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An Intersectional Approach to Exploring Computing Academic Success Self-Efficacy (CASS) for Black Undergraduate Students

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Abstract

The lack of diversity in computing has been a known issue for a long time. Considerable research has focused on factors that impact persistence of students in computing, especially those from groups that have been historically excluded from the field. Self-efficacy is a factor that has been shown to influence students' persistence and has been studied significantly in the literature. Existing literature has largely focused on factors such as prior computing experience, race, gender, etc. However, some gaps exist in this literature. For example, the interest in intersectionality is more recent. Research focusing on Black women's barriers and factors impacting computing self-efficacy is more recent as compared to research focusing on self-efficacy of women in computing. Research focusing on Black men in computing is extremely sparse. This study aims to fill these gaps and hence, takes an intersectional approach to investigating the factors that predict the Computing Academic Success Self-efficacy (CASS) for Black women and Black men in computing. This study also considers less researched factors predicting computing self-efficacy, such as departmental support and first-generation status in addition to sense of belonging and prior computing experience. The study uses data from the Data Buddies survey and looks at participant responses of 209 Black women and 340 Black men from R1/R2 universities. Results indicate a difference between factors predicting CASS among Black women and Black men, reinforcing the need to take an intersectional and holistic approach as the scientific community works on broadening participation in computing.

Keywords: self-efficacy in computing, Black women in computing, Black men in computing, broadening participation in computing

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An Intersectional Approach to Exploring Computing Academic Success Self-Efficacy (CASS) for Black Undergraduate Students

Sonal Dekhane and Nannette P. Napier

1. INTRODUCTION

Increasing the number of qualified computing graduates is critical for meeting industry demand for skilled technical talent (CompTIA, 2024). One approach to meeting this demand is to broaden the participation of students who choose to enter the field of computing and persist through graduation. Unfortunately, it is well-known that women and members of several ethnic and racial groups remain underrepresented in computing programs (Belle et al., 2023). For instance, about 12.1% of the U.S. population identifies as Black or African/American and, similarly, about 12.5% of postsecondary enrollment consists of Black students (Postsecondary National Policy Institute, n.d.) However, when focused more narrowly on undergraduate computing majors, the 2023 Taulbee survey found that Black students represented only 6.7% of enrolled students and 4.2% of degrees awarded (Computing Research Association, 2024). In the field, Black women comprise less than 3% of the tech workforce (Beldon et al., 2024; UNCF, 2020). Research shows that diverse teams generate more creative solutions, consider diverse perspectives and produce higher quality outcomes and innovative solutions (Page, 2007). Black students bring lived experiences that presents a different perspective and helps identify problems overlooked by others and design solutions for communities ignored by others. Thus, their contributions can directly shape technical innovation (Yosso, 2005).

Studies focused on the experiences of Black students in computing have identified several barriers to persistence. Solomon et al., 2018 found that the culture of computing conflicts with Black students' identity, resulting in a feeling of not belonging in computing. Some Black women in computing report a hostile culture throughout their educational experience and in early internships (Rankin et al., 2021). Black men studying information technology highlighted struggles to fit with the traditional IT professional model, expressed feelings of isolation, and identified race as a barrier (Cain & Trauth, 2022).

When seeking to understand why some Black students persist in computing while others do not, we can draw from extensive research focused on the student's self-efficacy (Ojha et al., 2024). Having enhanced self-efficacy has been shown to significantly and positively impact student retention, particularly for underrepresented populations (Estrada et al., 2018). As a result, various interventions have also been studied that were designed to increase self-efficacy (Chapin & Bowen, 2023; Wortmann & Vahrenhold, 2024; Bogart et al., 2024). Despite considerable efforts and notable successes, the overall impact on increasing recruitment, progression, and graduation of underrepresented groups remains small.

Against this background, our study examines factors that predict computing academic success self-efficacy (CASS) for Black undergraduate computing majors. We analyze the extent to which sense of belonging, prior computing experience, perceived departmental support, and first-generation status predict CASS across two groups: Black men and Black women. We utilize national, multi-institutional data collected from the Data Buddies Project led by the Computing Research Association (CRA) and focus specifically on students enrolled at research-intensive institutions with Carnegie classification of R1 (Doctoral, very high research activity) or R2 (Doctoral, high research activity). Sense of belonging and priori computing experience have been studied before, but we want to investigate them as predictors of CASS specifically for Black men and Black women, as an intersectional approach has been lacking in the literature. Perceived departmental support and first-generation status have not been studied extensively in the literature but are factors that could impact CASS. Hence, we include these factors in our study.

The research questions guiding this study are:

- RQ1: *What factors predict computing academic success self-efficacy for Black women computing majors?*

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- RQ2: *What factors predict computing academic success self-efficacy for Black men computing majors?*

2. PREVIOUS RESEARCH

Computing Self-Efficacy

Computing self-efficacy refers to an individual's belief in their ability to successfully perform computing-related tasks, such as programming, debugging, solving computer-based problems, etc. It is rooted in Bandura's broader concept of self-efficacy (Bandura, 1997) and is an important predictor of students' persistence in computing. To accurately measure self-efficacy in computing, researchers have differentiated between general computer self-efficacy (GCSE) and specific computer self-efficacy (SCSE). GCSE refers to an individual's belief in their ability to use computers and perform tasks across multiple domains, whereas SCSE refers to an individual's belief about their ability to perform specific computer-related tasks within general computing. Research suggests that GCSE influences other SCSEs and the development of SCSEs further enhances GCSE (He & Freeman, 2010; Marakas et al., 1998; Agarwal et al., 2000; Hasan, 2006; Downey et al., 2008). For example, programming self-efficacy is a type of SCSE and is defined as an individual's belief in their ability to perform programming related tasks. Researchers have studied programming self-efficacy among computing majors, identifying factors that impact this type of self-efficacy (Liu et al., 2023; Uzun et al., 2025). Researchers in computing education have studied factors impacting computing self-efficacy (both general and specific) and strategies to improve computing self-efficacy among students. Strategies such as whiteboarding and group work, and cohort-based instruction have been shown to impact students' computing self-efficacy (Chapin & Bowen, 2023; Wortmann & Vahrenhold, 2024; Bogart et al., 2024). This paper focuses on students' confidence in navigating the academic demands of their undergraduate computing degree, defined as Computing Academic Success Self-Efficacy (CASS), which is not addressed in the literature.

Factors Impacting Computing Self-Efficacy

Sense of Belonging

Research identifies low sense of belonging (SoB) and low self-efficacy as factors contributing to low retention in computing, especially among students from groups underrepresented in computing (Mithun & Luo, 2023). Good, et al. (2012) define sense of belonging to an academic domain as the feeling that one fits in, belongs to, or is a member of the academic community in question. It is one's personal belief that one is an accepted member of an academic community whose presence and contributions are valued. Several student integration models have investigated students' sense of belonging and its impact on various outcomes. For example, Tinto's student integration model suggests that students' integration into their social and academic college environment predicts whether they are likely to remain enrolled in college (Tinto 1994, Tinto 2012). Other studies, found a correlation between sense of belonging and multiple factors such as improved self-efficacy, increased interaction with faculty and improvement in GPA over time (Walton & Cohen, 2007).

When considering barriers to a strong sense of belonging, research shows that students from groups underrepresented in computing tend to have a lower sense of belonging. This stems from multiple factors, such as lack of role models, institutional or departmental climate, etc. A study conducted by Solomon et al. (2018) found that the culture of computing conflicts with Black students' identity as a Black person resulting in a feeling of not belonging in computing. This study also revealed that for Black women to belong in computing leading to their persistence in the field they must downplay different parts of their identities and adopt the femininity of White women. When considering strategies to improve sense of belonging, mentoring, peer mentoring and interactions, pedagogical interventions, instructional transparency, and the presence of role models have been shown to positively impact students' sense of belonging in computing (Ojha, et al., 2024; Dekhane et al., 2024; Black, et al. 2011; Cheryan, et al. 2013; Kim, et al. 2011; Hurtado, et. al. 2007; Mithun & Luo, 2023; Fong et al. 2024).

SoB is an independent variable in our model, and our study investigates the relationship between SoB and CASS for Black men and Black women. Taken together, the literature suggests we would find a positive relationship between SoB and self-efficacy.

Prior Computing Experience

Researchers have studied various factors impacting self-efficacy of students in computing. Ojha et al. (2024) found that substantial prior computing experience positively predicts computing self-efficacy, even when controlling for students' gender, race, ethnicity, and major. Ramalingam et al. (2004) conducted a study indicating that programming self-efficacy is

influenced by students' previous programming experience and increases as they progress through an introductory programming course. Their study shows that students' mental model of programming also influences their self-efficacy and that both mental model and self-efficacy affect course performance. Another study conducted by Hasan (2003) examined the influence of eight different computer experiences on computing self-efficacy and found that prior experiences with programming and graphics applications have strong effects on computing self-efficacy whereas experience with spreadsheets and database applications had weak effects. Mooney & Becker, (2020) noticed a difference in gender regarding the relevance of prior experience: for men, prior experience positively impacted student's sense of belonging; however, for women, it did not.

This paper considers both substantial and some prior computing experience as independent variables and investigates their impact on the CASS of Black men and Black women. Overall, the studies above suggest prior computing experience would be associated with increased self-efficacy with some potential differences based upon gender.

Gender

The problem of women's underrepresentation in computing has been persistent and has been studied by many researchers. Several researchers have found that even with same abilities as men, women perceive themselves as being low in competency for personal academic achievement. A study conducted by Zeldin & Pajares (2000) showed that verbal persuasion and vicarious experiences were the main sources of self-efficacy for women and these sources were more important for women in male-dominated fields such as computing than for women in traditional fields. The relationship between identifying as non-binary and computing self-efficacy has also been found to be negative (Ojha et al., 2024).

Overall, studies on the influence of gender on self-efficacy are not conclusive but seem to suggest that male students have higher computing self-efficacy than women (Fisher et al., 1997; Katz et al., 2006; Cassidy & Eachus, 2002; Goh et al., 2007; Karsten & Schmidt, 2008; Roach et al, 2011; Kiehlbauch et al., 2024).

Race and Ethnicity

The Ojha et al. (2024) study also identified race and ethnicity as influencing computing self-efficacy. Other studies, such as one by Perdriau et al. (2025) found that women and Black students were more likely to report discounting success microaggression, i.e. being told that their success is due to a special treatment based on their gender and/or race. This type of microaggression negatively predicts students' self-efficacy, sense of belonging and plans to persist in computing. While the Hispanic population in US has grown since 1990s, Hispanics remain underrepresented in computing programs and in the industry. Lack of institutional support and lower levels of academic preparation are reported as barriers for Hispanic students in computing (Núñez et al., 2021).

This existing research supports that race and ethnicity can impact self-efficacy in significant ways. While our study does not compare self-efficacy of Black students to that of other groups, it does provide a focused look at how self-efficacy differs within this group (i.e., Black men versus Black women).

Intersectionality

In recent years there has been growing awareness about intersectionality, a framework that recognizes the impact of considering multiple aspects of an individual's identity, such as race, gender, class, sexuality, etc. on their unique experiences of privilege or discrimination (Crenshaw, 1989). Intersectionality is believed to impact computing self-efficacy. For example, Blaney & Stout (2017) found that self-efficacy of first-generation college women in an introductory computing course was the lowest and was affected by their experiences in those courses. Studies investigating the persistence of Black women in computing have found that Black women experience a sense of isolation, microaggressions, and epistemic violence in computing education. A mixed methods study by Willis & Freeman (2024) found that both woman-computing identity and Black computing identity were a significant positive predictor of psychological toll and negative indication of retention intention, suggesting that being a Black woman and fitting into computing imparts a psychological toll on Black women that may lead them to leave computing. Qualitative data in this study suggested varying levels of self-efficacy among Black women in computing resulting from their experiences of double marginalization.

Studies investigating computing self-efficacy among Black men are extremely limited. A systematic mapping study of the literature conducted by Belle et al. (2023) showed that existing research largely focused on Black students or Black women and that Black men's

self-efficacy and persistence in computing were not studied explicitly. This study identified 13 persistence factors in four thematic categories that impact Black students' persistence in undergraduate CS programs. These categories include, 1) social capital, networking and support, 2) career and professional development, 3) pedagogical and programmatic interventions, and 4) exposure and access. This paper is centered in intersectionality and compares the CASS for Black women vs. Black men. It also investigates the predictors of CASS for both groups to understand the differences in the factors that impact CASS for each group.

Departmental Support and First-Generation Status

Research on broadening participation in computing clearly shows that the computing field is still dominated by White and Asian men and that those who wield this power need to be an active part of the broadening participation in computing initiative. Scholars have suggested institutions to seek systemic change initiatives to bring about impactful and sustainable change. Research on systemic change at department and/or institutional level focuses on retention of students from underrepresented groups. It does not specifically explore the impact of departmental support on computing self-efficacy. This gap in the literature needs to be addressed as self-efficacy has been tied to persistence (Rosson et al., 2011).

Similarly, when looking at students' first-generation status research on broadening participation considers first generation students, but specific studies exploring the impact of first-generation status on computing self-efficacy are lacking.

Summary

Overall, extensive research has been conducted on self-efficacy, sense of belonging and prior knowledge in computing. Studies focusing on computing self-efficacy of women and students from underrepresented groups exist. Studies focusing specifically on Black and Hispanic students also exist. While interest in intersectionality has increased in recent years, the focus of this research has been largely centered on Black women in computing. Studies investigating the computing self-efficacy of Black men are lacking. Similarly, studies investigating the impact of departmental support and first-generation status on computing self-efficacy are lacking in the literature. This study aims to fill these gaps and looks at the computing self-efficacy of Black women and Black men. It considers the impact of sense of belonging, department support, first generation status, and prior computing experience on the self-efficacy of these groups.

3. RESEARCH METHODOLOGY

Data Source

We utilized data collected as part of the Data Buddies Project, an initiative by Computing Research Association's (CRA) Center for Evaluating the Research Pipeline (CERP) to provide information on the state of computing in higher education (Computing Research Association, Center for Evaluating the Research Pipeline, n.d.). The survey is distributed annually to undergraduate and graduate students in computing-related programs through partnerships with volunteer institutions in the United States and Canada as well as to students who were prior participants of CRA programming. In exchange for participating in the survey, computing departments receive personalized reports comparing their data against peer institutions. In 2023, the survey was completed by 9,432 students from 162 unique departments across the nation. Further details of this dataset can be found on the CERP website referenced above. For this preliminary study, we requested deidentified data for all participants who completed the 2023 Data Buddies Survey. We asked for additional fields to provide the Carnegie classification of the institution where the student studied. After filtering the data to align with our research questions, our final dataset included 209 Black women and 340 Black men who were undergraduate computing majors enrolled at R1 or R2 institutions.

Measures

Computing Academic Success Self-efficacy (CASS)

The Data Buddies survey contains 13 items designed to measure different aspects of computing self-efficacy. The prompt asked students to indicate the extent to which they disagree or agree with statements related to self-efficacy. Even if they did not have experience with a particular item, they were asked to rate their confidence in their ability to do so. All questions used a Likert Scale Rating ranging from 1-5 (*Strongly disagree=1; Somewhat disagree; Neither disagree nor agree; Somewhat agree; Strongly agree=5*). For this study, we focused on the following questions related to students' confidence to:

- Complete an undergraduate degree in computing

- Learn the foundations and concepts of computing
- Pass my computing courses

To differentiate this from other aspects of self-efficacy, we labeled this as Computing Academic Success Self-efficacy (CASS) which we defined as students' perceived confidence in navigating the academic demands of their undergraduate degree. A reliability analysis to assess internal consistency indicated a strong Cronbach's alpha *(α)* = 0.868. In preparation for further analysis, we created a composite variable taking the average of the indicated survey items.

Sense of Belonging

The Data Buddies survey contains 3 items designed to measure sense of belonging using the same 5-point Likert scale described above. We completed a principal component analysis with Varimax rotation and found that the following items represented a single factor:

- I feel like I belong in computing
- I feel like an outsider in computing *(reverse coded)*
- I do not have much in common with the other students in my computing classes *(reverse coded)*

A reliability analysis to assess internal consistency indicated a reasonable Cronbach's alpha *(α)* = 0.681. In preparation for further analysis, we created a composite variable taking the average of the indicated survey items.

Departmental Support

The Data Buddies survey contains 7 items designed to measure different aspects of departmental support. The prompt asked students to Think about the environment of the computing department (including faculty, staff, administrators, and students) and rate the extent to which you disagree or agree with the provided statements using the same 5-point Likert scale described above. We completed a principal component analysis with Varimax rotation and removed 1 item with low factor loadings: "People in the department often attribute my success to special treatment or luck, rather than my competence". For this study, we focused on the following questions related to departmental support:

- I feel a sense of community in the computing department.
- The environment in the computing department inspires me to do the best job that I can.
- My ideas or opinions are minimized or ignored. *(reverse coded)*
- The computing department cares about its students.
- Computer science administrators and faculty care about diversity.
- The computing department is NOT very supportive of its students. *(reverse coded)*

A reliability analysis to assess internal consistency indicated a strong Cronbach's alpha *(α)* = 0.826. In preparation for further analysis, we created a composite variable taking the average of the indicated survey items.

Table 1 summarizes the means and standard deviations for each of these measures broken out by intersectional demographic group.

	Black Women Mean (Std. Dev.)	Black Men Mean (Std. Dev.)	p-value
Computing Academic Success Self-Efficacy (CASS)	4.34 (.74)	4.29 (.81)	.235
Sense of Belonging	3.20 (.87)	3.50 (.85)	<.001
Departmental Support	3.60 (.82)	3.70 (.73)	.061

Table 1: Means and Standard Deviations of Key Measures

Sense of belonging was the only measure where there was a statistically significant difference ($p<.001$) between the groups. In particular, Black Men reported a larger sense of belonging than Black Women.

Student Demographics

Students were allowed to select up to two majors from a predefined list. For our dataset, we selected students who selected a computing-related major for either of these questions (i.e., computer science, information technology, computer information systems/informatics, software engineering, computing and business, other computing & technology major, or data science/data analytics).

Race. Students were asked "What is your race? Please select all that apply." Our dataset includes all students who checked the box for the option "African American/African/Black." It is possible that they also selected other choices.

Gender. Students were asked "What is your gender identity?" Our dataset includes all students who selected either "Man" or "Woman".

First Generation. Students were asked to describe the highest level of education attained by any of their parent(s) or guardians. This information was used to determine whether they were the first generation to obtain a college degree. In our data set, 39.7% of Black women and 39.1% of Black men identified as first generation students.

Prior Computing Experience. Students were asked "Which of the following experiences did you have prior to entering an undergraduate program? Select all that apply." Consistent with [16], students were coded as having substantial prior computing experience if they took an AP Science course, learned a computer programming language, or completed an online course related to computing. In our data set, 56.9% of Black women and 57.1% of Black men had substantial prior computing experience. Students without substantial experience could be coded as having *some* prior computing experience if they engaged in software or hardware related projects, took part in student groups related to computing, or attended a workshop or other training in computing. In our data set, 5.3% of Black women and 9.1% of Black men were classified as having some prior computing experience.

4. RESULTS

We used the following linear regression model to examine whether the independent variables predicted students' Computing Academic Success self-efficacy (CASS):

$$\begin{aligned} CASS = {} & \beta 0 \\ & + \beta 1 SenseOfBelonging \\ & + \beta 2 DepartmentalSupport \\ & + \beta 3 FirstGeneration \\ & + \beta 4 SubstantialComputingExperience \\ & + \beta 5 SomeComputingExperience \end{aligned}$$

To operationalize our intersectional focus on how predictors may differ between Black women from Black men, we ran two separate regression analyses. Table 2 in Appendix A summarizes our results for Black women. For Black women, two predictors of CASS were statistically significant: *sense of belonging* and *first-generation status*. As anticipated, sense of belonging was a significant positive predictor (β =0.352, p < .001) of CASS for Black women. Also expected, we found that first generation status was a significant negative predictor (β = -0.146, p = .033) of CASS. Neither departmental support nor prior computing experience had a statistically significant impact on CASS for Black women. Overall, our model explained 17.3% (adjusted R^2 = 0.151) of the variance in CASS scores for Black women, the lowest adjusted R^2 value among all our groups. This suggests that additional variables may be more salient for Black women than the ones that were found to be salient for other groups as discussed in the literature.

For Black men, *sense of belonging* (β =0.247, p<.001), *departmental support* (β =0.319, p<.001), *substantial prior computing experience* (β =0.127, p=.025), and *some prior computing experience* (β =0.186, p=.001) were all statistically significant positive predictors of CASS (see Table 3 in Appendix B). This result was consistent with the literature and our expectation that higher feelings of connectedness would translate into higher confidence in ability to complete the undergraduate computing program. When looking at the standardized coefficients, we found that departmental support had the strongest impact among the three. While first generation status had a marginal negative impact on CASS, this variable was not statistically significant for Black men. Overall, our model explained approximately 26.8% (adjusted R^2 = 0.256) of the variance in CASS scores for Black men, a notably higher amount than Black women.

5. DISCUSSION AND CONCLUSIONS

Research on self-efficacy in computing shows that this is an important factor in predicting student persistence to graduation (Tinto 1994, Tinto 2012). This exploratory study contributes to the existing literature on self-efficacy by focusing our analysis on Black undergraduate computing majors at research-intensive universities. We examined five predictors for computing academic success self-efficacy. Two of these represent conditions that could be shaped by the institution (i.e., sense of belonging and departmental support) while the other three are immutable, personal characteristics of each student (i.e., first-generation status, substantial prior computing experience, and some prior computing experience). We adopt an intersectional lens to identify whether differences exist between the experiences of Black women and Black men. Through a series of regression analyses, we identify predictors we found to be statistically significant for each group. Overall, this study identified a few key findings for Black computing students at research-intensive institutions.

Sense of belonging was the only predictor of CASS that was statistically significant for both groups ($p < 0.001$). The robustness of this finding is noteworthy and supports the considerable research base focused on sense of belonging in computing (Black et al., 2011; Dekhane et al., 2024; Ojha et al., 2024). This suggests that investments in building students' sense of belonging indeed can contribute to increasing CASS and, ultimately, student persistence. From Table 1 above, we also noted that Black women in our data set experienced a statistically significant lower sense of belonging than Black men (3.20 versus 3.50, $p < .001$). This is consistent with prior literature that stated that women generally had lower sense of belonging than men (Cassidy & Eachus, 2002; Fisher et al., 1997; Katz et al., 2006). Given the importance of sense of belonging to persistence, strategies to increase sense of belonging for Black women could be especially important.

Departmental support was the strongest predictor for Black men having a positive CASS level – even more so than sense of belonging. For Black men, the perception of departmental concern and encouragement matters significantly to them. This finding can provide additional motivation for administrators that their efforts at developing an inclusive culture that demonstrates concern for students does make a difference – especially for Black men. Surprisingly, for Black women, this departmental support was not statistically significant. One possible explanation is that Black women may look for their primary sources of support with other organizations like community groups, student organizations, close friends or family (Fisk et al., 2024, Napier & Bourgeois, 2024). Some research has also shown that students who feel like they do not belong build a higher level of resilience and learn to expect very little from organizations (Willis & Freeman, 2024).

When looking at personal factors that impacted CASS, we again found differences between Black women and Black men. Being a first-generation student negatively predicted CASS; however, this relationship was only statistically significant for Black women. It makes sense that lack of firsthand family knowledge on how to successfully navigate college would negatively impact their self-efficacy in this area. For prior computing experience, we found like others (Mooney & Becker, 2020) that prior computing experience did not make a difference in CASS for Black women, but it did for Black men. Our findings for Black men are consistent with the literature, though results for Black women differ from prior work on factors affecting self-efficacy. For faculty and administrators these findings indicate that Black students cannot be considered as a monolith, and the intersectional dimensions of student demographics cannot be ignored. So, while faculty, departments, and institutions adopt evidence-based practices to broaden participation in computing, it will be important to pay attention to the factors that influence engagement, progression, and retention through this intersectional lens.

6. LIMITATIONS AND FUTURE DIRECTIONS

This study advances our knowledge on predictors of CASS specifically among Black men and Black women. It has certain limitations though, which also present opportunities for further research. For example, this study used data from only one year, 2023 and showed unique patterns for predictors of CASS for Black women vs Black men only. Future research could analyze multi-year data and investigate if any trends exist. It would also beneficial to compare Black students with non-Black students to highlight any unique factors associated with self-efficacy for Black undergraduates. This study also did not consider whether there were any differences for Black students of Hispanic background or students with multiple races.

While this study reveals differences between Black women and Black men, it has a relatively low R^2 value and does not explain why those differences exist. A qualitative study could provide further insights into why certain factors are predictors of CASS for Black men but not Black women (e.g. departmental support) and vice versa. Additionally, this study revealed that for Black women there is a need to consider other factors as predictors of CASS, as some of the more common predictors (e.g. prior experience) did not seem to have a strong impact on CASS in our analysis.

Our literature review also showed that studies broadly focusing on self-efficacy, broadening participation in computing and women in computing have been conducted for a long time and rich literature exists in these areas. The interest in intersectionality is comparatively more recent and even within that, the focus has largely been on Black women in computing. Research on Black men in computing is sparse leaving a gap that needs to be filled in. Similarly, when considering factors impacting computing self-efficacy, significant research exists on prior computing experience. However, factors such as first-generation status and departmental support

have received limited attention. As institutions acknowledge and work towards implementing systemic change to broaden participation in computing, these other factors as predictors of self-efficacy need to be studied. Since much research does not exist around these factors, future direction of this project will involve developing and evaluating the impact of various interventions that improve CASS for first generation students. Designing and evaluating interventions that improve departmental support for students, especially for Black men will be another direction to pursue for this project.

This study focused specifically on computing academic success self-efficacy. Other types of computing self-efficacies and their predictors, such as Research and Graduate School Self-efficacy (RGSS) and Technical Communications Self-efficacy (TCS) also need to be studied. RGSS reflects students' perceived confidence in succeeding in graduate school and research in computing, while TCS reflects students' perceived confidence in communicating effectively in professional and technical settings. Knowledge on these different types of self-efficacies and their impact on student persistence in computing could further contribute to the research on broadening participation in computing.

The Data Buddies project provides a large amount of multi-institutional and multi-year data that could be mined to advance the research in the directions identified above.

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APPENDIX A
Regression Model for Black Women

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta (β)		
(Constant)	3.456	.257		13.426	<.001
Sense of Belonging *	.298	.064	.352	4.644	<.001
Departmental Support	.029	.070	.032	.412	.681
First Generation **	-.216	.101	-.146	-2.146	.033
Substantial Prior Computing	-.147	.126	-.088	-1.168	.244
Some Prior Computing	-.112	.114	-.074	-.977	.330
a. Dependent Variable: Computing Academic Success Self-efficacy (CASS) * Largest standardized beta, statistically significant p <.001 ** Second largest standardized beta, statistically significant p <.05					

Table 2: Regression Model for Black Women

APPENDIX B
Regression Model for Black Men

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta (β)		
(Constant)	2.011	.230		8.725	<.001
Sense of Belonging **	.229	.049	.247	4.697	<.001
Departmental Support *	.353	.058	.319	6.057	<.001
First Generation	-.026	.080	-.016	-.329	.742
Substantial Prior Computing	.227	.100	.127	2.256	.025
Some Prior Computing	.311	.094	.186	3.297	.001
a. Dependent Variable: Computing Academic Success Self-efficacy (CASS) * Largest standardized beta, statistically significant p <.001 ** Second largest standardized beta, statistically significant p <.001					

Table 3: Regression Model for Black Men