERISTICS OF WOMEN IN COLLEGE**

	Women’s Colleges	Liberal Arts Colleges	Public Universities
<b>AGE OF UNDERGRADUATE WOMEN, 2017</b>			
Under 18 years	3.0%	3.2%	5.1%*
18-24 years	50.6%	90.9%*	77.5%
25-65 years	16.6%	6.0%*	17.2%
Over 65 years	0.2%	0.3%*	0.2%
<b>RACE/ETHNICITY OF UNDERGRADUATE WOMEN, 2017</b>			
American Indian/Alaska Native	0.4%	0.6%	1.2%*
Asian/Native Hawaiian/Pacific Islander	6.0%	4.1%	5.0%
Black/African American	18.5%	11.7%	14.4%
Hispanic/Latino(a)**	12.8%	8.4%	13.2%
White	49.8%	61.5%*	56.4%
2 or more races	4.2%	3.4%	3.9%
Race/ethnicity unknown	3.3%	4.9%	3.1%
Nonresident alien	5.0%	5.1%	2.8%
<b>SELECTED GROUPS, AS A PERCENTAGE OF UNDERGRADUATE WOMEN OF KNOWN RACE, 2017</b>			
American women of color	43.5%	29.9%*	39.0%
White	51.3%	64.8%*	58.2%
Nonresident alien	5.2%	5.3%	2.8%
<b>SOCIOECONOMIC STATUS OF FULL-TIME FIRST-TIME UNDERGRADUATES, 2016-2017</b>			
Mean percentage awarded Pell Grants	43.2%	32.6%*	40.3%

Source: IPEDS, 2019.

\* The mean is significantly different than women’s colleges, at the 0.05 level. Only significant differences between the comparison groups and women’s colleges are noted. Additional significant differences were noted between liberal arts colleges and public universities. Meaningful differences in the context of this study of women’s colleges are addressed within the text.

\*\* Hispanic/Latino(a) is the category reported within IPEDS, so it will be used within this paper.

AGE. One-way ANOVAs for each of four age ranges indicated statistically significant main effects, indicating that not all groups had the same percentage of students under 18 years, 18-24 years, 25-65 years, or over 65 years. Post hoc comparisons were conducted to determine which pairs of colleges differed significantly for each age range. These results are given in Table 3. Undergraduate women at women’s colleges are statistically more likely to be 25-64 years old than undergraduate women at liberal arts colleges (16.6% vs. 6.0%), and statistically less likely to be 18-24 years old (50.6% vs. 90.9%) or over 65 years (0.2% vs. 0.3%). Because of the small percentages of students over 65 years in all study groups, in general women’s college students are more likely to be older than liberal arts college students are, whereas liberal arts college students are more likely to be traditional college-aged students than women’s college students are.

**TABLE 3. POST HOC RESULTS FOR AGE OF UNDERGRADUATE WOMEN, 2017**

	DIFFERENCE IN MEANS (I - J)			
	J.	Women’s Colleges	Liberal Arts Colleges	Public Universities
PERCENTAGE UNDER 18 YEARS, WELCH’S $F(2, 91.20) = 7.70, P < .05$				
I. Women’s Colleges ( $M = 3.0$ )		–		
Liberal Arts Colleges ( $M = 3.2$ )		0.3	–	
Public Universities ( $M = 5.2$ )		2.2*	1.9*	–
PERCENTAGE 18-24 YEARS, WELCH’S $F(2, 87.82) = 68.61, P < .001$				
I. Women’s Colleges ( $M = 80.6$ )		–		
Liberal Arts Colleges ( $M = 90.9$ )		10.4*	–	
Public Universities ( $M = 77.5$ )		-3.1	-13.4***	–
PERCENTAGE 25-64 YEARS, WELCH’S $F(2, 85.84) = 65.91, P < .001$				
Women’s Colleges ( $M = .6.6$ )		–		
Liberal Arts Colleges ( $M = 6.0$ )		-10.6*	–	
Public Universities ( $M = 17.2$ )		0.6	11.2***	–
PERCENTAGE OVER 65 YEARS, WELCH’S $F(2, 68.39) = 3.28, P < .05$				
Women’s Colleges ( $M = 0.2$ )		–		
Liberal Arts Colleges ( $M = 0.3$ )		0.2*	–	
Public Universities ( $M = 0.2$ )		0.1	-0.1	–

\*  $p < .05$ , \*\*\*  $p < .001$

RACE AND ETHNICITY. Similarly, one-way ANOVAs indicated statistically significant main effects for the percentages of American women of color, white women, and nonresident alien women, among undergraduate women of known race. Post hoc comparisons were conducted to determine which pairs of colleges differed significantly for each selected group. These results are given in Table 4. Women’s colleges enroll a statistically higher percentage of undergraduate women of color than liberal arts colleges (43.4% vs. 29.9%). The race/ethnicity profile of undergraduate women at women’s colleges is similar to the profile at public universities nationally (43.4% American students of color at women’s colleges vs. 39.0% American students of color at public universities).

**TABLE 4. POST HOC RESULTS FOR SELECTED GROUPS AS A PERCENTAGE OF UNDERGRADUATE WOMEN OF KNOWN RACE, 2017**

	DIFFERENCE IN MEANS (I - J)			
	J.	Women’s Colleges	Liberal Arts Colleges	Public Universities
PERCENTAGE AMERICAN WOMEN OF COLOR, <i>WELCH’S F</i> (2, 89.05) = 14.57, <i>P</i> < .001				
I. Women’s Colleges (M = 43.5)		–		
Liberal Arts Colleges (M = 29.9)		-13.6*	–	
Public Universities (M = 39.0)		-4.5	9.1***	–
PERCENTAGE WHITE WOMEN, <i>WELCH’S F</i> (2, 89.78) = 9.20, <i>P</i> < .001				
Women’s Colleges (M = 51.3)		–		
Liberal Arts Colleges (M = 64.8)		13.4*	–	
Public Universities (M = 58.2)		6.8	-6.6*	–
PERCENTAGE NONRESIDENT ALIEN WOMEN, <i>WELCH’S F</i> (2, 79.93) = 18.21, <i>P</i> < .001				
Women’s Colleges (M = 5.0)		–		
Liberal Arts Colleges (M = 5.1)		0.1	–	
Public Universities (M = 2.8)		-2.2	-2.3***	–

\* *p* < .05, \*\*\* *p* < .001

SOCIOECONOMIC STATUS. With regard to the socioeconomic status of students, a one-way ANOVA indicated a statistically significant main effect, indicating that not all groups of colleges included in the study had the same percentage of students awarded Pell Grants in 2016-2017. Post hoc comparisons were conducted to determine which pairs of colleges differed significantly, and these results are given in Table 5. Full-time first-time undergraduates at women’s colleges are significantly more likely to have been awarded a Pell Grant than students at liberal arts colleges (43.2% vs. 32.6%), indicating that students at women’s colleges are more likely to come from families with limited financial means. On this variable, the socioeconomic profile of full-time first-time undergraduates at women’s colleges is similar to public universities.

**TABLE 5. POST HOC RESULTS FOR SOCIOECONOMIC STATUS OF FULL-TIME FIRST-TIME UNDERGRADUATES, 2016-2017**

	DIFFERENCE IN MEANS (I - J)			
	J.	Women's Colleges	Liberal Arts Colleges	Public Universities
PERCENTAGE AWARDED PELL GRANTS, WELCH'S $F(2, 85.85) = 13.98, P < .001$				
I. Women's Colleges (M = 43.2)		–		
Liberal Arts Colleges (M = 32.6)		-10.65*	–	
Public Universities (M = 40.3)		-2.89	7.76***	–

\*  $p < .05$ , \*\*\*  $p < .001$

**STANDARDIZED TEST SCORES.** Scores on the ACT and SAT standardized tests are one proxy for academic status. One-way ANOVAs of average composite ACT, SAT math, and SAT evidence-based reading and writing scores for first-year students indicated a statistically significant main effect, indicating that not all groups of colleges included in the study had the same percentile scores on these tests. Post hoc comparisons indicated that only the liberal arts colleges and public universities groups differed on these variables, so these statistical results are not detailed within this paper. As noted above, academically, students at American women's colleges are not significantly different than students at liberal arts colleges or public universities. Average composite, math, and reading and writing scores on the ACT and SAT standardized tests for first-year students at women's colleges fall in between averages for students at liberal arts colleges and public universities (with students at liberal arts colleges scoring significantly higher than students at public universities).

### Opportunity

The ways that college attendance contributes to opportunity can be measured in multiple ways. As noted in Table 1, this study measures opportunity in terms of retention and completion rates, degree conferral in STEM, and social mobility.

**RETENTION.** Retention rates measure the persistence of students from first year to second year of college. A one-way ANOVA of retention rates indicated no significant differences in retention for part-time students at the three types of colleges (*Welch's*  $F(2, 29.51) = 2.11, p = .139$ ). See descriptive statistics in Table 6. A similar analysis indicated statistically significant main effects for full-time students (*Welch's*  $F(2, 85.53) = 9.58, p < .001$ ). Post hoc comparisons indicated that the retention rate for full-time students at liberal arts colleges was significantly higher than at public universities, but neither comparison group differed from women's college retention rates in a statistically significant way.

**TABLE 6. 2017 RETENTION RATES OF ALL STUDENTS**

	Women's Colleges	Liberal Arts Colleges	Public Universities
Full-time students	77.3%	79.8%	75.7%
Part-time students	36.3%	39.9%	47.8%

Source: IPEDS, 2019.

COMPLETION. For this study, completion rates were measured as graduation with a bachelor's degree within six years of beginning college. Mirroring national trends, completion rates at each of the college groups varied by demographic characteristics of students. See descriptive statistics in Table 7.

One-way ANOVAs of completion rates were conducted for all women at the three types of colleges, by each race/ethnicity group reported within IPEDS, and for Pell Grant recipients. Statistically significant main effects emerged in all analyses, indicating that not all types of colleges had the same completion rates for any of the demographic subgroups. Post hoc comparisons were conducted to determine which pairs of colleges differed significantly for each demographic variable. These results are given in Table 8.

There was a significant difference in the six-year bachelor's degree completion rates for women at women's colleges and women at public universities (62.2% vs. 54.0%). Completion rates for women at women's colleges were statistically similar to women students at liberal arts colleges (68.9%).

**TABLE 7. 2017 COMPLETION RATES OF ALL STUDENTS – BACHELOR'S DEGREE WITHIN SIX YEARS**

	Women's Colleges	Liberal Arts Colleges	Public Universities
All women	62.2%	68.9%	54.0%*
BY RACE/ETHNICITY			
American Indian	42.3%	53.5%	41.1%
Asian/Native Hawaiian/Pacific Islander	62.3%	67.9%	53.7%
Black/African American	54.8%	56.7%	40.0%*
Hispanic/Latino(a)	63.2%	62.2%	44.9%*
White	63.1%	67.8%	53.0%*
2 or more races	54.3%	64.4%	45.5%
Race/ethnicity unknown	51.3%	61.4%	49.6%
Nonresident alien	74.0%	69.7%	57.2%*
BY PELL GRANT STATUS			
Pell Grant recipients	59.9%	61.4%	45.2%*

Source: IPEDS, 2019.

\* The mean is significantly different than women's colleges, at the 0.05 level. Only significant differences between the comparison groups and women's colleges are noted. Additional significant differences were noted between liberal arts colleges and public universities. Meaningful differences in the context of this study of women's colleges are addressed within the text.

**TABLE 8. POST HOC RESULTS FOR 2017 SIX-YEAR COMPLETION RATES OF ALL STUDENTS BY SELECTED GROUPS**

	DIFFERENCE IN MEANS (I - J)			
	J.	Women's Colleges	Liberal Arts Colleges	Public Universities
ALL WOMEN, WELCH'S $F(2, 87.91) = 50.13, P < .001$				
I. Women's Colleges ( $M = 62.2$ )		–		
Liberal Arts Colleges ( $M = 68.9$ )		6.7	–	
Public Universities ( $M = 54.0$ )		-8.2*	-14.9***	–
AMERICAN INDIAN STUDENTS, WELCH'S $F(2, 38.12) = 4.79, P < .05$				
Women's Colleges ( $M = 42.3$ )		–		
Liberal Arts Colleges ( $M = 53.5$ )		11.1	–	
Public Universities ( $M = 41.1$ )		-1.3	-12.4*	–
ASIAN/NATIVE HAWAIIAN/PACIFIC ISLANDER STUDENTS, WELCH'S $F(2, 78.40) = 22.46, P < .001$				
Women's Colleges ( $M = 62.3$ )		–		
Liberal Arts Colleges ( $M = 67.9$ )		5.5	–	
Public Universities ( $M = 53.7$ )		-8.7	-14.2***	–
BLACK/AFRICAN AMERICAN STUDENTS, WELCH'S $F(2, 82.63) = 41.75, P < .001$				
Women's Colleges ( $M = 54.8$ )		–		
Liberal Arts Colleges ( $M = 56.7$ )		2.0	–	
Public Universities ( $M = 40.0$ )		-14.7*	-16.7***	–
HISPANIC/LATINO(A) STUDENTS, WELCH'S $F(2, 82.70) = 45.71, P < .001$				
Women's Colleges ( $M = 63.2$ )		–		
Liberal Arts Colleges ( $M = 62.2$ )		-.9	–	
Public Universities ( $M = 44.9$ )		-18.2***	-17.3***	–
WHITE STUDENTS, WELCH'S $F(2, 81.4) = 42.26, P < .001$				
I. Women's Colleges ( $M = 63.1$ )		–		
Liberal Arts Colleges ( $M = 67.8$ )		4.7	–	
Public Universities ( $M = 53.0$ )		-10.1*	-14.7***	–
STUDENTS OF 2 OR MORE RACES, WELCH'S $F(2, 89.78) = 9.20, P < .001$				
Women's Colleges ( $M = 51.3$ )		–		
Liberal Arts Colleges ( $M = 64.8$ )		13.4*	–	
Public Universities ( $M = 58.2$ )		6.8	-6.6*	–
STUDENTS WITH RACE/ETHNICITY UNKNOWN, WELCH'S $F(2, 76.02) = 36.52, P < .001$				
Women's Colleges ( $M = 54.3$ )		–		
Liberal Arts Colleges ( $M = 64.4$ )		10.1	–	
Public Universities ( $M = 45.5$ )		-8.8	-18.9***	–

NONRESIDENT ALIEN STUDENTS, WELCH'S  $F(2, 70.33) = 18.23, P < .001$

Women's Colleges ( $M = 74.0$ )	–		
Liberal Arts Colleges ( $M = 69.7$ )	-4.3*	–	
Public Universities ( $M = 57.2$ )	-16.8*	-12.4***	–
PELL GRANT RECIPIENTS, WELCH'S $F(2, 85.54) = 56.23, P < .001$			
Women's Colleges ( $M = 59.9$ )	–		
Liberal Arts Colleges ( $M = 61.4$ )	1.5	–	
Public Universities ( $M = 45.2$ )	-14.7***	-16.2***	–

\*  $p < .05$ , \*\*\*  $p < .001$

Six-year graduation rates at women's colleges were also significantly higher than at public universities for several groups of historically underserved students, including Black or African American students, Hispanic/Latino(a) students, nonresident alien students, and Pell Grant recipients. Completion rates for these groups at women's colleges are also similar to these groups at four-year liberal arts colleges. Furthermore, liberal arts colleges had a significantly better completion rate than both women's colleges and public universities for American Indian students, Asian American students, and students with race/ethnicity unknown.

We can then conclude that women's colleges are enrolling students similar in demographic profile to public universities (enrolling those who have been historically less well served by higher education) and achieving completion rates like liberal arts colleges (statistically higher than public universities).

STEM DEGREES. In order to assess the opportunity for women in STEM at women's colleges, liberal arts colleges, and public universities, I completed two analyses. See descriptive statistics in Table 9. First, I completed a one-way ANOVA of degrees conferred to women in STEM fields at the three types of colleges, as a percentage of all bachelor's degrees earned by women. A statistically significant main effect emerged, and post hoc comparisons were conducted to determine which pairs of colleges differed significantly. Second, I completed a one-way ANOVA of the percent of bachelor's degrees in STEM fields conferred to American women of color, among women of known race, at the three colleges. Again, a statistically significant main effect emerged, and post hoc comparisons were conducted to determine which pairs of colleges differed significantly. Results from all post hoc comparisons relative to women in STEM are given in Table 10.

**TABLE 9. 2008-09 DEGREES CONFERRED TO WOMEN IN STEM FIELDS**

	Women's Colleges	Liberal Arts Colleges	Public Universities
Degrees conferred to women in STEM fields, as a percent of all bachelor's degrees earned by women	10.8%	14.6%*	10.1%
Percent of bachelor's degrees in STEM fields conferred to American women of color (among women of known race)	34.2%	19.8%*	29.4%

Source: IPEDS, 2019.

\* The mean is significantly different than women's colleges, at the 0.05 level. Only significant differences between the comparison groups and women's colleges are noted. Additional significant differences were noted between liberal arts colleges and public universities. Meaningful differences in the context of this study of women's colleges are addressed within the text.

**TABLE 10. POST HOC RESULTS FOR 2008-09 DEGREES CONFERRED TO WOMEN IN STEM FIELDS**

	DIFFERENCE IN MEANS (I - J)		
	J. Women's Colleges	Liberal Arts Colleges	Public Universities
PERCENT OF ALL BACHELOR'S DEGREES TO WOMEN THAT WERE CONFERRED IN STEM FIELDS, <i>WELCH'S F</i> (2, 94.43) = 17.81, <i>P</i> < .001			
I. Women's Colleges ( <i>M</i> = 10.8)	–		
Liberal Arts Colleges ( <i>M</i> = 14.6)	3.8*	–	
Public Universities ( <i>M</i> = 10.1)	-0.7	-4.5***	–
PERCENT OF STEM BACHELOR'S DEGREES CONFERRED TO WOMEN OF COLOR, AMONG WOMEN OF KNOWN RACE, <i>WELCH'S F</i> (2, 82.17) = 11.00, <i>P</i> < .001			
Women's Colleges ( <i>M</i> = 34.2)	–		
Liberal Arts Colleges ( <i>M</i> = 19.8)	-14.4*	–	
Public Universities ( <i>M</i> = 29.4)	-4.8	-9.5***	–

\* *p* < .05, \*\*\* *p* < .001

The percent of bachelor's degrees earned by women conferred in STEM fields in 2008-2009 was significantly lower at women's colleges than at liberal arts colleges (10.8% vs. 14.6%) and statistically similar to the rate at public universities (10.1%), which serve much larger numbers of students overall.

At the same time, the percent of bachelor's degrees in STEM fields conferred to American women of color, among women of known race, was significantly higher at women's colleges than at liberal arts colleges (34.2% vs. 19.8%), indicating a bright spot of success that is partially due to the strong performance of the historically Black women's college Spelman College, which accounts for over half (53.2%) of STEM degrees conferred to women at American women's colleges. Again, the percent of bachelor's degrees in STEM

fields conferred to American women of color, among women of known race, was similar at women's colleges and public universities (29.4%), which serve much larger numbers of students overall.

**SOCIAL MOBILITY.** For this variable, women's colleges were compared to all other colleges and to mobility ratings for those who did not attend college or went to college later. A one-way ANOVA of social mobility ratings revealed a statistically significant main effect (*Welch's*  $F(2, 30.84) = 126.60, p < .001$ ), and post hoc comparisons were conducted to determine which pairs differed significantly.

There was no significant difference in mobility ratings for women's colleges than for all other colleges. The mean mobility rating (Chetty et al., 2017) for women's colleges was slightly higher than the mean mobility rating for all other kinds of colleges (2.11 vs. 1.82), but well within the standard deviation for the population ( $SD = 1.31$ ).

There was a significant difference between women's colleges and no college ( $p < .05$ ) and a significant difference between all other colleges and no college ( $p < .001$ ). Therefore, mobility is correlated with going to college, generally, matching the findings of Chetty and his colleagues (2007).

Chetty and his co-authors note that variations in mobility rates across colleges do not correlate with differences in fields of study, public/private control, selectivity, completion rates, or cost of attendance. Therefore, the authors caution readers to use mobility to assess specific colleges, not make general comparisons about groups of colleges. While the mobility ratings for individual women's colleges varied widely, sixteen women's colleges (63%) had a mobility rating higher than the median for all rated colleges. Mobility ratings for individual women's colleges are noted in Table 11. A key standout is Mount Saint Mary's University, with a mobility rating within the top 40 nationally.

**TABLE 11. MOBILITY RATINGS OF AMERICAN WOMEN'S COLLEGES, JUNE 2019**

INSTITUTION	LOCATION	MOBILITY RATING*
Agnes Scott College	Georgia	1.474416
Alverno College	Wisconsin	<b>2.660782</b>
Barnard College	New York	<b>3.454579</b>
Bay Path University	Massachusetts	1.704366
Bennett College	North Carolina	<b>3.884872</b>
Brenau University	Georgia	<b>2.090932</b>
Bryn Mawr College	Pennsylvania	<b>1.826379</b>
Cedar Crest College	Pennsylvania	N/A
College of Saint Benedict	Minnesota	1.240949
College of Saint Mary	Nebraska	N/A
Converse College	South Carolina	0.690211
Cottey College	Missouri	N/A
Douglass Residential College of Rutgers University	New Jersey	N/A
Hollins University	Virginia	1.057432
Judson College	Alabama	N/A
Mary Baldwin University	Virginia	1.197596
Meredith College	North Carolina	1.278232
Mills College	California	<b>3.286253</b>
Moore College of Art and Design	Pennsylvania	N/A
Mount Holyoke College	Massachusetts	<b>2.598581</b>
Mount Saint Mary's University	California	<b>6.388687</b>
Notre Dame of Maryland University	Maryland	<b>2.240082</b>
Russell Sage College of the Sage Colleges	New York	N/A
Saint Mary's College	Indiana	0.621336
Salem College	North Carolina	0.848086
Scripps College	California	<b>2.518584</b>
Simmons College	Massachusetts	<b>2.320686</b>
Smith College	Massachusetts	<b>1.8842866</b>
Spelman College	Georgia	<b>3.288828</b>
St. Catherine University	Minnesota	<b>2.049412</b>
Stephens College	Missouri	0.71729
Sweet Briar College	Virginia	0.807196
Texas Woman's University	Texas	<b>2.534088</b>
Trinity Washington University	District of Columbia	N/A
Wellesley College	Massachusetts	<b>2.408345</b>
Wesleyan College	Georgia	N/A

Source: Women's College Coalition, 2019; Chetty et al., 2017.

\* Mobility rankings above the mean for all colleges nationally are bolded.

## DISCUSSION

So, what role do American women's colleges play today in providing access to higher education? This study shows that students at American women's colleges are demographically similar to students at public universities. When compared to students at liberal arts colleges, students at women's colleges are older, more likely to be women of color, and more often from families with limited financial resources. American women's colleges, then, join public universities in creating an access route to higher education for students in these groups.

Given this important access role, we might expect to see differences in academic preparation among new students at women's colleges and liberal arts colleges. Indeed, the data above show that students at liberal arts colleges score significantly higher than students at public universities on the ACT and SAT standardized tests. However, standardized test scores for students at American women's colleges are not significantly different than students at either liberal arts colleges or public universities. ACT and SAT standardized test scores for first-year students at women's colleges fall in between averages for students at liberal arts colleges and public universities.

What role do American women's colleges play today in advancing women's success and economic opportunity? We might expect to see more limited outcomes from women's colleges when compared to liberal arts colleges, given the systematic differences in experiences and outcomes for nontraditional aged college students, people of color, and low-income students. However, retention rates at women's colleges are comparable to retention rates at both liberal arts colleges and public universities. Further, six-year graduation rates at women's colleges are similar to graduation rates at liberal arts colleges and significantly higher than at public universities—indicating a better than expected opportunity for students to complete their degrees at women's colleges.

Six-year graduation rates are also significantly higher at women's colleges than at public universities for the following groups of historically underserved students: women, Black/African American students, Hispanic/Latino(a) students, white students, nonresident alien students, and Pell Grant recipients. The completion rates for these groups of students are statistically no different from liberal arts colleges, who have some of the highest success rates of any type of higher education.

While all degree completions represent a positive opportunity, particular national interest has been paid to the number of bachelor's degrees in STEM fields earned by women. In total, similar percentages of bachelor's degrees in STEM fields were conferred to women at women's colleges and public universities, and the percent of bachelor's degrees in STEM fields earned by women is significantly higher at liberal arts colleges than at women's colleges or public universities.

At the same time, the percent of bachelor's degrees in STEM fields conferred to American women of color, among women of known race, was significantly higher at women's colleges and public universities than at liberal arts colleges.

Similar percentages of bachelor's degrees in STEM fields were conferred to women of color at women's colleges and public universities. Again, this reinforces the narrative that women's colleges provide broader access than liberal arts colleges with similar opportunity, or, alternatively, the narrative that women's colleges provide similar access as public universities with the outcomes expected from more selective liberal arts colleges.

Given the findings above, one might hypothesize that women's colleges help disadvantaged students achieve above average outcomes. But, does that translate into economic and social mobility? As noted above, there was no significant difference in mobility ratings for women's colleges than for other colleges. However, mobility is correlated with going to college, generally, so providing broader access to higher education for traditionally underserved women plays an important role in economic mobility, no matter the educational institution or sector.

Future research could interrogate further the ways that women's colleges advance women's social and economic opportunity by considering shared aspects of public universities and women's colleges that lead to robust educational access, and shared aspects of liberal arts colleges and women's colleges that contribute to social mobility. Colleges across all sectors could consider whether strategies used by women's colleges to support access and opportunity for women could inform practices to support women at other types of institutions.

While the differences between liberal arts colleges and public universities were not a focus of this study, it is clear from the data within that there are important differences in access and opportunity within these sectors. Broadly, public universities provide greater access to women who are historically underserved, and liberal arts colleges provide greater opportunity for women as measured by successful college completion and degree attainment in STEM fields. The differences between liberal arts colleges and public universities was starker than differences between either comparison group and women's colleges.

Given some overlap in the liberal arts college and women's college groups, further research could examine what outcomes are unique to the women's college experience, and what outcomes are related to the liberal arts experience more directly. This is particularly important for those of us who seek to replicate the women's college experience and their intense focus on women's success within other institutional contexts.

Finally, the data compiled by Opportunity Insights (Chetty et al., 2017) are ripe for future research and for informing educational policy and practice. Examining trends among colleges that contribute to higher-than-average social mobility could help all colleges—including women's colleges—improve on this indicator.

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## Research Experiences Kick-Starting Careers: The Next Generation of Scientists Starts Here

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**Abstract.** Despite the current overrepresentation of women as undergraduate students, substantial gender inequities persist in STEM-related careers, and women are consistently underrepresented in a wide array of scientific fields. At Cedar Crest College, educators have addressed this gender gap by providing women a liberal arts education with opportunities to pursue a specialized major in the biological sciences. Here, we examine how this approach was developed and how it has impacted graduates of the College. Interviews with faculty who initialized the specialized majors and independent research programs provide perspectives on the advantages and challenges of these initiatives. Alumnae who pursued either traditional careers in scientific research or research-informed careers responded to surveys about their experiences as undergraduates. These illuminate how their experiences as students before and after implementation of the specialized majors and research-focused programs have impacted their later career choices and experiences. The opportunity to explore novel scientific questions as an undergraduate researcher provided a strong foundation for alumnae as they advanced their careers. Since Cedar Crest graduates go on to pursue a PhD in the STEM fields at a high rate, providing specialized majors and research experiences in the supportive environment of a women's college may have broadened the population of women who persist through the STEM pipeline.

**Biographies.** Audrey J. Ettinger, PhD, is an Associate Professor of Biology and has taught at Cedar Crest College since 2003. She has served as the Director of the Neuroscience Program since 2007, and co-teaches the departmental capstone course Science, Ethics, and Society. She chairs the Cedar Crest Faculty Personnel Committee and serves as the Faculty President-Elect.

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K. Joy Karnas, PhD, is a Professor of Biology and has taught at Cedar Crest College since 2001. She served as the Director of the Genetic Engineering Technology Program from 2002-2014, was the Chair of Biological Sciences from 2014-2017, and is the Director of the College's Honors Program.

## INTRODUCTION

Many sources have documented the continued underrepresentation of women in STEM fields, especially at the highest levels of achievement (e.g. Hill et al., 2010 and Bureau of Labor Statistics, 2020), representing a “Gender Gap to Innovation” according to a Department of Commerce report (Beede et al., 2011). Future success as a scientist requires experience during the formative years; using case studies to illustrate how College initiatives have provided opportunities for women in a time when few opportunities existed, this article shows the direct impact of women’s education, highlighting the value of educating women in a liberal arts setting and stressing the important work that has been accomplished by engaging women in science.

### **Cedar Crest College History in the Biological Sciences**

Cedar Crest College, a private liberal arts college on the outskirts of Allentown, Pennsylvania, has been providing a foundational educational experience for women since 1867—more than 150 years, starting long before most of this country’s historic institutions allowed entry to women. While founded as a finishing school, Cedar Crest evolved to offer a full academic program and currently serves around 1,700 undergraduate and graduate students. Before 1977, science options included the traditional Biology and Chemistry majors, as well as a Medical Technology major with certification. Strong leadership by a female department chair spurred a movement to incorporate more innovative niche science majors in Nuclear Medicine, Genetic Engineering Technology, Neuroscience, and Environmental Conservation. The College’s commitment to the sciences is illustrated not only through the development of modernized majors, but also through the incorporation of independent research projects into the student experience and acquiring instrumentation to support those research programs. Consistent with a focus on research, the 2009 Vision and Change in Undergraduate Biology Education report (AAAS, 2009) emphasized “the integration of authentic research experiences into individual courses and biology programs overall” as a crucial tool for retaining students in the study of biological sciences and helping them develop into competent scientists. Given that female students may enter their undergraduate years with an interest in science, but less “science capital” gained from past experiences (Archer et al., 2015), the research participation and supportive environment that we have provided has helped us retain women in STEM fields and has contributed to the professional success of our students. Cedar Crest College was included in the Council of Independent College (CIC) STEM Pipeline report (2019) as an example of a small college that produces STEM graduates who pursue doctoral degrees at an impressively high percentage in comparison to larger research-focused institutions.

The College’s current mission states “Cedar Crest College is a liberal arts college primarily for women dedicated to the education of the next generation of leaders.” In this article, we will provide evidence for how our science programs have embraced that sentiment. We will explore the creation of the first specialty “niche” majors in the science departments,

noting the motivation for their creation and a few challenges that were encountered during their development. We will then discuss the status of research programs at the College during the latter part of the 20th century. Finally, we will outline a few case studies, exploring reflections by emeriti faculty in the Biology department and alumnae who moved from college into science careers and/or graduate programs in the sciences.

## **PART A: NICHE MAJORS**

A review of the Cedar Crest College catalog before 1942 would reveal typical science majors being offered at Cedar Crest College, both Biology and Chemistry. In contrast, our most recent College catalog outlines undergraduate women's college programs in Biochemistry, Biology, Chemistry, Environmental Conservation, Forensic Science, Genetics & Counseling Psychology, Genetic Engineering Technology and Biotechnology, Global Diseases (a minor), Integrated Biology, Neuroscience, and Nuclear Medicine Technology. There are also various programs in a separate Health Sciences department and formal affiliations with professional programs in the medical sciences. In a 1983 press release announcing the inception of the Genetic Engineering Technology major, it was noted that "Cedar Crest is a 117 year old women's college which emphasizes career preparation anchored in the liberal arts. The College was among the first in the country to introduce a curriculum in medical technology (1942) and a major in nuclear medicine technology (1978)" (Butler 1983). Not only does this document note the novelty of these cutting-edge majors and the early date of their inception, but it also indicates the unusual nature of housing these programs in the context of this type of educational institution, as the school was (and continues to be) a small, liberal arts college focused on the education of women. "We believe the genetic engineering technology program at Cedar Crest is newsworthy because of the promise this field holds for improving the quality of life in the twenty-first century, because of its economic implications, and because the program has been developed not at a major research university or technical school but at a small liberal arts college for women" (Butler 1983). At the time that this press release was written, the College was celebrating much success in the sciences, in spite of its small size with a full-time enrollment of 756 students.

In this section, we will explore the origins of programs housed in the Department of Biological Sciences, which opened the door to other such "specialty" or "niche" majors not only within this department, but also in the neighboring Department of Chemical and Physical Sciences. While these types of majors may not be unique in the context of today's educational options, the creation of such focused programs was unusual in the mid-1900's, especially in the context of a small, liberal arts college for women. Each new major was developed with the current trends in the job market in mind, adding appropriate hands-on training to give the Cedar Crest College graduate the skills she would need to succeed.

## **The Medical Technology Major**

In 1942, Cedar Crest College started its Medical Technology Program under the guidance of Katharine Hirst, who led the program for its first 20 years (Ubben and Kayhart, 1978). In 1978, it was noted that this program was “with the exception of education...the longest continually operated vocational program at Cedar Crest.” The program was initially affiliated with Allentown Hospital and Sacred Heart Hospital, but added several other affiliated hospitals over the next several decades, including a brief affiliation with a hospital as far away as Pittsburgh (Benedum). In the first twenty years of this program’s existence, more than eighty students received a BS degree in Medical Technology; in spite of greater competition for available clinical spaces towards the end of the 1950’s, 98% of students were successfully placed. The limited clinical spaces did prompt the College to cap program enrollment through established GPA requirements. In 1978, the course requirements for this program went beyond the basic accreditation standards, including three additional semester hours of mathematics and a quantitative analysis course in chemistry and recommending courses in advanced biology (e.g. applied microbiology and Biological Techniques), Physics, Probability and Statistics, and Computer Science.

As new programs were developed, student interest shifted away from the Medical Technology major. That, combined with the growing difficulty in finding sites for clinical training as hospitals closed their own programs, led to the decision to discontinue the program before the 2001-02 academic year. The last official graduate completed her study in 2005, but the successful existence of this program during its first three decades opened the door to the next niche major in nuclear medicine, a field that was less accessible to women at the time.

## **The Nuclear Medicine Technology Major**

In the early 1970s, biology faculty at Cedar Crest noted a rising need for technologists trained in nuclear medicine and sought to create a major that would build on the Medical Technology program, preparing graduates for the growing job market. The College’s Admissions staff was “enthusiastic about the proposed program...[as] more than 20 percent of the high school women in the country who take the SAT tests indicate an interest in the health field” (Hall 1975). The Biology department noted that “the field of Medical Technology is rapidly becoming overcrowded” and noted the difficulties in placing students in clinical training sites (Kayhart 1975). Kayhart further noted that a Nuclear Medicine Technology (NMT) program would “give those students interested in the allied health professions an additional option.” The original application to the Joint Committee of Educational Programs in Nuclear Medicine Technology was submitted on June 25, 1976 and notes affiliations with both Allentown Hospital and Allentown Sacred Heart Hospital Center, which provided “the most extensive and comprehensive nuclear medicine services for the Lehigh Valley” (Hardin 1976). At that time, the College also had “a fully equipped radiation laboratory with preparation area, counting area, darkroom facilities and isotope storage area” (Hardin 1976). Part of the rationale for starting the

program included both the expected job market (“the employment outlook in nuclear medicine technology is bright...there will be a need to prepare approximately 1,300 individuals per year to fill available positions in nuclear medicine technology”) and the lack of similar programs (“there are 47 programs in the United States...only four grant the bachelor’s degree upon completion...two programs in Pennsylvania, both in Harrisburg, and neither is a degree-granting program”) (Kayhart 1975).

One challenge encountered during the accreditation process came from the College’s status as a women’s college. An Admissions Policy, approved by the President’s Cabinet in 1977, divided the College into two units: the “Regular Session” and the “Weekend College” (Cort 1977a). Regarding the former, the policy states that “Cedar Crest College has traditionally been a women’s college. It does not accept males into either matriculated or non-matriculated status in its regular session. The single exception to this policy is in regard to admission into the nursing program...” The Weekend College, designated as “a separate unit of Cedar Crest College [that] offers courses separate from those offered in the regular session of the College,” had a broader admission policy whereby “both males and females may be admitted.” This statement was in conflict with the discussions held between the Biology department and affiliate hospitals in regard to developing the new Nuclear Medicine program, as it was assumed that allied health programs at the College would be treated similarly to nursing with regard to male admissions (Kayhart 1977a); concerns were communicated to the Admissions Department, and the initial administrative response by the College’s Director of Admissions discussed the nature of the nursing program as a separate unit with a distinct admissions policy (Cort 1977b). As this issue jeopardized the development of the NMT program, a rebuttal was delivered to Admissions from the Biology department indicating that Allentown Sacred Heart Hospital may reconsider their affiliation with the program if males were not allowed admission; it was also noted that administrators at foundations who might potentially fund the new program could construe a women-only program to be discriminatory (Kayhart 1977b). A revised admissions policy broadened male participation in the “Regular Sessions” of the College, allowing non-matriculated or matriculated men into the Nursing or Nuclear Medicine Technology programs and allowing matriculated male degree candidates in the “Weekend College” as well as eligible men in the Lehigh Valley consortium (LVAIC) to enroll in Regular Session courses (Cedar Crest College 1977). It should be noted that although men were allowed admission to the NMT program from its start, the first 26 graduates from the program were all women, and women have comprised 90% of the total program graduates through 2020.

As part of the application process, a site visit was conducted on May 30, 1979, and while there were a few weaknesses noted in the post-visit evaluation, including better preparing students for the clinical year through improved coursework and improved interaction between the College and the clinical sites, it was also noted that the proposed program was “more advanced than the usual NMT program” and that the “radiation lab is a big

asset.” Ultimately, the program was granted initial five-year accreditation on October 18, 1979 (Beckley 1979), and the first student graduated in 1978.

Thus, the second niche major for the College’s Biology department not only broadened the career options for women, but also shifted the nature of the department, allowing men to complete a science major. Today, NMT remains the only coed science major, with all other undergraduate programs focused on women’s education; however, the need for male students to take courses in support of the Nuclear Medicine major means that several of the foundational courses in both Biology and Chemistry are not single-sex. The third niche major built on the development of the Biology department, physically expanding the footprint of science at Cedar Crest College as enrollment booms towards the end of the 20th century caused growing pains.

### **The Genetic Engineering Technology Major**

The Genetic Engineering Technology major (GET) was not the first specialty major for the Biology department, but it was one connected to a boom in the growth of the College, spurring the addition of two new science building wings. The first “expansion will provide a new laboratory suite for the college’s genetic engineering technology program and two medium-sized 35-seat classrooms for general use” (Morning Call 1987) and was dedicated by Nobel Laureate Rosalyn Sussman Yalow in 1988 (Morning Call 1988). The second was dedicated by then United Nations Secretary-General Kofi Annan in 1997, and amounted to a “\$4.3 million academic building [that] doubles the school’s space for student research [including] a genetic engineering laboratory, a physics lab, an area for studies in neuroscience and environmental science, nursing and nutrition” (Morning Call 1997). At the time of groundbreaking for the latter building, Cedar Crest was reported to have “1,700 students—the majority women — and about 70 faculty members. Through [President] Blaney’s leadership, it has been ranked by U.S. News & World Report in the top tier of liberal arts colleges for the last seven years. Thus, it has experienced an 86 percent increase in enrollment over the past six years” (Shope 1996).

The program was launched in the fall of 1983 and hailed as one of the nation’s first undergraduate programs in Genetic Engineering Technology. A College press release in November 1983 states, “Here, in a laboratory especially set up for this purpose, undergraduate students will soon be performing recombinant DNA procedures which have won three Nobel prizes within the past decade” (Butler 1983). The program was the brainchild of Department Chair Dr. Marion Kayhart, and she developed the program in consultation with Dr. Leslie Stringfellow, a microbiologist at Oak Ridge Laboratories who graduated from Cedar Crest in 1975 (Wlazelek 1983). In a 1982 grant application, Dr. Kayhart noted the importance of this program, “By introducing a new degree program focused on such new technology, Cedar Crest College will be fostering the development of career tracks in science for women, fields in which women have been traditionally under-represented” (Kayhart 1982). She further notes, “An institution such as

Cedar Crest, with a strong Biology Department is an ideal setting for developing such a program. The mission of the college is 'career preparation anchored in a strong liberal arts tradition'. The curriculum which we have proposed will prepare students for entry level positions in the gene splicing industry. Since Cedar Crest is a college for women, the program will also serve as a means of enabling more women to enter the field of science..."

The program's first director was Dr. Douglas Dennis, and he ensured that as part of the course curriculum, students used procedures "that earned scientists three Nobel prizes in the past decade" as they formed recombinant DNA molecules and engaged in molecular research projects (Wlazelek 1983). The program began with funding from the Ben Franklin Partnership Fund, financing a collaboration with Cytos Corporation to develop a commercial use of bacteria to detoxify industrial wastes (Butler 1983 and Dennis 1984). Thirty-one students were engaged in research to clone the parathion hydrolase gene in fulfillment of the initial grant requirements, and Dr. Dennis presented this work at the Society for Industrial Microbiology in August 1984. As he accepted a position at another college, there was a transition to a new director, Dr. Marie D'Agostino, who was later replaced by Dr. Arthur Ayers in 1986 when she left her teaching position to dedicate more time to her research.

The nature of the Genetic Engineering Technology program and its potential need at the undergraduate level was not without controversy. In the February 26, 1983 broadcast of his radio show on WOR, Bernard Meltzer was noted by Dr. Dennis to have indicated that he would not send his own daughter to Cedar Crest College for the Genetic Engineering Technology program, as it was his belief that this type of expertise required a graduate school education (Dennis 1983). In a letter to Meltzer, Dennis argues that while this was true several years earlier, programs like the one at Cedar Crest College opened the door to moving biotechnology into the undergraduate level of study. In addition, the Cedar Crest College program was mentioned in a 1983 article in *Nature Biotechnology* in a review of emerging biotechnology programs, their lab intensive courses, and the job potential in the field (Amatniek 1983). The article contrasts these advantages with concerns that the courses are "trendy" and might "create a glut of biotechnologists." Furthermore, there is a discussion about the interdisciplinary nature of this subject as a "hybrid between biology and chemical engineering," (Kenneth Giles, Worcester Polytechnic Institute) expressing the concern that the undergraduate years should be used to build a solid foundational background across basic science to enable effectively taught interdisciplinary studies at the graduate level. The program was also discussed in a newspaper article from a neighboring institution, the Lehigh University *Brown and White*, in September 1983 (Stoddard 1983). Cedar Crest faculty defended the College's program design with Dr. Dennis stating, "There is a definite need...There are ads in the back of *Science* magazine looking for bachelors degree microbiology and biochemistry students where normally most ads look for doctorate

degrees...Our intent is to better prepare students to take advantage of companies like Air Products in the Lehigh Valley that are starting research in biotechnology." At that time, the Lehigh University Department of Biology had proposed a new molecular biology major that had not yet been approved by the administration. Lehigh Associate Professor of Physics Jeffrey Sands stated that the University was not involved in genetic engineering experiments at that time, and while Cedar Crest's Dennis discussed the inclusion of research in the undergraduate program, Lehigh Professor of Biology Steven Krawiec felt Cedar Crest's program was more "vocational" in nature than the proposed Lehigh major which is "not comparable to Cedar Crest's genetic engineering major." It is not clear how much this comment was driven by sexism or was purely based on programmatic differences at a neighboring institution.

An additional complication for the Genetic Engineering Technology program derived from the College's association with the United Church of Christ (UCC) during the program's development. In 1986, clergy and lay delegates from the Penn Northeast Conference of the UCC met to discuss concerns related to genetic engineering, calling on "colleges and universities supported by the UCC to take steps to protect the public health during genetic research" (The Morning Call, 1986). Fortunately for the College, the UCC took the stance that this field has more potential for helping humanity than harming it.

Despite several initial concerns about the nature of the genetic engineering program, it has persevered for more than three decades. It has generated interest from a broad range of prospective students, including male students who have never been able to major in genetic engineering at the College—the article in *Nature Biotechnology* ends with the statement that "Cedar Crest College says it had more than 400 inquiries about its 10-slot program, which is starting this fall. Most of the inquiries were from men. Cedar Crest is a women's college" (Amatniek, 1983). One of the first students enrolled in the program noted her excitement in the program's content, as she had "always been interested in preventative medicine and in genetics. I'd like to work on a method of preventing birth defects" (Wlazelek 1983). The third program director, Dr. Arthur Ayers, noted that "This is a ground-breaking perspective, for women have traditionally acquiesced to a passive posture when confronted by the stereotypical competitive male scientist. As a consequence, until recently few women have attained leadership positions in scientific fields. Women's colleges have been uniquely successful in preparing women for careers in sciences, because women in these institutions received the same benefits of leadership training and mentoring that are reserved for males in coeducational colleges....most of the women in the GET Program have the skills and talents to be leaders in any field. What the GET Program does for these women is to permit them to make a choice" (Cedar Crest College *Breaking Ground*). Interestingly, while the impetus for the program seems to have been preparation for entry-level genetic engineering jobs, graduates of the program have often chosen to pursue graduate level study in related fields; the concerns about students

being poorly prepared for graduate study were not warranted, nor were the worries about creating a glut of genetic engineers for the workforce.

The Medical Technology major, Nuclear Medicine major, and Genetic Engineering Technology major each changed the nature of science at Cedar Crest College. Despite the fact that the Nursing major at the College remains the largest draw for incoming students, the natural sciences have continuously attracted prospective students, and options have continued to grow beside enrollment. Neuroscience and Environmental Science (a joint venture with the chemistry department) were the next majors to be added in 1997, bringing with them new faculty expertise and creating a dynamic environment in the classrooms, research labs, and hallway discussions.

### **Neuroscience, Environmental Conservation, Integrated Biology, and Genetics & Counseling Psychology Majors**

Continuing in the tradition of offering specialized science majors within a liberal arts environment, the Neuroscience major was included in the 1998-99 College catalog and graduated its first student in 2001. At that time, Neuroscience majors were becoming more common at undergraduate schools; in 1998, only 30 undergraduate neuroscience programs existed, while 85 programs offering only the Bachelor's degree were reported by the 2008-09 academic year (Ramos et al., 2011). Unlike the Genetic Engineering Technology major, the Neuroscience curriculum involved study in Psychology as well as Biology, and included Computer Science and Philosophy options in its initial list of elective courses. Around half of Neuroscience alumnae have pursued health professions after graduation, including allopathic and osteopathic medical schools, optometry, and physician assistant training, building on the department and College traditions of training health care professionals, while others have continued in Neuroscience graduate programs or directly pursued laboratory research positions. The Neuroscience program offered its first Brain Awareness Week program in 1998 (Morning Call, 1998) and has continued to collaborate on community events and an annual Research Symposium as a founding member of the Lehigh Valley Chapter of the Society for Neuroscience.

A second interdisciplinary program began under the "Environmental Science" title as a collaboration with the Chemistry department. Over time, the program shifted to the Biology department as a Conservation Biology major, and further developed into its current Environmental Conservation form, offering both the BS and BA degrees. Like the Neuroscience major, the BA degree program in Environmental Conservation is intentionally interdisciplinary, including required Anthropology, Global Studies, Economics, Philosophy, and Communication courses. Both Conservation majors also require a field experience that can be completed locally or via several travel courses that include a research component, with one to Arizona and another to the Amazon Basin. The program has continued strong relationships with local organizations including the Lehigh Valley Zoo, Hawk Mountain Sanctuary, and the Wildlands Conservancy, each of which provides field experience sites for Cedar Crest students.

More recently, the department added two additional majors requiring significant work outside the traditional science offerings. An Integrated Biology BA degree, parallel to the BA in Environmental Conservation, requires students to choose an area of interest outside the Biology department to combine with their Biology study. The first student graduated with this major in 2011. The most recent offering, Genetics & Counseling Psychology, sought to help students interested in pursuing professional training in Genetic Counseling to broadly explore related subjects at the undergraduate level. To that end, the program includes Psychology and Health Sciences courses along with core Biology content. Together, these majors represent a continued commitment to the interaction between the liberal arts and sciences at Cedar Crest, and help graduates prepare for a wide range of graduate fields and professions in the sciences.

## **PART B: UNDERGRADUATE STUDENT RESEARCH**

While alumnae from as early as 1957 mentioned research opportunities in the department, an increase in faculty numbers, especially younger biologists eager to pursue their research interests in collaboration with students, contributed to an increased culture of student engagement in independent research, according to retired chair Dr. Marion Kayhart (2020 interview). The Genetic Engineering Technology major included a research requirement from its inception, described in the Lehigh University Brown and White as in the fall of 1983 as “half the year in independent research and half in an internship at a local lab—resulting in about 20 hours of lab work each week.” This requirement was described in the same article as distinctive, with program director Douglas Dennis stating, “It is unusual to have research at the undergraduate level going on at a small college. This is something that is done in larger college programs. (Stoddard 1983)” In 1987, Arthur Ayers, Director of the College’s Genetic Engineering Technology program noted that in “addition to providing the preparation for leadership and the development of self-confidence that a women’s college traditionally offers, the GET Program was designed to provide its students with exposure to a research experience that will give them a decisive advantage over their peers from other institutions of any type” (Cedar Crest College *Breaking Ground*).

The research program continued to expand along with the size of the department during the early 1990s (Kayhart, 2020), and the hiring of new faculty brought research interests that aligned with the developing majors. Eventually all department students were required to complete a senior research project and present that work in a departmental symposium at the end of the academic year. A distinctive course-embedded “freshman research” program, where students in the second semester of the first year conduct short-term but genuine projects within the faculty’s established research programs, typically under the direction of an upper-class student “research director,” was established in the 1990s and has continued to the present (with the exception of a few year hiatus), further contributing to

the research opportunities available to all students as well as providing a leadership experience for the research directors.

In 2002, the department faculty made the difficult decision to cease requiring independent research, reasoning that since it was a major focus of the department, most students would continue to pursue research by choice; faculty committed to providing research access for all interested students, rather than making research a privilege only for selected students. This assumption was supported by departmental data collected from 2003-2018 showing that 90.6% of department graduates completed at least one semester of independent research, and 38.5% of graduates participated for four or more semesters. These numbers exclude graduates of the Nuclear Medicine Technology program, who must complete clinical work off campus. In 2004-05, the department developed a separate Thesis and Presentation course for graduating seniors, and began to hold "Research Fridays" to bring the department together for informal student presentations with time for discussion and faculty input during the research process.

Impacts of the research program are further discussed by Emeritus Faculty and by alumnae, in Parts C and D, below. Overall, the ability for Cedar Crest students to conduct original research was observed to be helpful in encouraging students to stay in science, whether by entering the workforce directly or through graduate study, consistent with the literature showing that undergraduate research is a high impact practice for STEM retention (e.g. AAAS, 2011).

### **PART C: CEDAR CREST COLLEGE CASE STUDIES, EMERITUS FACULTY**

In the 1950s, the Department of Biological Sciences had but two faculty members (Kayhart n.d.). Dr. Marion Kayhart entered as Chair of the department in 1954, replacing a faculty member who left the College. The facilities consisted of two labs and one faculty office in the basement of the Administration Building, and a third lab on the second floor of that building. The department offered two majors, Biology and Medical Technology, and the combined annual graduating classes were about six students total, while many of the College's students enrolled in biology courses only as part of their liberal arts studies. Although the number of graduates remained fairly low in the 1960s, there was an increase in biology faculty with the hire of two new staff in 1962 and 1968. A science center was opened in 1966 and housed five labs with prep rooms, a greenhouse and animal care room, two independent study labs, four faculty offices, a lecture hall, a seminar room, a museum, and additional facilities (labs, prep rooms, offices) for the Chemistry department. The 1970s saw much growth for the department, with 8-15 Biology majors graduating per year and two additional faculty members being added in 1973 and 1975. Departmental numbers continued to grow throughout the 1980s and 1990s, ending the century with 14 faculty and staff members, 30-35 students graduating across the Biology, Nuclear Medicine, and Genetic Engineering Technology majors, and two wings added to the science center in 1988 and 1997. From 2000-2019, the

Department graduated a total of 592 students from the Biology, Genetic Engineering, Nuclear Medicine, Neuroscience, Conservation, and Genetics & Counseling Psychology majors, despite some enrollment fluctuations at the College level and a reduction in faculty numbers.

**CASE STUDY:**

**Interview with Marion Kayhart (employed 1954-1993)**

When Dr. Marion Kayhart joined the College to chair the Biology department, the most popular major was Education, but she notes that the “situation changed during my 39 years at the College. Education, though still maintaining a good enrollment began to compete with a very popular and successful Nursing major and with steadily increasing popularity of the Science majors and programs.” In reflecting on the development of “niche” majors in the department, she notes that the impetus for their creation came from both faculty interests/expertise and “perceived changes in the larger world which seemed to indicate a need for people trained in those particular areas.” The challenges that came along with the development of those programs include the expected space, funding, and equipment issues, but also included concerns about diminishing the existing programs and curriculum. She particularly noted faculty concerns that the Genetic Engineering Technology Program would reduce overall resources available to other programs/courses. The benefits of having these programs were seen in the area of student recruitment—more options can mean a broader appeal for more students—plus, energy is generated from new programs. As Dr. Kayhart notes, “Often there is a contagious excitement among students who enter a new specialized program—a feeling of setting out on a voyage of discovery that others who are not in that program have not had the opportunity or foresight to undertake.”

As she reflected on the research programs in the department, Dr. Kayhart noted dramatic growth, especially in the 1990s and beyond. The new faculty who came to the College at that time were young, fresh from graduate school, and excited to continue their ongoing research projects. Students benefited from the mentor-student relationship model, and their completion of an undergraduate research project boosted their confidence level, especially important for “women students who tend to underestimate their ability.” In addition, the independent research appealed to a new cohort of prospective students, those who are interested in science and who often have a strong academic record, consequently improving the overall academic level of the College.

**CASE STUDY:****Interview with Dolores Yaschur Sproule (employed 1975-2006)**

Dr. Dolores Yaschur Sproule was hired in 1975 to help support the Nursing Program by teaching Microbiology; at that point, the nursing program had grown sufficiently large as to require a second microbiologist on staff. She notes that the department environment at that time meant that other majors, such as Nursing, were “more popular, [but] as specialized science majors were developed the numbers of science students increased.” In the 1970s, faculty were hired to teach courses, which included preparing lab courses (ordering lab supplies, making reagents, set-up, break-down, etc.), and being available to students. There was no lab manager, and faculty were not expected to engage in their own research projects. While faculty were required to supervise student research, the nature of these projects was rarely hands-on, and more often involved library research projects. As new majors brought new faculty and equipment to the campus, there was a shift to include much more faculty and student research. Students also were more engaged, and the young faculty were enthusiastic. While Dr. Yaschur Sproule did attend professional meetings, the new surge of research in the department meant that students had the opportunity to present their work as well. Faculty time also became more valued—initially, at the time of her hire, Dr. Yaschur Sproule received only one credit for the three-hour lab course. By the time of her retirement, not only were faculty allotted two credits for teaching laboratory courses, they were also given release time to perform collaborative research with students.

**CASE STUDY:****Interview with Brian Misanko (employed 1981-2013)**

With the addition of the relatively new Nuclear Medicine Program, the College hired Dr. Brian Misanko in 1981 as the program’s director and Radiation Safety Officer. As the Nursing Program was one of the largest programs at the College, Dr. Misanko spent most of his teaching load in Anatomy & Physiology labs, supporting that program. As the College looked for growth in summer and evening programs, Dr. Misanko notes that the department, under the direction of Dr. Marion Kayhart, reflected on the direction it wanted to take to increase its own student numbers. Even though the number of courses in the department was growing as the Nursing program expanded and late afternoon, evening, and summer courses filled to capacity, the number of majors in the Biology department had not increased. Dr. Misanko indicates that the Genetic Engineering Technology major “moved the Department into a new era,” but this was not without concern—it took a lot of convincing to get the Administration on board with the development of this major. “We were a small, women’s, liberal arts college entering a field that many large universities had not yet entered.” Equipment costs, space, and student recruitment were the main concerns, but the department received help from alumnae in the molecular field.

Student research was increased in the 1980s, particularly in areas where faculty had expertise. Dr. Bob Halma, "as a true ecologist," pushed the department into the area of environmental science, establishing the College as an arboretum and co-authoring a book, *The Poconos*. As a geneticist, Dr. Kayhart pushed the department in the direction to "utilize the advanced technology that was available (1980's) to study genetic material. From those discussions, we developed the Genetic Engineering Program. Student research!" Dr. Misanko recalls his contribution to research came from his association with the Lehigh Valley Hospital where he was granted the title "Clinical Physiologist" in the Department of Radiology and later in the Department of Neurology. He started to lay the groundwork for bringing MRI to the hospital and even began to develop an MRI technology program until a concern regarding conflict of interest for the College's president ended the endeavor. He was able to start student research in Nuclear Medicine and recalls the increasing number of students involved in research leading to College funding for both the research supplies and for travel to conferences. "We started sending students to the Annual Meeting of the Pennsylvania Academy of Science. We increased our number of oral and poster student presentations and the quality of the research each year at PA Academy of Science. We were for many years the college to beat for number of quality presentations. Many of our students made their presentations without notes. Eventually we advanced to presentations at national meetings. There was good support by Admin and the College... Throughout the Science Center walls held student poster presentations from past meetings that encouraged prospective students and the campus to 'see' our student research." Dr. Misanko notes that President Dorothy Blaney, inaugurated in 1989, was very supportive of the new directions taken by the department, mainly because so many new students were being attracted to the College.

Dr. Misanko notes several new directions that the department explored. Some, like the MRI technology program, and a Physical Therapy BS and MS were explored and deemed less than feasible, but others like the Neuroscience Program gained the support of the Administration and were added to the options for Cedar Crest students. "I think our choices of new majors, programs, directions have been good ones. Our choice to increase student research added greatly to our standing in the science community. Many times in my attendance at national meetings or bumping into a medical sales person on a plane and hearing they have heard of Cedar Crest. The GE program placed us in the 'news' and all other majors and programs since then just added to the 'news.'"

## PART D: CEDAR CREST COLLEGE CASE STUDIES, ALUMNAE DATA

The department has maintained records of graduates as they accept their initial positions. One such data set from 2017 examined all 96 graduates from 2011 to 2016 who completed one of the seven majors offered in the department. The work or school placement of 83% of graduates was known, and only 6.3% reported that they were not engaged in science-related activities. Of all graduates, the largest group was working in scientific fields, including laboratories, animal conservation or care, and science education (37.5%), with another 10.4% working in healthcare fields. Graduates were also pursuing additional education in science (11.5%) or health professions fields (14.6%), and a few were actively applying for work or school (3%).

Several programmatic reviews of the specialty majors have also been conducted using self-reported information from alumnae; the general finding has been that these specialty majors have successfully connected graduates to careers in science. As one example of this data, during a study period of 2010-2019, 94.3% of the 53 students who graduated with a Genetic Engineering major initiated a career in science either by accepting a science-related job or by entering graduate school in a science-related field; 33.96% of these were accepted to terminal degree programs (e.g. PhD, MD). A second data example involves a review of the Neuroscience graduates (n=12) from 2011-2016, which showed that 25% were pursuing a PhD degree in a Neuroscience-related field while another 25% were working in laboratory settings. Health professions are another common choice for Neuroscience majors, and an additional 25% of the group were working or studying in these fields after graduation. While not all of the students involved in these studies may have remained in science beyond that first career position, this data shows the success of these niche majors for helping students attain their initial career goals.

For this article, we requested open-ended survey responses from alumnae of the Department of Biological Sciences and received 32 replies representing the classes of 1956 to 2019. Respondents included alumnae who had majored in Biology (13), Medical Technology (2), Nuclear Medical Technology (1), Biodiversity and Conservation Biology (1), Environmental Conservation (1), Genetic Engineering Technology (12), and Neuroscience (2). A variety of double majors, minors, and campus activities were also represented by the alumnae who returned surveys. Note that while some male graduates have completed the NMT degree, all respondents were female. Of this smaller sample group, 85% were employed in science careers, broadly defined.

As described above, the Medical Technology and Nuclear Medicine Technology majors were the earliest niche majors at the College. The advent of the Genetic Engineering Technology major was the beginning of niche majors rooted in basic science, rather than in fields requiring certification and directly related to health. Regardless of major or class year, alumnae viewed these niche majors as an important recruiting tool for the College, both for the course offerings and research opportunities. Several responses

noted that the ability to specialize as an undergraduate attracts passionate, committed students and helps Cedar Crest stand out as a unique institution, since most small, liberal arts colleges only offer broader fields of study.

*One of the benefits of having niche majors is that CCC can remain competitive with other universities who are offering these interesting areas of study. There are so many new and different careers in the sciences that you must remain competitive with the fields of study.*  
– Christine A. Krieman, MS (1988, NMT)

*I remember as a high school senior seeing the flyer for Cedar Crest College and it was advertising strongly in the sciences including a major in Genetic Engineering. I didn't know what Genetic Engineering was at the time but it was mentioned as a growing field and I started looking into it. Ultimately it was the reason I ended up selecting CCC over other institutions.* – Kristi Miller, PhD (1994, GE)

Another perceived advantage to niche majors is for career choice and career preparation after graduation. Many alumnae described how the technical skills they acquired at Cedar Crest helped them gain job interviews or entry-level positions. As alumnae moved on to post-graduate study or jobs, a few reported how individuals unaware of Cedar Crest College were impressed with their previous knowledge, lab experience, and communication skills. Some survey responses also described how the exposure to niche majors helped them discover careers they were excited about following.

*I only see the positive impact the niche major had on my career trajectory because it made my resume stand out in a sea of resumes.*  
– Liz Deutch Murphy (1986, GE; the first year the degree was awarded)

*Although it's possible I could have majored in biology and ended up in a very similar place...I do think the molecular biology background and research at undergrad were instrumental in acceptance to grad school where I embarked on another niche program of 'tumor cell biology.'* – Kristi Miller, PhD (1994, GE).

The ability to delve deeply into a particular area, rather than a more traditional approach of exploring more introductory material about a broader swath of biology, was another advantage noted by alumnae, even those who had majored in Biology. A few Biology majors stated that they focused their electives in one of the specialized programs, and even though they still have the more general degree, they find the experiences in those niche courses to be helpful for their current careers. For those who chose a niche major, many appreciated being able to pursue their passions. In at least one case, the niche major provided a major opportunity that would not have been available to a Biology major:

*...I was easily learning graduate level work at the Bachelor level because of the niche major and this put me and my colleague ahead of many folks coming out with general Biology Degrees. Finally,*

*it was the niche major that allowed me to sit for the Patent Bar. General Biology majors were not eligible to do that, the additional high-level molecular biology degree was required. – Beth Goldstein, JD (1990 GET and Biology)*

Some respondents felt that the broader Biology major was a better choice for them and had advantages over choosing a niche major. Several alumnae explained that acquiring a Biology major allowed them to explore avenues they might not have pursued had they chosen a more focused major. One alumna felt that because career options in the field are so varied, her Biology degree made her more well suited to find her current career in regulatory affairs. Another survey response recognized that attracting faculty who can teach and provide research opportunities in the various niche programs can be more difficult than hiring faculty to teach in a broader Biology program. Only two alumnae were neutral on the question of niche majors, feeling that either a niche major or a Biology major would have been equal in preparing them for their careers. The majority of surveys, even from Biology majors, noted advantages to offering both the specialized programs and the general Biology degree.

*I appreciated that as a traditional biology major I was exposed to many things—versus what I assume to be provided in a niche major. .... If I hadn't had the broad-biology experience that I had, I may had never been exposed to public health during my undergraduate career. – Emily Mowl Chew, MS (2008, Biology)*

*I think the niche majors was a disadvantage when I wasn't sure where my passions were and it seemed like too much of a commitment. It was an advantage when it came to going to graduate school because I was a strong candidate for a genetics PhD program with the Genetic Engineering BS. The admission committee told me that was an important factor in my acceptance—it was clear I knew my passion. – (Anonymous, mid-2000's, GET)*

We also asked alumnae to comment on the role of independent research in their college experiences and subsequent careers. Unsurprisingly, only a few alumnae graduating prior to the 1980's had completed any undergraduate independent research. One 1969 Biology graduate described her one-semester-long project as “a bust” and wished for more and better mentoring. On the other hand, a 1956 Biology major recalled faculty attending scientific meetings and incorporating new findings into their classes, showing that even though she herself did not complete independent research, she benefited from the newest scientific discoveries. The majority of respondents reported completing independent research and felt that the experience was instrumental to careers, even if the research was not directly related to their later work. In fact, discovering that laboratory bench work was not a passion was also cited as an advantage to independent research projects.

*The hands-on laboratory experience that I had as an undergraduate was vital to my post-graduation and internship experiences. Knowing not only the background behind the techniques but actually having done them myself, I feel put me ahead of some of the other applicants. – Jennifer Richards-Yutz, MS (2004, GET)*

*The research and internships I did during my CCC degree years is what built my resume and made me a better candidate for jobs in the Ecology field—while the Biology degree was necessary to open the door, “just” the degree doesn’t get you the job on an otherwise empty resume. – Karen Haase Klein, MS (1992, Biology)*

*The benefits of independent research in biology are indescribable. I use both the critical thinking skills and the technical skills I learned to impress my now PI and enter the lab of my choice in graduate school. Since being in this lab I have excelled because I am able to work independently and ask questions/for help when necessary. The simple ability to put 2.5 yrs research experience on my graduate school application was essential to my post-undergraduate career. – Gabrielle Moody (2014, Neuroscience)*

*The research and presentation provided me with several insights. First, I knew I did not want a career in the lab, I was not suited for it. But it did help me find that I was suited for writing [and] public speaking and that I excelled at both. – Beth Goldstein, JD (1990, GET and Biology)*

Learning to use the scientific process and being allowed to fail in the nurturing environment of Cedar Crest were also cited by many alumnae. Many explained that working on independent research for several semesters, rather than just one or two, helped them better learn how to conduct research and gave them a later competitive edge. Some of the survey respondents moved on to work or pursue post-graduate degrees at large universities. They contrasted their experiences as undergraduates, completing the projects on their own with faculty support, to the more competitive, sometimes political nature of research at larger institutions.

*Offering independent research in biology is important because it exposes you to the challenges of bench research. Cells don’t grow. Experiments fail. Designing good experiments with adequate controls is more important than getting the answer you want. It gives students the opportunity to learn techniques but also working through the process and thinking like a researcher. – Kristi Miller, PhD (1994, GET)*

*...the opportunity to do research so early and so often was one key to success...there's lots of things that make research not fun and it's hard....I fell in love with research at Cedar Crest and not having the hierarchy got rid of a lot of the things that make research un-fun. That was a magical thing about Cedar Crest. – Morgan Schrock, DVM, PhD (2006, GET)*

We were also interested to discover how the surveyed alumnae felt their attendance at a women's college versus a co-educational college influenced their lives. Two alumnae were positive about their experiences but felt that graduating from a woman's college had little to no impact on their careers. Women from the earliest graduating years were more likely to mention competition with men, both in terms of the lack of such competition as undergraduates and the ability to compete successfully after graduation. Most alumnae detailed feeling empowered and confident in their abilities because of their undergraduate experience; the building of independence, leadership skills, and focus were other common themes throughout the responses. Some of the alumnae stated that they were actively seeking a women's college as applicants. However, many explained that while they did not attend Cedar Crest because it is a women's college, they grew to appreciate their experiences at a single-sex institution, either as students or later as they pursued higher degrees and careers in science.

*As a person who was responsible for radiation safety and regulatory compliance, I had to have a voice that people heard and respected. It wasn't always easy to have a difficult conversation with an important doctor or researcher but it definitely was easier after my experiences being a student at an all-female college.*  
– Christine A. Krieman, MS (1988, NMT)

*I never really gave it much thought about it being all women or not at that time. Looking back, the experience of an all women's college was extraordinary in shaping me as an adult. I found a lot more confidence in myself that I might not have had the opportunity to find otherwise and to this day, our class still has great ties with each other. I've been able to work very independently and have a great rapport with coworkers. I don't think I would have that level of confidence if it wasn't for the opportunities I received at CCC.*  
– Rose Moran, CT(ASCP)(IAC) (2003, GET)

*In retrospect, I'm very happy that I attended an all-women's college. The depth of relationships I had with my peers, and the ability to focus in an all-women environment were critical to my success.*  
– Daneen Schaeffer, PhD (2004, GET)

*The fact that Cedar Crest is a women's college did not impact my decision to enroll. However, the fact that I attended a women's college greatly impacted me. Attending a women's college improved my self-esteem and gave me confidence that I may not have had otherwise. Attending a women's college gave me more support than I think I would have received at a co-ed college.*  
– Renita Polk, PhD (2008, GET)

*I was never afraid to speak up or ask questions or felt intimidated subconsciously because a man was in the room. I also know for sure that there are plenty of women in my field because I was taught by them and graduated with them. In my current position, I am often*

*the only woman in the room, but I am not deterred by this knowledge as I was empowered by attending a women's college.*  
– Taylor Robbins (2019, Environmental Conservation)

Some respondents additionally described how their experiences at a women's college have led them to advocate for women in their professional lives.

*...I was selected to be a co-president for a neuroscience camp for high school students at my medical school. During one of our meetings where we were selecting and scheduling physicians and scientists to come speak at the camp, I noticed that there were no female physicians or scientists. I knew that the girls at the camp needed to see physicians and scientists who looked like them. I voiced this realization to my three male co-presidents who eagerly acted as allies and agreed that we needed to diversify the group of physicians and scientists. I know that my experience learning in an all-female environment is what trained me to have an eye/ear to notice these moments, and it definitely gave me the voice to speak on them.* – Kelcy McIntyre (2017, Biology)

*[A women's college] prepared me to be resilient and courageous—I still take that with me at boardroom meetings and I don't feel intimidated but rather excited and grateful to be there to discuss my work. I also feel an extra sense of responsibility to help mentor younger female scientists as well as provide support to those who are looking for career advice, guidance and networking opportunities.* – Zainab Khalfan (Jagani), PhD (1999, GET)

While this survey sample was not completely representative of the entire population of the Department of Biological Sciences alumni, some insights into the niche majors and independent research programs can be gleaned. Overall, the niche majors were viewed as a benefit both to the College and to the individual students, with only a few disadvantages noted. It was possible that Biology students might feel that the niche majors competed for resources (lab equipment, mentoring availability, etc.), but that was not reported. Rather, most Biology students were excited to have the opportunity to enroll in upper-level courses designed for the niche majors and competition between various programs was never mentioned in these survey responses. The later graduates were more likely to view the College as “science focused” than earlier graduates, who reported that Nursing and Education were more popular programs when they were students. Independent research was also largely seen as an important component of the respondents' experiences. Even earlier graduates, who rarely participated in research, clearly recognized the benefits of practicing the scientific process and learning key lab skills; alumna MaryAnne Ries ('57) recalled being offered a research position that she declined. Additionally, learning in a single-sex institution was largely seen as positive, enabling these alumnae to gain skills in leadership and communication, and to possess confidence about their own capabilities.

An intriguing result found in our surveys was that departmental alumnae from earlier classes reported an interesting array of career choices: a pastor (who had previously chaired a town's Housing Authority; Karen L. Roy-Guglielmi, 1969), the director of an organization providing services to people with intellectual and physical disabilities (Carolyn Wolf, 1956), an Educational Program Auditor for a large school district (Doris Frantz Hillegass, 1957), and a computer programmer (MaryAnne Ries, 1957). Each of these women mentioned their strong biology and liberal arts education as helping them to prepare for their careers, even though those careers were quite different than what they might have originally intended. A more recent graduate, lawyer Beth Goldstein (GE and Biology, 1990), observed that her "science background actually allowed me to understand lab results, protocols and gave me the ability to work easily with scientific experts in DNA and drug testing. [...] I had help finding the opportunities and avenues available to pursue beyond the traditional science related jobs as I knew I did not want to spend my career in the lab." Renita Polk, PhD (GE, 2008) noted that "even though I did not end up working in the field that I studied at Cedar Crest the 'soft' skills (e.g., critical thinking, problem-solving) that I learned during my time at Cedar Crest have been useful in my current role working in policymaking." Over many decades, alumnae from the Biological Sciences at Cedar Crest have successfully used their liberal arts and scientific training to be successful not only in science or health professions, but also in a variety of additional fields.

## CONCLUDING LESSONS AND FUTURE DIRECTIONS

When we reviewed the history of the Biological Sciences at Cedar Crest College, an educational institution that was established in 1867, well before most academic institutions allowed women entry into higher education, we learned that innovation is nothing new: this College was innovative from the start, and a female Chair of Biology (Dr. Marion Kayhart) and two female Presidents, Pauline Tompkins and Dorothy Blaney, helped this department to innovate productively and contribute to the institution. Yet, at the College's 101st annual convocation, President Pauline Tompkins noted that "proposals for change should be tested against the valid criteria and be part of the total concept of the College and its goals" (Cedar Crest College *Breaking Ground*). In other words, the College does not simply innovate for innovation's sake; rather, it identifies those innovations that will make her graduates stronger.

Former Dean of Faculty Kathleen Dubs once stated that the College is "innovative in that we can sense what needs are going to be and fill them" (Cedar Crest College *Breaking Ground*). In this article, we have outlined a few needs that were identified in undergraduate science education and explored how innovations in the Department of Biological Sciences filled those needs, benefiting our graduates as they successfully found careers in science. As the College has evolved over more than 150 years, one thing has remained the same: the dedication that this institution has to its students and doing what is necessary to move them into leadership positions. In the

past, the Department has created programs in response to societal needs. The relatively new niche majors in Integrated Biology and Environmental Conservation redesign departmental BA degrees to emphasize connections with the liberal arts and encourage interdisciplinary solutions to complex global problems. Also an interdisciplinary degree, the department's new Genetics and Counseling Psychology major encourages students to take a new approach to understanding genetic disorders and the underlying risks associated with inherited mutations. A second current focus involves revising the laboratory portions of our courses in an effort to increase real-world research experiences as part of traditional coursework. Finally, in an effort to expand access to STEM fields for those who have been traditionally underrepresented, the department is working toward creating a more inclusive environment through both course content and classroom structure. In this ever-changing world where science plays a vital role in the health and well-being of its inhabitants and their environment, we are ready to respond as new needs arise.

"Cedar Crest provides women with affirmation and approval of their roles as bright females along with the knowledge and courage necessary to reach out and expand their ambitions. In a society which has sought to put limits on that to which a woman may aspire, Cedar Crest has provided models of strong, able women who have been ground breakers in their lives and who have built foundations for new expectations and options for generations to come" (Cedar Crest College *Breaking Ground*). While women have reached parity in training in Biological Sciences fields at the Bachelors, Masters, and PhD levels (National Center for Education Statistics 2019), the continued underrepresentation of women in higher level positions across STEM fields means that Cedar Crest College and its Biological Sciences programs will have a role to play in educating women scientist leaders for many years to come.

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## Who, Me? Increasing High School Girls' Entrepreneurial Self-Efficacy, Knowledge and Intentions

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**Abstract.** This paper provides a case study of two female-only entrepreneurship education programs designed by faculty from Brescia University College, Canada's only women's university, located in London, Ontario, Canada. The programs were designed to address the substantial gender gap found in women's participation in entrepreneurial activities by inspiring, educating, and exposing program participants to entrepreneurial endeavours. One program was a one-day conference and the other was a one-week boot camp. The study was designed to better understand how to strengthen the female entrepreneurial pipeline by measuring changes in entrepreneurial knowledge, entrepreneurial self-efficacy (ESE), and entrepreneurial intentions (EI). Program participants were asked to complete pre- and post-experience questionnaires where information about leadership experiences, role models, entrepreneurial knowledge, ESE, and EI was collected. The results of the analysis reveal that the gender-specific programming increased ESE in the one-week camp and that both programs significantly increased both objective and self-perceived knowledge of entrepreneurship. The authors conclude that the female-only educational interventions helped to transform adolescent girls' sense of entrepreneurial possibilities. We recommend a scaffolded and integrated approach to future entrepreneurship education programming to address and ultimately close the entrepreneurship gender gap.

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## INTRODUCTION

The ventures started, managed, and run by women<sup>1</sup> entrepreneurs represent a major contribution to the economies in which they operate. In Canada, majority women-owned small and medium-sized enterprises (SME) contributed \$130 billion to the economy in 2012, equivalent to seven percent of GDP (RBC Economics, 2013), and employed over 1.5 million Canadians (BMO Financial Group, 2012). In the United States, it is estimated that women-owned businesses generate over \$1.3 trillion in revenues and employ nearly 7.8 million people (American Express OPEN, 2013). In addition to the economic impact at the macro level, the impact of entrepreneurial activity on the individual can be very powerful. Women who participate in entrepreneurial ventures may experience greater financial success, independence, and self-respect than they would otherwise (Wilson et al., 2004).

Although women entrepreneurs make significant contributions to the societies in which they operate, there is still a substantial gender gap in early stage entrepreneurship participation which has resulted in an overall weakening of the entrepreneurial pipeline. An entrepreneurial pipeline is a way of understanding the entrepreneurial process, starting with individuals who hold a positive view of entrepreneurship and believe that they have the skills and abilities to start a new business. Individuals who hold this view and these beliefs are more likely to engage in the steps necessary to explore starting a business (Elam et al., 2019). A robust entrepreneurial pipeline is crucial in the exploration and ultimate formation of new ventures.

Women's participation in entrepreneurial ventures continues to lag behind that of men in the United States (4.3% gap), Canada (7.0% gap), and the U.K. (6.4% gap) (Huynh et al., 2017). In the 1990s, Canadian women led 45% of start-ups; but, by 2012, this number had declined to 40% (Tal, 2012). Statistics show that although the number of women-owned businesses has increased, the percentage of majority women-owned SMEs in Canada has declined from 16.4% in 2007 to 15.5% in 2011 (Industry Canada, 2015). In the U.S., women's share of business ownership has remained unchanged, at approximately 36%, in the five-year period between 2007 and 2012 (Lichtenstein, 2014). The enduring gap between men and women in early stage entrepreneurial participation and the weakening of the female entrepreneurial pipeline can be tied to lower levels of confidence, or entrepreneurial self-efficacy (ESE), entrepreneurial intentions (EI), and program participation among women (Chen et al., 1998; Gatewood et al., 2002; Kourilsky & Walstad, 1998; Wilson et al., 2009).

Adolescent career aspiration research has shown that teen girls are less likely than boys to aspire to entrepreneurial careers (Kickul, 2008; Kourilsky

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<sup>1</sup> Throughout this paper, we use Brescia's policy regarding transgender or gender questioning applicants to define the terms "female" or "woman" which includes cis gendered females and "self-identified women and people assigned female at birth who do not fit into the gender binary." (*Undergraduate Admissions for Transgender or Gender Questioning Applicants Policy*, 2015, p. 1).

& Walstad, 1998; Marlino & Wilson, 2003) and also less likely to participate in voluntary entrepreneurship programming opportunities such as Junior Achievement (JA) (Elert et al., 2015). Menzies and Tatroff (2006) found that post-secondary level women were more likely than men to indicate that entrepreneurship did not fit their personalities as a reason for not taking entrepreneurial education. Also, women in post-secondary programs have been shown to exhibit lower ESE and EI than do men (Dempsey & Jennings, 2014; Wilson et al., 2009).

Recent research suggests that female entrepreneurs possess a number of unique characteristics, including being risk-averse, valuing relationships with clients, “fac[ing] a confidence gap” in starting their own businesses, and perceiving “that women are portrayed in stereotypical ways and do not believe they have adequate business skills” (Aidis, 2015 para. 9). Role models also appear to be of greater importance to women than men in supporting EI (Laviolette et al., 2012). Overall, women have been found to be less likely to pursue entrepreneurial endeavours because of low ESE (Chen et al., 1998; Gatewood et al., 2002; Kourilsky & Walstad, 1998). For example, in Ontario, women are less likely than men to believe they possess adequate entrepreneurial knowledge and skills (61.6% of men versus 47.2% of women) and more likely to report fear of failure as a reason for not starting a business (34.2% of men versus 43.0% of women) (Huynh et al., 2017).

The declining trends in the percentage of women-owned businesses combined with the career aspiration research findings are troubling. Fewer entrepreneurial-minded women in the pipeline will ultimately translate into fewer women starting businesses and contributing to their local and national economies. Encouraging greater female participation rates by addressing potential barriers, including low ESE and EI, could result in significant contributions to national prosperity (RBC Economics, 2013).

Evidence suggests that educational opportunities and targeted education positively influences ESE more for women than for men (Wilson et al., 2007) and that entrepreneurial education programs have the potential to increase entrepreneurial knowledge, ESE, and EI (Bae et al., 2014; Elert et al., 2015; Florin et al., 2007; Martin et al., 2013). However, by the time women reach post-secondary education, many have developed a belief that entrepreneurship does not fit with their personality (Menzies & Tatroff, 2006), suggesting that efforts to improve ESE and EI need to occur during primary and secondary education.

As a means to close the entrepreneurship gender gap, we decided to explore the effectiveness of short-term, female-only entrepreneurship programs at Canada’s only women’s university. The first program was delivered in the form of a one-day conference and the second was delivered as a one-week residential camp for girls enrolled in secondary school. These programs were designed to promote entrepreneurial knowledge, ESE, and EI.

The purpose of this study is to build on previous research by exploring the relationship between entrepreneurial knowledge, ESE, and EI. This study answers the call for more research to understand if and how entrepreneurship education can influence entrepreneurial perceptions and intentions (Chrisman & Vesper, 2002; Krueger & Brazeal, 1994). It also addresses the appeal to provide diverse learning experiences in entrepreneurial education to better fit with cognitive styles (Barbosa et al., 2007) accomplished through the design of gender-specific programming. Finally, it contributes to closing the gap in studies on subjects under the age of 25 (Cañizares & García, 2010).

## THEORETICAL BACKGROUND

### **Entrepreneurial Self-Efficacy and Entrepreneurship Education**

From Bandura's classic work (1977), the concept of self-efficacy can be defined as the belief that one can successfully perform a task required to achieve a particular outcome. Self-efficacy is malleable in that it develops and changes over time through skills obtained through experiences (Bandura, 1982; Gist, 1987; Hollenbeck & Hall, 2004). Although individuals can develop and intensify self-efficacy beliefs through mastery<sup>2</sup> experiences, modeling (observational learning), social persuasion, and judgements about their own psychological states, the most effective way is through mastery experiences (Bandura, 1977, 1982; Gist, 1987). Evidence suggests that those with higher levels of self-efficacy are more likely to pursue and persist in a given task (Bandura, 1977).

ESE, an extension of self-efficacy, is a "construct that measures a person's belief in their ability to successfully launch an entrepreneurial venture." (McGee et al., 2009, p. 965). Individuals who exhibit high ESE are more likely to engage in entrepreneurial activities (Chen et al., 1998). It is essential to understand how ESE is formed because it is such an important construct in entrepreneurship research (Shinnar et al., 2014).

Research on entrepreneurship education and self-efficacy perceptions have yielded divergent results despite the fact that a number of studies have identified education opportunities as having a positive impact on individual ESE perceptions (Peterman & Kennedy, 2003; Shinnar et al., 2012; von Graevenitz et al., 2010; Zhao et al., 2005). Additional research has found that entrepreneurship education can act as a gender equalizer as education opportunities have been found to be more important to women than to men in increasing self-efficacy (Wilson et al., 2007, 2009). The contradictory findings on the effect of entrepreneurial education on ESE as well as the potential positive impact entrepreneurial education may have on female program participants leads us to hypothesize that participation in gender-specific entrepreneurial programming will have a positive impact on ESE.

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<sup>2</sup> The term mastery is commonly used in the self-efficacy literature to connote proficiency or expertise in a specific set of abilities or domain. Despite the gendered nature of the term mastery, we decided to use it for the sake of clarity.

## **Knowledge Acquisition and Entrepreneurship Education**

A number of studies have established that creative skills and entrepreneurial knowledge are key factors in the start-up, survival, and growth of entrepreneurial ventures (Brüderl et al., 1992; Corbett, 2007; Davidsson & Honig, 2003). Kourlisky and Walstad's (1998) study of a population of high school students revealed that although both males and females exhibited a low level of entrepreneurial knowledge, females were found to be more aware of their lack of knowledge than were males. Other studies have found gaps in knowledge confidence as females were reported to be significantly less confident in their rating of entrepreneurial abilities than were males (Duval-Couetil, 2014; Wilson et al., 2004). Findings from a number of studies also suggest that an entrepreneurship education has the ability to increase the entrepreneurship knowledge and skills (Kirkwood et al., 2014; Volery et al., 2013) in female adolescents which could increase confidence, intent, and activity. Thus, we hypothesize that participation in the educational interventions will positively affect the entrepreneurial knowledge of participants.

## **Entrepreneurial Intentions and Entrepreneurial Education**

A desired outcome of many entrepreneurship education interventions is to increase EI, which Boyd and Vozikis (1994) describe as, "the state of mind that directs and guides the actions of the entrepreneur toward the development and implementation of the business concept" (p. 64). The literature identifies two theoretical perspectives that suggest entrepreneurship education is positively related to EI: (1) ESE (Boyd & Vozikis, 1994; Chen et al., 1998; De Noble et al., 1999; Fitzsimmons & Douglas, 2011; Krueger et al., 2000; Zhao et al., 2005) and (2) human capital theory (Becker, 1975).

The overall relationship between entrepreneurial education and EI was found to be small but positive from Bae et al.'s (2014) meta-analysis of 73 studies, 74 samples, and a sample size of 37,285 respondents. Feder and Nițu-Antonie's (2017) more recent study demonstrated a link between EI, entrepreneurial education, and gender identity in which women participants in an entrepreneurship education program showed an increase in EI whereas men did not. Shinnar et al. (2012) showed that gender had a moderating impact on the relationship between entrepreneurial education and EI such that male EI became stronger while female EI became weaker when exposed to an educational intervention. One explanation for this finding may be the presence of a gender-stereotype threat. Women may experience a conflict between an entrepreneurial identity and traditional female gender roles (Ahl, 2006; Baron et al., 2001). As a result, entrepreneurship is generally viewed by women as a masculine career and not an attractive option (Gupta et al., 2009).

Moderators of the entrepreneurial education-entrepreneurial intention relationship, including duration, level of engagement and self-selection bias, may also influence the EI of participants. Bae et al. (2014) hypothesized that

students would be able to absorb more learning in a program of greater duration. And as previously referenced, the most effective way to improve confidence in the ability to carry out and ultimately pursue and persist in a task is through mastery experiences (Bandura, 1977, 1982; Gist, 1987). In the case of self-selection bias, it is quite probable that those who purposefully enrol in entrepreneurial education programming already desire or have a high level of interest in an entrepreneurial career (Liñán, 2004; Long, 1987; Noel, 2002).

Based on this research, we hypothesize that a single day exposure to entrepreneurship with limited opportunities to engage in mastery experiences will not be sufficient to significantly shift EI. We also believe that the self-selection bias present in the one-week camp, due to the considerable expectations of applicants, is enough to neutralize any possible increase in EI.

## STUDY CONTEXT

### Exposure to Entrepreneurship

In the province of Ontario, where the studies were conducted, the high school curriculum is designed centrally and administered locally.<sup>3</sup> The publicly funded provincial high schools have the authority to determine which non-core courses, including courses in business studies, to offer student populations. A total of three entrepreneurship courses, at the grade 11 or 12 level, may be available to students. If any of these entrepreneurship courses are available, two carry the "college" (community college) designation, and one carries the "open" (to any student) designation. Grade 11 and 12 students who are interested in applying to university would be unlikely to take a community college designated course as it would limit their ability to meet university application prerequisites.

Extracurricular youth (under 18 years) entrepreneurship programming in the province is limited to community-based programming like JA and student entrepreneurship clubs, such as DECA.<sup>4</sup> Both programs attract participants who have a predisposition to entrepreneurship. The limited availability of curricular and extra-curricular programming, lack of offerings for university-

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<sup>3</sup> In Canada, education is constitutionally a provincial responsibility, in which the province develops policy and curricula and local boards of education deliver the curricula. Section 93 of the Constitution of Canada entitles Roman Catholics to attend denominational schools and Francophone families to send their children to French-language schools, which are funded by the Government of Ontario. As a result, there are four types of publicly funded school boards in Ontario: English Public, English Catholic, French Public, and French Catholic. Finally, the Ontario secondary school system categorizes credits in the first two years of secondary school as academic or applied. In the final two years courses are categorized according to the destination students aspire to after graduation, including courses designed to prepare students for community college, university, both university and college, workplace, and open courses, which are designed for all students. Students may take courses from multiple categories, but data suggests that the students tend to choose courses from a single category (*The Trouble with Course Choices in Ontario High Schools*, 2013).

<sup>4</sup> DECA Ontario is an extra-curricular business club for high school students which fosters leadership and entrepreneurship in high school students. DECA Ontario has 206 chapters across the province. It is a member of the international DECA movement.

bound students, and probable self-selection bias could be a contributing factor to the weakening of the female entrepreneurial pipeline.

*Just Own It! Program Overview.* Wilson et al. (2007) suggest that providing education opportunities to women could be particularly important to fuel the entrepreneurial pipeline and that targeted education appears to positively influence confidence more for women than for men. To test our hypotheses, we analyzed data collected from two separate entrepreneurial education interventions (called Just Own It!) offered at Brescia University College (see Appendix A for an institutional profile) that delivered programming to female high school students, as entrepreneurship education at pre-college levels has been found to be effective in increasing interest in entrepreneurial careers (Dyer, 1994; Kourilsky, 1995). A provincial government grant funded the program. Our objectives were to raise awareness of entrepreneurial activities, provide exposure to young female entrepreneurial role models, increase confidence in entrepreneurial abilities (Krueger & Brazeal, 1994), and increase participation in provincial and community-based youth entrepreneurship programming.

The programming mirrored effective entrepreneurial programs by including elements of interactivity, experiential learning, role modeling, and links to the local entrepreneurial ecosystem (Gupta et al., 2009; Peterman & Kennedy, 2003). Both interventions incorporated successful female role models that encouraged identification with the role model (Laviolette et al., 2012).

## **STUDY 1: ONE-DAY CONFERENCE**

### **One-Day Conference Intervention Description**

In the first entrepreneurial education experience, 220 female high school students from 39 high schools participated in a one-day entrepreneurship conference at a local women's university in February 2015. Students came from across Southwestern Ontario, from English-language urban and rural schools in six Catholic or Public Boards of Education. The conference programming allowed participants to explore the idea of entrepreneurship and to engage in entrepreneurial activities. The organizers promoted the event through school boards and high school staff who selected participants based on their leadership skills, creativity, and engagement. It was specifically highlighted that participants did not need to express an interest in entrepreneurship, or to have taken business courses, to minimize the risk that students who were not interested in business would self-select out of the program (Verheul et al., 2005).

The participants and their teachers started the day with a keynote speech by a recent university graduate who had cofounded a successful business. She emphasized the varying nature of the entrepreneurial experience and her personal reflections as a pre-angel start-up. Her talk was intended to provide an aspirational role model for the participants.

Participants then moved to breakout groups for three interactive, experiential learning sessions on opportunity identification, prototype development, and technology, which were led by female entrepreneurs from the local community with assistance from female university students. The conference emphasized creativity (a gender-neutral stereotype) and engagement with customers (a characteristically female stereotype) to avoid stereotype threat, and to increase the likelihood of the participants evaluating an entrepreneurial career more positively (Gupta et al., 2014).

Each high school student was exposed to a minimum of three women entrepreneur role models in the small group sessions to counter the male occupational role stereotype that both men and women associate with entrepreneurship (Bird & Brush, 2002; Langowitz & Minniti, 2007; Mueller & Conway Dato-on, 2013; Shneur et al., 2013; Urban, 2010). During the lunch break a trade show took place featuring 15 organizations that support youth entrepreneurship in the local area, including banks, credit unions, local business support centres, youth entrepreneurship programs, and several local women-owned businesses. At the end of the three break-out sessions, participants reconvened in a plenary session featuring a closing keynote speech from a 17-year-old female high school student. This young woman had been operating a small business since the age of 15, providing the conference participants with a role model of their age and life-experience.

### **Study 1 Hypotheses**

To evaluate the effectiveness of the one-day conference programming, we measured changes in entrepreneurial knowledge, confidence and intention to explore the following hypotheses:

**Hypothesis 1:** Participation in the one-day conference will positively affect the ESE of participants.

**Hypothesis 2:** Participation in the one-day conference will positively affect the entrepreneurial knowledge of participants.

**Hypothesis 3:** Participation in the one-day conference will not positively affect the EI of participants.

### **Study 1 Participants and Procedure**

Participants were asked to complete pre- and post-experience questionnaires designed to measure the effectiveness of the programming (Fayolle & Liñán, 2014; Wilson et al., 2007). The first questionnaire ( $t = 0$ ) was administered during the first breakout session and the second questionnaire ( $t = 1$ ) was administered at the end of the third breakout session, before the final keynote speech.

A letter of intent was incorporated in the registration documentation and given to parents/guardians requesting parental permission for registrant participation in the study.<sup>5</sup> A two-page questionnaire asked respondents to

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<sup>5</sup> This study was approved by the Brescia University College Research Ethics Board (#11-2014-01) following the Tri-Council Research Ethics Policy Statement.

complete measures of work and leadership experiences, role models, entrepreneurial knowledge, ESE, and EI. A total of 159 pre-conference questionnaires and 170 post-conference questionnaires were completed for response rates of 72.3% and 77.3%, respectively.

## MEASURES

### **Entrepreneurial Self-Efficacy**

Most theorists argue that ESE is best conceptualized as a multi-dimensional measure; as a result, some studies have attempted to break the construct into components (Barbosa et al., 2007; McGee et al., 2009; Mueller & Goić, 2003). McGee et. al (2009) developed and validated a five element ESE construct, particularly suited to examining the behaviour of nascent entrepreneurs. The construct includes the following five dimensions: (1) searching, which captures the creativity and innovation required in the idea development phase; (2) planning, which includes activities that would help the entrepreneur convert the idea into a feasible plan; (3) marshaling, which describes the process to assemble required resources; (4) implementing-people, which includes the skills necessary to grow and sustain the business through good management principles; and, (5) implementing-financial, which relate to the financial competencies required to manage the business effectively. The dimensions follow a process model that divides entrepreneurial activities into discrete phases.

To measure ESE, respondents rated themselves on 10 ESE competency statements drawn from the works of McGee et. al (2009) and Wilson et. al (2007). Using a five-point Likert scale (1 = much worse and 5 = much better) respondents were asked, "Compared to other students in your grade, how would you rate yourself in the following areas?" The statements were grouped into McGee et al.'s (2009) multi-dimensional construct for analysis.

### **Entrepreneurial Knowledge**

Participants were asked to answer four objective questions about entrepreneurs to measure their entrepreneurial knowledge. From these questions a composite variable was computed to examine whether participants' objective entrepreneurial knowledge increased by the end of the program. This variable, summing to a total of 10, represented a score of objective knowledge, where the higher the number, the greater the knowledge. To measure subjective knowledge, respondents were asked, "Overall, rate your knowledge and understanding of starting and managing a business" on a five-point Likert scale (Kourilsky & Walstad, 1998).

Cronbach's alpha was used to determine the internal consistency of both the ESE and entrepreneurial knowledge constructs. A Cronbach alpha of 0.7 or above is considered acceptable and demonstrates reliability of the scale (Cronbach, 1951). Cronbach's alpha was 0.861 for ESE and 0.747 for entrepreneurial knowledge, including results from both the pre- and post-experience data.

## Entrepreneurial Intentions

To measure EI respondents were asked how interested they were in various careers including starting/owning a business on a five-point Likert scale (1 = definitely not interested and 5 = extremely interested) (Wilson et al., 2009). See Appendix B for the survey questions used to measure ESE, entrepreneurial knowledge, and EI.

## STUDY 1 RESULTS

Descriptive statistics were generated to assess the sample. Independent t-tests, rather than paired t-tests, were conducted to evaluate the impact of the one-day conference. Paired t-tests were not possible for the one-day conference as logistics prevented matching responses. Results were analyzed using IBM SPSS 23.

To better understand the population, demographic and experience data were collected (see Table 1). Respondents reported a considerable amount of leadership experience which might minimize any significant increase in ESE as the population already possessed a high degree of confidence. We noted that a large percentage of this population knew an entrepreneur personally.

**TABLE 1. ONE-DAY CONFERENCE PARTICIPANT PROFILE**

Grade	%	Work Experience	%	Leadership Experience	%	Know an Entrepreneur	%
9	5	Employed	54	Yes	70	Mother	16
10	14	Business Owner	6	No	30	Father	40
11	33	No Experience	43			Grandparent	27
12	48					Aunt/Uncle	31
						Family Friend	39

Note: Work experience and knowing an entrepreneur add to more than 100% because participants could choose more than one response.

## ENTREPRENEURIAL SELF-EFFICACY AND ENTREPRENEURSHIP

EDUCATION. To examine H<sub>1</sub>, that participation in the one-day conference will positively affect the ESE of participants, the means of the pre- and post-conference ESE composite score and the multi-dimensional ESE construct were analyzed. The results presented in Table 2 show that, although the composite ESE mean and the means of all ESE categories increased (except implementing-financial), the results were not statistically significant, and therefore H<sub>1</sub> was not supported. These results imply that a five-hour program was not sufficient to alter the confidence of participants.

**TABLE 2. ONE-DAY CONFERENCE PARTICIPANTS' SELF-REPORTED ESE**

Variable	Time	Mean	t	df	p
Composite Score	Pre	3.7	-0.92	320	0.356
	Post	3.8	-0.93	320	0.355
Item-Level Constructs					
Searching	Pre	3.8	-0.93	327	0.354
	Post	3.8	-0.93	326	0.354
Planning	Pre	3.8	-1.05	327	0.295
	Post	3.9	-1.05	323	0.295
Marshalling	Pre	3.6	-0.41	325	0.685
	Post	3.6	-0.41	325	0.684
Implementing -People	Pre	3.9	0.06	325	0.951
	Post	3.8	0.06	325	0.950
Implementing-Financial	Pre	3.6	0.36	327	0.719
	Post	3.6	0.36	326	0.719

KNOWLEDGE ACQUISITION AND ENTREPRENEURSHIP EDUCATION. The results shown in Table 3 indicate that both objective and subjective entrepreneurial knowledge increased by the end of the entrepreneurial education program; therefore, H2, participation in the one-day conference will positively affect the entrepreneurial knowledge of participants, was supported. This finding supports the notion that the program content was appropriate in building knowledge to better understand entrepreneurship.

**TABLE 3. ONE-DAY CONFERENCE KNOWLEDGE ACQUISITION**

Variable	Time	Mean	t	df	p
Objective Knowledge	Pre	7.7	-2.57	305	0.011*
	Post	8.3	-2.56	294	0.011*
Perceived Knowledge	Pre	3.1	-8.42	317	p < 0.001*
	Post	3.9	-8.41	309	p < 0.001*

Note: \*p<0.05

ENTREPRENEURIAL INTENTIONS AND ENTREPRENEURIAL EDUCATION. The results shown in Table 4 show that H<sub>3</sub>, that participation in the one-day conference will not positively affect the EI of participants, was supported. The mean score for starting/owning a business did increase; however, it was not significant (p > .05). This result reinforces the established relationship between ESE and EI in that a shift in EI is partially dependent on a shift in ESE.

**TABLE 4. ONE-DAY CONFERENCE ENTREPRENEURIAL INTENTION**

Variable	Time	Mean	t	df	p
Entrepreneurial Intentions	Pre	3.6	-0.33	327	0.743
	Post	3.7	-0.33	327	0.742

## STUDY 2: ONE-WEEK CAMP

We conducted a second study to explore whether a longer, more intensive entrepreneurial education program would have a greater impact on ESE and EI. In the second study, 49 female high school students from 31 high schools participated in one of two one-week residential entrepreneurship boot camps in July 2015. Participants attended English-language public and Catholic high schools across Southwestern Ontario, primarily from the Greater Toronto Area (GTA) and from the London/St. Thomas area. Participants were required to submit a formal application to the program which included two short essays, one describing a business idea and one describing a teamwork or collaboration experience, as well as provide a nomination from a teacher or guidance counsellor.

The program was promoted through local school boards. The marketing message highlighted that the girls did not need to express an interest in entrepreneurship, or to have taken business courses in high school, or plan to take a business major at university or college. The curriculum used an experiential learning pedagogy, similar to those used by Steve Blank, an American entrepreneur and educator based at Stanford University and by the MaRs Discovery District, which is an innovative organization based in Toronto that works with a network of private and public sector partners to help entrepreneurs launch and grow companies.

After discussing entrepreneurial personalities and skills, students formed founders' teams on the first day of the camp. They then identified a specific customer problem and created a solution in the form of a business model canvas (Osterwalder & Pigneur, 2010). On day two students focused on designing a product or service, creating a prototype, and conducting customer discovery (Blank & Dorf, 2012). On day three students used the information they learned in customer discovery to modify their business models, exploring the concept of the pivot and product validation (Ries, 2011). They also worked on revenue models and costing. Day four consisted of fine-tuning product prototypes, participating in a pitch workshop, and developing pitches. Throughout the first four days, participants worked with experienced women entrepreneurs during the workshop sessions. They also engaged in a storytelling (Donnellon et al., 2014) session with three experienced women entrepreneurs. Day five involved preparation for and delivery of the pitches in front of a panel of experienced entrepreneurs and investors, as well as friends and family.

## Study 2 Hypotheses

We expected both the ESE and entrepreneurial knowledge of participants to increase; however, we did not expect EI to increase. The camp demanded a rigorous application process and a five-day commitment so we predicted participants would report a high level of pre-camp EI; therefore, it was unlikely that the intervention would increase EI. In summary, our hypotheses for the one-week camp included:

**Hypothesis 4:** Participation in the one-week camp will positively affect the ESE of participants.

**Hypothesis 5:** Participation in the one-week camp will positively affect the entrepreneurial knowledge of participants.

**Hypothesis 6:** Participation in the one-week camp will not positively affect the EI of participants.

## Study 2 Participants, Procedures, and Measures

For the one-week camps, a total of 49 pre- and post-experience questionnaires were collected for a response rate of 100%. The same procedures, instruments, and measures were used in Study 1 and Study 2.

## Study 2 Results

We generated descriptive statistics and conducted t-tests to evaluate the impact of the one-week camps. The descriptive statistics revealed that camp participants possessed both work-related and leadership experiences comparable to the experience results from the one-day conference; therefore, a possible ESE bias could be present in this population as well. Camp participants were also found to know many entrepreneurs.

**TABLE 5. ONE-WEEK CAMP PARTICIPANT PROFILE**

Grade	%	Work Experience	%	Leadership Experience	%	Know an Entrepreneur	%
9	8	Employed	56	Yes	71	Mother	19
10	21	Business Owner	6	No	29	Father	46
11	58	No Experience	40			Grandparent	27
12	13					Aunt/Uncle	35
						Family Friend	44

Note: Work experience and knowing an entrepreneur may add to more than 100% because participants were able to choose more than one response.

## Entrepreneurial Self-Efficacy and Entrepreneurship Education

The results for H<sub>4</sub> (participation in the one-week camp will positively affect the ESE of participants) are presented in Table 6.

**TABLE 6. ONE-WEEK CAMP PARTICIPANTS' SELF-REPORTED ESE**

VARIABLE	Time	Mean	t	df	p
Composite Score	Pre	3.9	-2.82	46	0.007*
	Post	4.0			
ITEM-LEVEL CONSTRUCTS					
Searching	Pre	3.9	-2.32	46	0.025*
	Post	4.1			
Planning	Pre	4.4	-0.62	46	0.537
	Post	4.4			
Marshalling	Pre	3.7	-1.60	46	0.116
	Post	3.8			
Implementing -People	Pre	4.1	-2.06	46	0.046*
	Post	4.3			
Implementing-Financial	Pre	3.9	0.22	46	0.830
	Post	3.9			

Note: \*  $p < 0.05$

The change in overall ESE, as well as the change in two ESE categories (searching and implementing-people), was significant ( $p < .05$ ), supporting H<sub>4</sub>. The camp curriculum focused on fostering creativity by exploring a problem-solution model (searching stage activities) through collaborative work (implementing-people activities) which appears to have been an effective means to increase confidence in those areas.

## Knowledge Acquisition and Entrepreneurship Education

Similar to the results from the one-day conference, the one-week camp intervention results shown in Table 7 supported H<sub>5</sub>, that participation in the one-week camp will positively affect the entrepreneurial knowledge of participants.

## Entrepreneurial Intentions and Entrepreneurial Education

Although the results from the one-week conference reveal that the overall EI mean decreased slightly, the results were not significant and H6; participation in the one-week camp will not positively affect the EI of participants, was supported. These results reinforce the assertion that due to the selection process, participant pre-experience EI was already strong and that it would be difficult to shift post-experience EI.

**TABLE 8. ONE-WEEK CAMP ENTREPRENEURIAL INTENTIONS**

Variable	Time	Mean	t	df	p
Entrepreneurial Intentions	Pre	4.0			
	Post	4.0	0.78	45	0.439

### Limitations

This study has several limitations that need to be acknowledged. First, because we used non-probability sampling, the final results cannot be viewed as representative of the population of adolescent females in Canada. Second, the study relied on self-reported data and assessed respondent's perceptions and not behaviours, even though intentions are consistently the best predictor of subsequent behaviour (Barbosa et al., 2007). Next, the data was collected in 2015. Although we have no evidence to suggest that the context has changed meaningfully, it is conceivable that the a more recent group of program participants would respond differently to the survey tools. Finally, we must be cognizant that female adolescents hold varying degrees of awareness and interest in exploring entrepreneurship and those differences must play a key role in the design of more effective programs.

### DISCUSSION AND IMPLICATIONS FOR PRACTICE

Our goal in designing, delivering, and evaluating these entrepreneurial education interventions was to better understand how to encourage female adolescents to explore entrepreneurship thereby closing the entrepreneurship gender gap. The studies attempted to understand if the interventions were effective at engaging high school students through measured changes in confidence and knowledge.

The two interventions in this paper differed in duration, intensity, and process. The one-day conference might have been more appealing to students in the curious, willing to explore stage whereas the one-week camps were likely more attractive to students who had already established an interest in entrepreneurship and were intent on further developing their skills and ideas. We compared the pre-intervention EI scores of the one-day conference with those from the one-week camp and discovered a significant difference ( $t = -2.177$ ,  $df = 79.66$ ,  $p = 0.032$ ). This result suggests that the populations were indeed different. The difference in intention to pursue an entrepreneurial career makes clear the need for diverse entrepreneurial

education opportunities for adolescent females in order to strengthen the female entrepreneurial pipeline.

First, there is a need to build entrepreneurial knowledge through exposure to ideas, experiences, and role models in the population that has not seriously considered entrepreneurship in early stage interventions (e.g. the one-day conference). Second, interventions designed to extend knowledge as well as strengthen ESE should be developed (e.g. the one-week camp). The next level of programming should focus on advancing competencies in planning, marshaling resources, and financial management (e.g. JA programs) followed by support and mentoring interventions as ventures are launched. A longitudinal study by Elert et al. (2015) demonstrated the effectiveness of JA programming by finding that participation increases the long-term probability of starting a firm.

We suggest a series of scaffolded interventions, starting with those designed to expose and inspire and ending with those intended to support venture implementation, are essential to fuel the female entrepreneurial pipeline. It is critical that the programming focus on competencies, such as creativity and relationship development, that do not trigger stereotype threat (Duval-Couetil, 2014; Gupta et al., 2008; Wilson et al., 2004), and that integrate role models, storytelling, and experiential learning activities (Laviolette et al., 2012).

At present there is limited coordination between developers of available entrepreneurial education programs in the region the study took place. In addition to recommending a more coordinated and intentional approach to the development and delivery of entrepreneurial education, we also recommend a change to the Ontario secondary school curriculum to offer entrepreneurship courses for university-bound students and to increase the availability of entrepreneurship courses.

Consistent with the mission of the Center for Advancement of Women at Mount Saint Mary's University to find solutions for persistent gender inequality, this paper provides a case study of entrepreneurship programming designed to reduce the entrepreneurship participation gap between men and women. Increased participation in entrepreneurial ventures may result in greater financial success, independence, and self-respect, thus improving the lives of girls and women. Women's colleges are better positioned to deliver female-only entrepreneurial programming due to their unique assets, including instructors who understand feminist pedagogy, awareness of the unique challenges facing female entrepreneurs, and connections to female entrepreneurs in the community who may act as role models for aspiring adolescent female entrepreneurs. Consistent with the mission of the Women's College Coalition, we believe that this program has helped to transform adolescent girls' sense of entrepreneurial possibilities, and therefore have the potential to change the world through education.

## **ACKNOWLEDGEMENTS AND CREDITS**

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## **APPENDIX A**

### **BRESCIA UNIVERSITY COLLEGE PROFILE**

Brescia University College (Brescia) was founded in 1919 by the Ursuline Order of the Chatham Union, a Roman Catholic organization of women religious, to provide university education to women. It originated as a women's college and survives today as Canada's only women's university. Brescia welcomes self-identified female students of all backgrounds and does not require students to observe any religious behavioural codes (Trick, 2015); moreover, Brescia has a strong heritage of inclusion, diversity, and social justice.

As of September 2019, Brescia boasted 1,600 undergraduate and graduate students (M. Simm, personal conversation, December 12, 2019). It offers programs in management and organizational studies, social sciences, foods and nutrition, arts and humanities, and leadership studies as well as discipline-specific courses in leadership.

Brescia is a publicly funded affiliate college of Western University, in London, Ontario, one of the 16 church-sponsored colleges affiliated with seven secular, publicly funded universities in the Province of Ontario. It is a legally separate entity from Western University, with its own governance structures and articles of incorporation. Brescia has canonical sponsorship from the Mother St. Anne Lachance Society, which includes representation of the founding order of Ursulines and the local Roman Catholic diocese. However, Brescia is constituted and governed independently from its canonical sponsor, albeit with representation of its sponsor on Brescia's governing board.

## **APPENDIX B**

### **SURVEY QUESTIONS**

#### **Measures of Entrepreneurial Knowledge**

##### **Objective Measure Questions:**

What is an entrepreneur? (Choose all that apply)

- a. A person who takes on risk in order to start and operate a business
- b. A person who is responsible for running all or part of a company
- c. A person who comes up with a new product or service idea
- d. A person who invests in businesses

What educational requirement is necessary to become an entrepreneur?

- a. University/College graduate
- b. High school graduate
- c. No specific education required

Do you have to have taken business courses to become an entrepreneur?  
Circle your answer.

Yes                      No

What are the goals of entrepreneurs? (Choose all that apply)

- a. Financial rewards
- b. Achieving social change
- c. Independence
- d. Doing something they love

##### **Subjective Measure Question:**

Overall, rate your knowledge and understanding of starting and managing a business

- a. Excellent
- b. Good
- c. Fair
- d. Poor
- e. Very poor

## Measures of Entrepreneurial Self-Efficacy

Five Element Construct Categories:

- 1) searching, which captures the creativity and innovation required in the idea development phase;
- 2) planning, which includes activities that would help the entrepreneur convert the idea into a feasible plan;
- 3) marshaling, which describes the process to assemble required resources;
- 4) implementing-people, which includes the skills necessary to grow and sustain the business through good management principles; and,
- 5) implementing-financial which relate to the financial competencies required to manage the business effectively.

Compared to other students in your grade, how would you rate yourself in the following areas?

	Much worse	A little worse	About the same	A little better	Much better
Being creative (1)					
Being able to solve problems (1)					
Organizing projects & activities (2)					
Working in teams (3)					
Getting people to agree with you (3)					
Making decisions (3)					
Explaining your ideas (3)					
Being a leader (4)					
Motivating others (4)					
Managing money (5)					

### Measure of Entrepreneurial Intentions

Rate your interest in the following careers:

	Definitely not interested	Probably not interested	Possibly interested	Somewhat interested	Extremely interested
Business or management					
Doctor, nurse or medical professional					
Actor or performer					
Artist/graphic designer					
Lawyer					
Starting/owning your own business					
Scientist/engineer					
Professional athlete					
Journalist/writer					
Working with computers					
Military					
Sales/marketing					
Teacher					
Nonprofit/government					

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## Exploring Writing Center Work in a Women's College

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**Abstract.** Despite the wealth of extant research on both single-sex education and gender identity in the writing center, comparatively little has been done on writing center work in single-sex contexts. This project attempts to fill this gap by combining primary and secondary research to assess the benefits, challenges, and opportunities presented by doing writing center work at a small women's liberal arts college. More specifically, the project synthesizes the existing research on the "feminization" of the writing center with interview responses from tutors at the Cottey College Writing Center (CCWC). The project concludes that while writing tutors at single-sex institutions may have advantages when it comes to building solidarity with visiting students, they may also contend with certain gender stereotypes that are exacerbated by the single-sex nature of their institution. For example, tutors at a women's institution may encounter the seemingly contradictory pair of stereotypes that (1) female tutors are less qualified and/or knowledgeable than their male counterparts and (2) female tutors are likely to be overconfident, arrogant, judgmental, and unapproachable. The project provides suggestions for how writing centers within such institutions can capitalize on their advantages to attract more students—and encourage more repeat visitors—while acknowledging and addressing the unique challenges they face.

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## INTRODUCTION: ARGUMENTS SURROUNDING SINGLE-SEX VS. CO-EDUCATIONAL CONTEXTS

The debate of whether (and to what extent) single-sex education has advantages over co-educational contexts centers largely on the differences in the opportunities often afforded to male students vis-à-vis female students. Proponents of a single-sex approach—particularly an all-women context—are quick to point out that having an exclusively female student body answers many common issues that arise in coed colleges; for example, the Association of American Colleges & Universities (AAC&U) (2016) cited the ability of women’s colleges to provide more leadership opportunities for students, opportunities that might otherwise go to their male counterparts. Such opportunities, the AAC&U claimed, include community engagement services offered by all-women institutions like Spelman College and St. Catherine University as well as leadership-focused courses and majors provided by Simmons University. Additionally, proponents have argued, women’s institutions address a problem observed by Sadker and Sadker in their 1994 study that from preschool to college, female students generally receive less attention from instructors than their male counterparts and are less often rewarded for being “smart” (Sadker & Zittleman, 2009, p. 69). In other words, an all-women context eliminates the inherent gender inequality of the classroom, allowing female students a greater opportunity to have their voices heard. Moreover, in many ways, the traditional public school ethos—and by extension that of higher education—favors masculine ways of learning. In her landmark book *The Separation Solution?*, Williams (2016) acknowledged that male students “thrive on competition and challenge” (p. 129), making them well-suited to the high-stakes, performance-focused environment offered by most institutions. Similar issues arise in discussions of standardized testing: a 1996 joint study by the Educational Testing Service and the College Board “concluded that multiple choice formats favor men over women, partly because men are more willing to guess on tests” (Ripin, 1996), and that male students are better suited to the timed nature of most of these tests. Those results were somewhat corroborated in a 2018 Stanford study by Reardon and colleagues that found “the estimated gaps [between male and female performance] are strongly associated with the proportions of the test scores based on multiple-choice and constructed-response questions” such that male students are better suited to the multiple-choice question style favored by most standardized tests.

On the other hand, criticism of a single-sex approach questions the extent to which the gender imbalance exists and, if it does, whether outright separation of the genders is indeed the answer. Williams herself decried the relatively scant amount of research validating significant differences between the educational quality received at single-sex public schools versus coed schools; even worse, she pointed out, “It also happens that some of the most commonly cited research studies on the subject are among the most shoddy” (p. 6). Williams argued that the effectiveness of single-sex education is overstated, perhaps because it sounds true enough on the surface or because those studies with the most striking results are the ones

that get circulated in educational circles (and perhaps even among the broader public of stakeholders, including parents, guardians, and school administrators). In a 2015 interview with *The Atlantic*, Williams claimed that single-sex education seems to many “like plain old common sense: they see differences between boys and girls, and they like the idea of creating schools that reflect these differences” (as cited in Anderson, 2015). She contended that any favorable results among single-sex schools are just as likely to be explicable by other factors such as lower student-to-teacher ratios and more mentorship opportunities, which these institutions often provide as a matter of course.

Likewise, Reardon and colleagues cautioned against drawing the wrong conclusions from their results: while they did indeed find a propensity for multiple-choice questions among male students, they admitted that their data comes from 2008-2009 test scores and that test content and format has changed dramatically since then; more importantly, though, they acknowledged that it is unclear whether any differences in the genders’ performance on these tests is due to a gender’s propensity for a way of thinking about a subject or rather a gender’s propensity for a test-taking strategy (e.g., willingness to guess, which is more common among males) (p. 16). Of course, this is to say nothing of the myriad other contextual, environmental factors that affect students’ test scores, factors that cannot realistically be controlled with one hundred percent validity.

In short, the research into whether there exist significant differences in how male and female students learn—and therefore how they should be taught—is lacking, but that certainly does not silence the debate surrounding single-sex versus coeducational approaches. And while the debate perhaps most often centers on public K-12 education policy, there is no denying that it has spilled over into higher education. Single-sex institutions like all-women Cottey College (the setting of this study) claim to provide an educational environment in which students feel “more powerful” and boast that “graduates of women’s colleges are more successful in careers [than their coed counterparts]; they tend to hold higher positions, are happier and earn more money” (n.d.). Other all-women institutions like Spelman College and Simmons University are equally eager to share the benefits of an exclusively female student body.

## **SEX AND GENDER IN THE WRITING CENTER**

Given the sustained fervor of the single-sex versus coed debate even in higher education, it is surprising that the debate has not gained more attention in the narrower realm of writing center studies, despite the fact that the field is certainly no stranger to issues of identity. H. Denny (2010), for example, has written extensively and convincingly on matters of sex and gender in the writing center, particularly the inherent femaleness of the writing center: “More often than not, these inclusive domains have disproportionate representation of women, as tutors or clients, a reality that confirms stereotypes of men’s reluctance to seek help (and women’s comfort doing it)” (p. 100). Because they foster collaborative and supportive

methods, writing centers align with the gendered stereotypes of mentoring and even mothering; Denny goes so far as to say that the role of women in education was always—and in many ways still is—tied to the gender roles of a post-agrarian society in which “women were positioned as pure, moral counter-weights and mothers of the republic and its children, shepherding them toward virtue and righteousness” (p. 95). Denny seems to suggest that the writing center, as a site of collaboration, sympathy, mentorship, and camaraderie, was always destined to be a women-centric fixture of the academy, in spite of (or maybe even because of) the larger institution’s privileging of masculinity.

Of course, Denny is not the only figure in writing center scholarship to refer to this seemingly inherent gendering of the writing center. In *The Oxford Guide for Writing Tutors*, Fitzgerald and Lanetta (2016) positioned the writing center within feminist theory by positing that “the writing center’s emphasis on interpersonal relationships...makes it a rich site for exploring the ways in which an ethic of care can push against the shortcomings of academic hierarchies” (p. 37). In this optimistic view, the writing center becomes a means of pushing back against the traditional masculine pedagogy of the institution, a pedagogy which often—like the aforementioned high-stakes testing of public school—fosters competition among students rather than collaboration, achievement vis-à-vis *other* students rather than the student’s individual achievement. By embracing these “womanly” (p. 37) characteristics, the writing center can send students the message that learning is not all about competing with one’s classmates.

That said, there are clear disadvantages to this gendering of the writing center as well. For one, Fitzgerald and Lanetta argued, this view of the writing center as a female-dominant site risks the “feminization” of the writing center, in which the center comes to be associated with “women’s work” (p. 37) and relegated to a lower position of power and authority within the institution. According to this view, the writing center by its very nature possesses “womanly qualities” such as “focus on the individual, on the emotions, and on the good of the other rather than the good of the self” (p. 37). Of course, none of these are detrimental qualities for a writing center to feature in and of themselves, but overemphasizing these qualities risks portraying the writing center as a less academically robust locus, one that values students’ personal feelings and comfort at the expense of, rather than as a complement to, rigorous scholarly improvement. This could affect how various stakeholders come to see the writing center: the center and its directorship could lose a certain amount of clout among administration if the center is seen as a “frill” service rather than an important educational fixture. Likewise, students and even faculty could be led to believe that the center lacks a certain masculine academic rigor and therefore is of limited—or no—use when it comes to actually improving writers’ performance. After all, even faculty are likely to be operating under the assumption that improving one’s writing requires a certain amount of “tough love” in the form of masculine-style tutoring approaches (e.g., commandeering/correcting

writers' papers, giving direct rather than indirect suggestions, offering harsh but accurate feedback).

On that note, Denny himself raised another concern about this feminization of the writing center: when tutors do turn to such so-called masculine tutoring methods, as is often to the writer's benefit, it may come as an unwelcome surprise to the writer, especially if the tutor is female. He wrote, "Because writing centers tend to be predominantly female spaces, and because women come to feel so comfortable in them, it's all the more unnerving when the safety of the writing center is violated in some way" (p. 113). When female tutors attempt to invoke a more masculine strategy, such as filling in silences and "offering up directive advice" (p. 101) rather than a feminine strategy like asking the writer questions, they may find themselves "feeling that they need to behave in ways that don't feel comfortable to them" (pp. 113-4); moreover, writers may be caught off guard by this sudden seeming betrayal of their gender expectations. This is not to blame the victim, of course: it would hardly be fair to insist that female writing tutors limit themselves to exclusively feminine tutoring methods—nor would sticking to just one set of strategies be sound tutoring practice. Seasoned tutors are able and should be able to employ the best strategy for the job, whether that strategy be labeled a "masculine" one or a "feminine" one. But the fact remains that the writing center has, on many and perhaps most college campuses, become feminized, and the tutors and directors who staff those centers must be prepared to contend with both the benefits and the challenges that reality poses.

As mentioned earlier, writing center scholarship is no stranger to matters of identity in general and gender more specifically. However, this scholarship has overwhelmingly been done on coeducational institutions, which presents a unique opportunity for new research. Very little has been done to examine questions of gender in a single-sex higher educational institution, leaving us to wonder what specific pedagogical implications present themselves in such contexts. To that end, this research begins with the rather broad question, "In what ways does writing center work at a single-sex institution—in this case, a women's institution—differ from writing center work at coeducational institutions?" And we might further refine this question to be, "What are the particular benefits, challenges, and opportunities of doing writing center work at such an institution?" Raising this question explores relatively new ground in writing center studies, as it brings these aforementioned issues of identity, gender, and the "feminization" of the writing center to a single-sex context, a context that is generally underexplored in the scholarship so far.

Moreover, we find in the research a palpable shortage of primary data, even though it seems obvious that questions of identity would bear fruit from speaking directly to the individuals involved with writing center work. Indeed, many of the points raised both in praise of fostering a feminine writing center and in criticism of doing so seem to rely largely on scant anecdotal evidence, notions that are rooted in gender stereotypes and

therefore may seem true but lack academic scrutiny, and theoretical speculation. For instance, while it stands to reason that feminine tutoring strategies which encourage a kind, nurturing writing center could prove favorable, this is by no means universally true, even in same-sex tutorials. By the same token, the common criticism that the feminization of the writing center reduces the center's on-campus clout is also little more than mere speculation and will also vary across campuses and contexts. In short, any research into gender in the writing center—whether that center is single-sex or coed—needs to speak to the students themselves, especially the tutors directly involved with the work of the writing center. It needs to ask these tutors, “What has been your experience?” “Why do you think that has been your experience?” “What can you—and we, the larger writing center community—learn from your experience?”

### **A BRIEF HISTORY OF THE COTTEY COLLEGE WRITING CENTER**

This project aims to address both of the aforementioned blind spots by synthesizing the existing literature with first-hand testimony of writing tutors at Cottey College, a small private women's college located in Nevada, MO, population: 8,200. Cottey itself enrolled just around 250 students for the 2019-2020 academic year and takes pride in its smallness, boasting “high retention and graduation rates, small class sizes, [and] a low student/faculty ratio” (J. Weitzel, as cited in Reed, 2019). The Cottey College Writing Center (CCWC), situated in the basement of the Ross Memorial Library, falls under the purview of the larger Cottey College Learning Center, which coordinates tutoring services across the curriculum. For the 2019-2020 academic year, the CCWC employed three paid writing tutors (three white women), all of whom were senior English majors, and a director (myself, a white man). Given that all three tutors were slated to graduate in Spring 2020 (a uniquely tumultuous semester, due to the COVID-19 quarantine, with implications that I return to later), I also brought on three unpaid interns—two freshmen (both white women) and a junior (a black woman)—who began their internships in the Spring 2020 semester with the expectation that they would be eligible for the paid positions to begin in the Fall 2020 semester. As it happens, one of these interns, the junior, withdrew from her internship shortly after Spring Break, citing a need to focus on her studies, and another opted to continue working for the Center in an internship capacity since she already had an on-campus job and would be ineligible for a second paid position. At the end of Spring 2020, I extended internships to two additional students, both freshmen and white women. In sum, for the Fall 2020 semester, the CCWC is expected to have one paid tutor and three interns, which seems an appropriate number to meet the needs of a student body as small as Cottey's.

Speaking of smallness, in many ways, Cottey's small enrollment—never mind its single-sex identity—works to the CCWC's advantage. Unlike writing centers at many larger institutions, the CCWC has relatively good visibility on campus despite being rather tucked away in the basement of the library; likewise, the already communal, tight-knit ethos of Cottey College obviously

aligns well with any writing center's mission to be seen by students as an inviting, welcoming space. It is common for writers to forge close relationships with certain tutors, and in an institution where it is barely an exaggeration to say that everybody knows everybody, it is perhaps easier for the tutors at the CCWC to establish such a mentor-mentee dynamic than it would be at larger institutions. The intimate nature of the campus also helps promote the CCWC, so to speak, as students share their positive experiences with their suitemates and peers.

But the CCWC has faced its own unique set of challenges, some of which are no doubt due in part to the distinctive nature of its larger institution. For one, that very same everybody-knows-everybody ethos that pervades the 14-building campus can just as well be a drawback as a boon, as a negative experience is more likely to make the rounds among a student's friend or peer group. For better or worse, tutors are more apt to earn a certain reputation for their work. Additionally, while first-time writers to the CCWC often become repeat visitors, getting new writers in the door has been a challenge. An informal survey of the student body in 2019 found that many students were disinclined to come to the CCWC simply because they did not feel they needed the help; perhaps they considered the writing center to be a place of remediation, a place to go when one has some deficiency or what S.M. North (1984) facetiously called "special problems" (p. 434). Of course, we in writing center studies are all too familiar with this issue regardless of the larger institution we find ourselves in; it is not uncommon anywhere for students—and even faculty—to associate their writing center with a sort of last resort: "One goes there hoping for miracles, but ready to face the inevitable" (North, 1984, p. 435). But on a campus as small as Cottey's, the problem may be exacerbated: students may feel even more self-conscious about going to the writing center if they believe it will stigmatize them as remedial or in need of extra help. Moreover, the CCWC has struggled to drum up student interest in other activities like workshops and special events, even when those activities offer incentives like extra credit. While it seems dangerous to speculate too much about the cause of this low turnout, the fact remains that the CCWC has plenty of room for development.

When I began my position at Cottey as Visiting Assistant Professor of English and Director of the Writing Center in Fall 2020, I was new to single-sex education: as a graduate student, I had taught at the University of Arkansas in Fayetteville, the flagship campus of the University of Arkansas with an enrollment total around 30,000. After earning my degree, I spent a year teaching as a full-time lecturer at Texas Christian University, a coeducational private university with enrollment of about 10,000. Therefore, upon being hired by Cottey, I was eager to learn more about single-sex education and its benefits, especially how they manifest in writing center work. And I wanted to go to the tutors themselves rather than relying on gut feelings and what the theory says should happen rather than what actually does happen. Such an approach often comes at the cost of getting to the heart of people's real, lived experiences, experiences that can tell us just as

much—if not more—about identity and why it matters to our discipline. Additionally, it was important that I remain cognizant of my own identity as a straight white male on a campus of exclusively female students, many of whom are international and/or nonwhite: I wanted to avoid being blinded by my own privileged identity—as well as my privileged position as director—in researching this gendering of the writing center in general and of Cottey’s writing center specifically. That said, the fact remains that my identity is a problematic factor in this study, an idea I return to later.

To that end, I interviewed two CCWC tutors about their experiences and surprises working at the CCWC, their thoughts about the benefits, challenges, and opportunities of tutoring writing in a single-sex context, and their ideas for how the CCWC could potentially attract more students given these benefits, challenges, and opportunities. In speaking with the CCWC tutors, I expected to hear echoes of what the existing research already tells us: that writing center work aligns well with classically feminine pedagogical themes of camaraderie and even motherhood, that students are likely to feel more welcome in a same-sex tutorial, and so forth—and indeed, these ideas did come up in the interviews. What surprised me, however, and where I argue this research has its most significant implications, is that the tutors both spoke to what they believed to be the CCWC’s unique potential to counteract certain deep-seated gender expectations—expectations that are often borne out of prior educational experiences as well as societal influence at large. More specifically, the tutors believed, in keeping with some of the feminist scholarship, that Cottey’s single-sex identity could be advantageously wielded as a means of disillusioning low-confidence female visitors, first, of the myth that writing talent is innate, but also of the myth that confidence—such as the confidence it takes to come to a writing center in the first place—is an exclusively masculine trait that reflects poorly when displayed by women. On the other hand, they also believed that a single-sex writing center faces a greater uphill battle on the front end (i.e., getting students to come in the first place) due to that same pair of myths, and their suggestions for improvement spoke to ways of addressing that reality.

### **BENEFITS AFFORDED BY THE WOMEN’S WRITING CENTER**

Heather, the sophomore who will be starting the paid position in Fall 2020, admitted that she was initially intimidated by the prospect of tutoring. While she already had plenty of experience helping her peers with their writing in informal contexts, her work at the CCWC required that she do so in a “professional setting,” and she “had low expectations because her friends always expected her to do all the work—she was the smart kid.” But she was pleasantly surprised that most students who came to the CCWC did so with a positive work ethic and “never felt like a tutee was expecting too much of her” (Heather, personal communication, May 12, 2020). She recalled her very first tutorial, in which she tutored a senior psychology major on her semester capstone project. Initially daunted by the difference in both age and level of education, Heather “left feeling happy and gratified,” and she believes that the success of that tutorial—namely, her ability to forge a

fruitful relationship with a student from a drastically different background in just thirty minutes, “speaks to Cottey’s community and smallness.” Here, Heather reiterates the notion that the institution’s small size and communal ethos was perhaps most key to this positive experience, but she also gets at the Freirean idea of solidarity, which E. Cushman (1996) defined as “a point of commonality where our perspectives overlap, despite our different positions” (p. 18). This is one of the more obvious benefits of tutoring in a single-sex institution: when tutor and tutee share even just one facet of identity, they are afforded a significant point of commonality that may prove useful in the tutorial. “A partnership,” Cushman stated, “Connotes people working together toward common goals” (p. 18); interestingly, Heather herself said she and the student “had fun figuring it out together,” suggesting she was able to establish a sense of solidarity with the writer and perhaps even a more long-term sense of solidarity that could encourage this writer to become a regular visitor to the Center. In her study of writers’ perceptions of male versus female tutors, K. Hunzer (1997) found that “female students saw the female tutors as being easy to work with, knowledgeable about everything...and willing to work through problems... this type of tutoring was extremely effective in the female students’ eyes” (p. 6). And while we obviously cannot say what was going on in the student’s head during Heather’s tutorial, it is likely that the shared gender, in this case at least, proved advantageous.

To play devil’s advocate, though, it is important to recognize that sharing gender identity does not guarantee the sort of solidarity that Heather was able to achieve in this session. D. Looser (1993) cautioned college writing scholars against pursuing the idea of a “universal women’s experience,” arguing that “to posit an ‘essence’ to women means identifying something that all have in common” (p. 56). It would be naïve to assume that the female tutor/female tutee dynamic always results in fruitful tutorials just because the two share a single point of solidarity. After all, Hunzer also concluded the following:

Students believe that females are more casual and caring... consequently, while the beliefs in these stereotypes can cause the student to feel more comfortable with and confident about writing, this belief can also hinder students as they allow the stereotypes to control their perceptions of the tutors. (p. 6)

Denny spoke to this hazard when he observed his female tutors’ struggles to employ more masculine tutoring strategies like direct intervention, even when those strategies were the right tools for the job. Female writers are often no more immune to committing gender stereotypes than male writers are, and if a female tutor suddenly and unpredictably invokes a masculine strategy, students may be caught off guard regardless of their gender. In fact, this could be an even greater risk at a women’s institution, as masculine tutoring strategies could seem even more out of place than in coed contexts. Again, we must avoid locking tutors into certain gender expectations; if a so-called masculine strategy works best, the tutor should

feel at liberty to use it. But there is value in recognizing the potential—for better or worse—of doing so.

When asked what opportunities writing center work at a women's institution afforded that might not be present at a coed institution, Vanessa, another tutor who began her internship at the same time as Heather, echoed Heather's thoughts about solidarity:

We have the opportunity to relate to similar experiences, which allows for a more bonding experience for the tutors and tutees that establishes that relationship, that allows them to be more comfortable asking for help...that offers us a stronger opportunity to have better relationships with the students.  
(Vanessa, personal communication, May 14, 2020)

Interestingly, both Heather and Vanessa spoke to the CCWC's unique ability to reduce the stigma attached to visiting a writing center, a stigma they believe to be exacerbated in coed contexts where female students are in many ways held in direct comparison to their male counterparts. Heather said, "In a coed class, students may feel ashamed or embarrassed to go to a tutoring center...having a writing center at a women's college opens the door for more women to see that they can write." Vanessa agreed:

The writing center offers the opportunity for students to feel more comfortable because they may not feel like they're being put down for coming for help. My professors have said that in coed schools, girls tend to not ask questions or ask for help. Being an all-women's school, there's more comfort in coming and asking for help.

Of course, the idea that going to the writing center carries with it a certain stigma is not unfamiliar to us: H.M. Robinson (2009), for example, reminds us that "students are often directed to the writing center by their instructor to attend to their writing problems" (p. 74), perhaps those "special problems" observed by North; as such, despite our best efforts, many students and even faculty stigmatize the writing center as a place of remediation for the "sick" or writing deficient. But Heather and Vanessa both clearly believe the problem is confounded in coed contexts where female students are often compared to—and perhaps compare themselves to—their male counterparts. At a women's institution, in contrast, the greater sense of solidarity afforded by the student body's shared gender identity could encourage students to see the center as a useful resource rather than a last resort. Plus, knowing that the tutors themselves are also women could alleviate some students' concerns that they may be judged by their tutor; this would agree with Hunzer's findings that most female students preferred to work with female tutors, owing to a greater sense of comfort working with these tutors and feeling less afraid to show weakness, ask questions, and try out their own words (p. 8).

## CHALLENGES FACED BY THE WOMEN'S WRITING CENTER

While Heather and Vanessa are optimistic that an all-women environment helps remove the stigma of shame or embarrassment attached to coming to the writing center, they also speculate that students at a women's institution face a gender-specific challenge that could inhibit their willingness to come: a societal expectation for women to be flawless from the beginning. Whereas male students are often seen as works-in-progress, diamonds in the rough that just need to be put through the rigors of formal training, female students often face expectations to always already be good at what they do. R. Simmons (2018) touched on this phenomenon in her book *Enough As She Is*, citing, for example, increased rates of depression and anxiety among adolescent female students due in part to "overthinking her every move...the self-criticism that girls are more likely to visit on themselves... [and] shame, the unshakable feeling that she is an unworthy person" (p. 6). Societal pressure on female students to approach academic problems—including writing problems—with flawlessness and poise could dissuade those students from stepping foot into the writing center. Heather said, "You [the tutor] have to fight that stigma, remind the women that they're not expected to be perfect when they get to college." She believes that, even in an all-women context, going to the writing center is admitting that one is *not* perfect. If this is in fact a reason that Cottey's female students avoid the center, it would agree with the informal survey I mentioned earlier that a plurality of the student body simply did not feel that they needed to come to the writing center. One could speculate that these students would indeed benefit from a writing tutorial and perhaps even truly believe that they would, but the pressure to always already be a "good" writer discourages them from crossing that threshold into the center, an act that they consider a concession. When asked what she thought the CCWC could do to attract more students, Heather responded, "It all comes down to that stigma around writing and tutoring. Students feel like, 'Tutoring is bad and I already know I'm bad at writing.'" The result, she suggests, is a tension between the positive force of same-sex solidarity or camaraderie and the counteracting force of societal pressure to be flawless.

Yet, Heather and Vanessa seem to believe that the greatest challenge facing the writing center at a women's institution has less to do with the gender of the students and more to do with the gender of the tutors. Vanessa worries that students—even female students—are more likely to be skeptical of female tutors' level of expertise:

There's that idea that sometimes girls aren't the smartest. They [students] may not think that they're going to get the help that they would in a coed school if they had a variety of different tutors. We're still, in the back of our minds, thinking, "Oh, they're just girls. They're not going to know everything." It sounds terrible, but there's that notion...they may feel there's less understanding or less knowledge.

In her study, Hunzer found that male students were often impressed by their male tutors' wealth of knowledge, even about relatively later-order concerns like grammar and punctuation, whereas those same students appreciated their female tutors' politeness but remained skeptical that they were truly getting the help they needed (p. 7). But Vanessa seems to think that female students likely fall into the same way of thinking, perhaps because at the same time as it insists on always-already perfection from female students, society simultaneously encourages them to doubt their own abilities and knowledge, or to at least be more modest about them.

Heather directly speaks to this idea that women are pressured by society to hide, as it were, their skill and knowledge sets lest they be seen as arrogant or unapproachable: "Especially as a woman, we're taught that confidence is a bad thing. Society tells us confidence is cockiness; strong, confident women are portrayed as conceited or bossy. Women who want to become confident are too ambitious." In Heather's mind, the students of a women's institution can be their own worst enemy: they can come to see female writing tutors—perhaps female tutors in general—as pretentious know-it-alls. K. Mitchell and J. Martin (2018) examined this issue in the broader context of teaching evaluations, concluding that "women are evaluated based on different criteria than men" (p. 648); more specifically, they found that student comments for female instructors tend to focus more on personality than those for their male counterparts, and they also underestimate female instructors' level of expertise (e.g., referring to them as "instructor" rather than "professor"). Moreover, "Women have been stereotyped as needing to exhibit nurturing and sensitive attitudes" (p. 649), and negative comments for female instructors more often employed language such as "rude" and "unapproachable" (p. 650). And while we must be careful to avoid treating teaching evaluations and students' perceptions of their tutors as interchangeable, Mitchell and Martin's findings provide support for Heather's hunch that some students could be dissuaded from coming to the writing center if they already assume that the tutors there will be cold at best and judgmental at worst. This obstacle could make it even more challenging for a female tutor to employ masculine tutoring strategies, as doing so could betray a student's expectations of her tutor to "exhibit nurturing and sensitive attitudes" at all times.

## **OPPORTUNITIES FOR THE WOMEN'S WRITING CENTER**

Given the assorted challenges of tutoring writing at a women's institution, especially counteracting the apparently contradictory stigmas of the always-already-perfect woman on the one hand and the overconfident, cocky woman on the other, what can be done? How can such a writing center use its unique identity to overcome—or at least resist—these challenges? When asked for their suggestions, both Heather and Vanessa emphasized the need to make things personal—in other words, to allow students to attach a face to a name, to see that the writing center was composed of knowledgeable yet approachable peers. Therefore, both tutors recommended that the

center take advantage of any and all opportunities to capitalize on the opportunity for solidarity between students and tutors. Heather suggested:

Have the tutors come to students and students physically see the writing center and that the tutors aren't scary or judging. That will encourage more people to use it. Also, encourage them to not be so afraid to get into writing. Even doing something like the clubs do where you get to see and meet the tutors. Just having the tutors come up so students can connect a face with a name and see that there's people in the writing center. [Students] feel like we get thrown into the building or room and we're ready to slap your hand with a ruler. That will help them see that we're humans.

It is interesting to see Heather acknowledge and caution against the heightened scrutiny against coldness that female instructors (and by extension, tutors) must contend with; she even goes so far as to invoke the stereotypical callous, overly-strict schoolmarm figure. Here, Heather's comments resonate with Mitchell and Martin's conclusions that women in pedagogical positions—even ones where the power differential between pedagogue and learner are diminished, such as peer tutoring—face extra pressure to avoid being seen as too teacherly. S.E. Holbrook (1991) noted the proliferation of this schoolmarm stereotype in writing studies in general, asserting that "the field has become associated with feminine attributes and populated by the female gender" (p. 201). Writing instruction has come to be seen in the United States as "women's work," and this reality brings with it not only a decreased level of esteem for the discipline among stakeholders (i.e., how hard can it be?) but also a greater risk of stakeholders' associating the discipline with rigid rules, conformity over creativity, and coldness from instructors. And while all writing centers must contend with these negative attitudes toward writing as a discipline, tutors at a women's institution must be even more cognizant of how they affect students' perceptions of themselves as tutors and of the writing center as a whole.

Vanessa's suggestions for attracting more students similarly emphasized the need to dispel these stereotypes. She said,

One way is going into writing classes—even the upper-level writing classes—and just telling them, 'We know this is hard. We've been there. We know that writing is always difficult.' Explaining that we've been there and we know you need help.

She also recommended that the writing center employ more classroom visits and special events like writing contests as a means of increasing visibility. Tellingly, Heather's and Vanessa's suggestions both entail the *tutors* approaching the *students* rather than the other way around, which suggests they sympathize with students' trepidation about physically coming to the writing center. As I discussed earlier, the mere act of crossing the threshold into a writing center (whether literally or figuratively, such as in the case of

making an online appointment) requires a great deal of confidence on the student's part regardless of gender, but female students may face the additional challenge of contending with the expectation of perfection, the concern that their tutor will be cold and arrogant, or perhaps even both. The solution, Heather and Vanessa seem to say, is to bring the writing center to *them*, to extend to students the opportunity for solidarity but on the students' own terms and in a more neutral environment. Indeed, Vanessa recognizes that an all-women writing center's single greatest advantage is "the opportunity to relate to similar experiences, which allows for a more bonding experience...as women, that offers us a stronger opportunity to have better relationships with the students." Solidarity is a powerful motivator, but as Freire (1968) himself put it:

The oppressor is solidary with the oppressed only when he stops regarding the oppressed as an abstract category and sees them as persons who have been unjustly dealt with...when he stops making pious, sentimental, and individualistic gestures and risks an act of love. (p. 5)

Freire would say that empty platitudes like "we're here for you" or "we're in this together" can only go so far: the writing center needs to engage in *praxis*; it needs to walk the walk, so to speak. According to Heather and Vanessa, it can do so by relieving some of the pressure on students to make that first step, by making itself better known on campus, and by showing students—rather than just telling them—that writing is a collaborative task. Such a strategy could allow the writing center to establish a sense of solidarity with students while simultaneously disillusioning them of the stereotypes that could be actively discouraging them from giving the writing center a chance.

## **CONCLUSIONS, IMPLICATIONS, AND OPPORTUNITIES FOR FURTHER STUDY**

This project has provided a glimpse into the underexplored realm of single-sex writing center work, but it comes with some important limitations that provide opportunities for further exploration. To begin with the elephant in the room, the Spring 2020 semester was marked by the COVID-19 pandemic and accompanying quarantine and social distancing measures; in Cottey's case, the campus moved to an exclusively online format beginning after Spring Break, on March 23, and students were instructed to vacate the campus for the rest of the semester. As for the CCWC, it—along with the Learning Center itself—stopped holding face-to-face tutorials (which were, up to that point, the only format available to students) and substituted them with Zoom tutorials, a chat room in which students could meet with tutors synchronously, and an online discussion forum on which students could post questions and have them answered by a tutor at a later time. While the tutors adapted to this change of format with fluency, the number of tutorials dropped dramatically for the rest of the semester, and even fewer students took advantage of the chat and discussion forum options. Whether Cottey's students were loath to utilize these services due to logistical difficulties,

personal challenges related to the outbreak or quarantine, or something else, the Spring 2020 semester was an atypically slow time for the CCWC, meaning Heather and Vanessa—who both started tutoring that semester—had limited experience to draw upon. Perhaps interviewing them again, once they have had more tutorials in Cottey’s vastly-preferred face-to-face format, could provide additional useful insight, as could interviewing past CCWC tutors who worked before the pandemic. Similarly, while I had initially sought to interview at least a couple of frequent visiting students to the CCWC to get their perspective, no such students were available, likely due in part to the logistical complications posed by the quarantine. Revisiting the option to interview students in addition to tutors would offer a meaningful expansion to this research, as this project has examined the benefits, challenges, and opportunities of single-sex writing tutoring exclusively from the tutor’s perspective.

But perhaps the pandemic offers a more latent opportunity for further study in the gendering of the writing center: given the common response among college campuses that navigating the post-quarantine landscape entails a certain “coming together” of the campus community, a notion built on the feminine ideals of camaraderie, mentorship, and mothering, could there be room to ask whether an all-female environment like the CCWC is in an advantageous position to reinforce this ethos? In a video shared with the Cottey community on March 30, 2020, President Jann Weitzel said, “Our priority at Cottey is for our students, faculty, and staff to be safe and well cared for during these difficult days.” She continued,

These are uncharted waters *for all of us*...It has been my honor to watch our students, faculty, and staff *come together* with this common mission in mind, and I know that going forward, we will witness incredible acts of *helpfulness, selflessness, and genuine caring* in the weeks ahead (emphasis mine).

If we accept that the writing center is a place already predisposed to these sorts of notions of safety, care, togetherness, and helpfulness, it stands to reason that the writing center could fulfill a unique role in college campuses’ responses to unexpected crises like that posed by COVID-19. Perhaps future research could explore the writing center’s capacity for fostering a “coming together” of the larger campus community that may or may not have to do explicitly with writing.

To return to the importance of speaking to the tutors themselves, another limitation of this project relates to my own identity as the researcher: not only do I write from the privileged position of a white heterosexual male, a rare identity on Cottey’s campus, I am also biased by my role as the CCWC’s director. Despite my best efforts, all of these components of my identity are bound to influence my reading of the theory surrounding gender’s role in the writing center and even my reading of the tutors’ interview responses. Moreover, the power differential between myself as researcher and my tutors as “subjects” could have influenced how they answered my questions and what stories they were willing to share with me; they may have, for

example, shown restraint in telling me about the unpleasant surprises of working at the CCWC or how the center could improve its services to students. I propose that the best solution to this limitation is to make sure that more data comes from the tutors themselves: perhaps tutors can keep more comprehensive records of and reflections on their own sessions, which would not only provide them more opportunities for metacognitive engagement with their tutoring work but could also form the basis for serious scholarly conversations around this data. Another potentially interesting approach might be to have a woman who is not their direct supervisor—perhaps another faculty member from the English Department—conduct interviews with them using the same question set. Not only would this help check the director’s gender as an influencing factor, it could also yield interesting contrasts between how tutors respond to a male versus female interviewer. Additionally, tutors could meet with each other and the director to dissect their tutorials in terms of what those tutorials say about gender’s role in the writing center, and tutors could have a more direct part to play in how that data is used (e.g., they could contribute to applying for and attending conferences or other opportunities to share this research). In short, writing center directors—particularly those whose identity puts them in an even greater privileged position—can put a check on their privilege by giving more control over the research to the tutors.

Finally, I mentioned earlier that international students constitute a significant part of Cottey’s student body, which raises the topic of intersectionality: in what ways do the benefits, challenges, and opportunities of tutoring writing at a single-sex institution intersect with the benefits, challenges, and opportunities of tutoring writing across other concepts of identity besides gender, such as race and class? The students of Cottey College may all be women, but they are not just women, after all; they come from a tremendous spectrum of socioeconomic and cultural backgrounds. And it would be naïve to assume that this diversity does not hold important implications for the writing center work done at Cottey or anywhere else. Again, we must be wary of pursuing the goal of what Looser called the “universal women’s experience” (p. 56). Looser rightly pointed out that this “essentializing” fails to “allow for differences (of race, class, sexual practices, age, culture, etc.) among women” (p. 56). But not only is it fallacious from an empirical standpoint to presume that shared gender identity is sufficient to “control” a study about identity in the writing center, it is also academically shortsighted, as these other differences provide fascinating opportunities for research in writing center work, particularly if they are intersected with, say, gender. For example, in recounting her first tutorial, Heather spoke at length about the age difference between her and the student and how that gap might have influenced her tutoring approach and the student’s response. Additionally, both Heather and Vanessa commented on the stigma associated with going to the writing center, and research in our field has firmly established that some student populations contend with this stigma with greater difficulty than others. Denny, for example, wrote that underprivileged students “contend with social and cultural pressures,

institutions, and structures that inevitably privilege dominant identities, forcing those on the margins to develop assimilationist or separatist strategies in relation to the center” (p. 117). Going to the writing center is often hard enough for privileged students, but marginalized students—including international students, nonwhite students, and students with pragmatic impairments—may face an even greater challenge when it comes to such acts as admitting that they need help with their writing or navigating matters of authority during a tutorial. How are these challenges compounded—or perhaps in some ways alleviated—by a single-sex context?

These and other avenues for further research could shed even more light on how writing center work “works” in a single-sex educational environment. And while this research has obvious implications for single-sex institutions (particularly other women’s colleges), I am optimistic that it has useful implications for writing centers across contexts. For one, examining writing center work in a single-sex context could put writing center work in coeducational contexts in greater relief, cluing us into the more latent intricacies of not just male tutor/male tutee and female tutor/female tutee dynamics but tutorials in which tutor and tutee do not share gender identity. For example, if Heather is right that female tutors are in a better position to send female students the message that confidence is an important part of writing well, are male tutors at a disadvantage when it comes to sending female students that message? Might their doing so be seen by some students as an assertion of privilege (i.e., “Just be confident—that’s easy for you to say!”)? Conversely, what happens when a female tutor tries to send that message to a male student? Is that tutor at greater risk of seeming “conceited or bossy,” as Heather put it, to the student? Furthermore, I hope that this project highlights the need for more research into identity in the writing center in general; as a service that seeks to appreciate each visiting student as an individual person and each tutorial as an individual session, it stands to reason that we seek to understand the significance of both tutors’ and students’ identities and how those identities converge, diverge, complement one another, clash with one another, and ultimately shape the role of the writing center at our own institutions.

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## APPENDIX A. INTERVIEW QUESTIONS

### Questions for Tutors:

1. What is the most interesting experience you have had at the Cottey College Writing Center?
2. What has surprised you about working at Cottey's writing center?
3. What do you think are the benefits of tutoring writing in an all-women context that might not be present in a coed context?
4. What do you think are the challenges of tutoring writing in an all-women context that might not be present in a coed context?
5. What do you think are the opportunities for tutoring writing in an all-women context that might not be present in a coed context?
6. What do you think Cottey's writing center can do to attract more students?
7. Besides tutoring, what other services or opportunities would you like to see Cottey's writing center provide?

*Note:* Interviewees may decline to answer any questions. Answers may be as long or as short as interviewees wish. The interviewer may follow up any of these questions with a request to the interviewee to give an example or provide further explanation.

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### **About *Collectif***

The Center for the Advancement of Women at Mount Saint Mary's launched *Collectif*, a digital research anthology, in 2018 as a companion piece to the University's annual Report on the Status of Women and Girls in California.™ *Collectif* is an anthology of original writing created by University faculty, students, and community partners.

### **About Center for the Advancement of Women at Mount Saint Mary's University**

The Center for the Advancement of Women at Mount Saint Mary's is a hub for gender equity research, advocacy and leadership development. Its vision is to find solutions to persistent gender inequities and work with partners to eradicate those inequities in our lifetime. That goal includes eliminating obstacles that women face in the workplace, in their communities, in the media and beyond to make a positive difference in the lives of women and girls in California and our nation. The Center also creates public programming, research guides, and training opportunities to engage more partners in its work.

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### **About Mount Saint Mary's University**

Mount Saint Mary's is the only women's university in Los Angeles and one of the most diverse in the nation. The University is known nationally for its research on gender equality, its innovative health and science programs, and its commitment to community service. As a leading liberal arts institution, Mount Saint Mary's provides year-round, flexible and online programs at the undergraduate and graduate level. Weekend, evening and graduate programs are offered to both women and men. Mount alums are engaged, active global citizens who use their knowledge and skills to better themselves, their communities and the world.

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In 2019, the national WCC found a new home at the Center for the Advancement of Women at Mount Saint Mary's. As a WCC member university that has a vested interest in advancing women's education, the Center dedicates its third edition of *Collectif*—an online research anthology—to questions related to the relevance and utility of women's universities in the 21st century.

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