LITERATURE REVIEW MATRIX (ANNOTATED BIBLIOGRAPHY)

Article	Citation (APA 7th Ed.)	Abstract	Methodology	Analysis	Theoretical Framework	Important Findings and Notable Quotes
	Rankin, Y. A., Thomas, J. O., & Erete, S. (2021). Black women speak: Examining power, privilege, and identity in CS education. *ACM Transactions on Computing Education*, *21*(4), Article 26. https://doi.org/10.1145/3451344	Despite the increasing number of women receiving bachelor's degrees in computing (i.e., Computer Science, Computer Engineering, Information Technology, etc.), a closer look reveals that the percentage of Black women in computing has significantly dropped in recent years, highlighting the underrepresentation of Black women and its negative impact on broadening participation in the field of computing. The literature reveals that several K-16 interventions have been designed to increase the representation of Black women and girls in computing. Despite these best efforts, the needle seems to have barely moved in increasing the representation or the retention of Black women in computing. Instead, the primary goals have been to recruit and retain women in the CS pipeline using gender-focused efforts intended to increase the number of women who also identify as members of racialized groups. However, these gender-focused efforts have fallen short of increasing the number of Black women in computing because they fail to acknowledge or appreciate how	Qualitative	Semi-structured interviews	Black feminist epistemologies (1984, 1989), Black feminist thought (2000), and intersectionality (1993, 1995, 2016, 2019)	1. Three issues were identified: traditional K-12 classrooms, predominantly white institutions (PWI), and internships 2. Epistemic violence in CS education is constant and can occur at every level, academically, personally, and professionally for Black women 3. CS education is not a colorblind meritocracy; it is a matrix of intersecting oppressions for Black women in computing 4. Examining the conceptual glue that uncovers assumptions about how students enter and navigate through CS education is important in understanding the system and structures that Black women contend with "According to consistently collected data from more than 100 colleges and universities in the U.S. for several years [108–112], Black women remain vastly underrepresented in CS departments at predominantly White institutions (PWIs)." p. 15 "While additional research needs to be done to explore the ways in which Black women in computing resist oppression, it is certainly logical to consider that exiting the field could be seen, not as a signal that Black women do not possess enough grit or are incapable, but rather, as a form of resistance to surveillance, subjugation to the margins, and

		intersectionality (the overlapping social constructs of gender, race, ethnicity, class, etc.) has shaped the lived experiences of Black women navigating the computing pipeline. Without honest dialogue about how power operates in the field of computing, the push for racial equality and social justice in CS education remains an elusive goal. Leveraging intersectionality as a critical framework to address systemic oppression (i.e., racism, gender discrimination, power, and privilege), we interview 24 Black women in different phases of the computing pipeline about their experiences navigating the field of computing. An intersectional analysis of Black women's experiences reveals that CS education consists of saturated sites of violence in which interconnected systems of power converge to enact oppression. Findings reveal three primary saturated sites of violence within CS education: (1) traditional K-12 classrooms; (2) predominantly White institutions; and (3) internships as supplementary learning experiences. We conclude the article with implications for how the field of CS education can begin to address racial inequality that negatively impacts Black girls and women, thus contributing to a more equitable and socially just field of study that benefits all students.				assimilation that was repeatedly reported by the Black women in our study." p. 25

	Lunn, S., Zahedi, L., & Ross, M. (2021). Exploration of intersectionality and computer science demographics: Understanding the historical context of shifts in participation. *ACM Transactions on Computing Education, 21*(2), Article 21. https://doi.org/10.1145/3445985	Although computing occupations have some of the greatest projected growth rates, there remains a deficit of graduates in these fields. The struggle to engage enough students to meet demands is particularly pronounced for groups already underrepresented in computing, specifically, individuals that self-identify as a woman, or as Black, Hispanic/Latinx, or Native American. Prior studies have begun to examine issues surrounding engagement and retention, but more understanding is needed to close the gap, and to broaden participation. In this research, we provide quantitative evidence from the Multiple-Institution Database for Investigating Engineering Longitudinal Development—a longitudinal, multi-institutional database to describe participation trends of marginalized groups in computer science. Using descriptive statistics, we present the enrollment and graduation rates for those situated at the intersection of race/ethnicity and gender between 1987 and 2018. In this work, we observed periods of significant flux for Black men and women, and White women in particular, and consistently low participation of Hispanic/Latinx and Native American men and women, and Asian women. To provide framing for the evident peaks and valleys in	Quantitative and Qualitative Context Methods	Descriptive statistics using the MIDFIELD and historical context analysis to identify results from the quantitative data	Intersectionality and standpoint theories	1. Low representation of women of color, especially Native American, Hispanic, and Latinx women. 2. Fluctuation enrollment and graduation periods for Black women and men and White women 3. Gradual increase in enrollment for Asian women "Although computing occupations have some of the greatest projected growth rates, there remains a deficit of graduates in these fields. The struggle to engage enough students to meet demands is particularly pronounced for groups already underrepresented in computing, specifically, individuals that self-identify as a woman, or as Black, Hispanic/Latinx, or Native American." p. 1 “More creative approaches, and especially those that highlight culturally relevant pedagogy,may serve to increase interest and to facilitate learning of topics students may otherwise find challenging. One such example was an initiative created at Spelman College, a private historically Black liberal arts college for women, in which DJing tasks were used to enhance learning of data structures [55]. Black music (which the author defined as “any genre of music created by people from the African Diaspora, such as Hip Hop, R&B, Jazz, Soul, Blues, Gospel, etc.”) was used to teach major concepts like classes, arrays, linked lists, and inheritance; physical instruments were also modeled using algorithms. Reactions included comments like “I was able to incorporate an important part of Black history which I think is essential to making technology accessible to all” and “It has helped put the new code into a real life perspective.” p.18

		participation, we applied historical context analysis to describe the political, economic, and social factors and events that may have impacted each group. These results put a spotlight on populations largely overlooked in statistical work and have the potential to inform educators, administrators, and researchers about how enrollments and graduation rates have changed over time in computing fields. In addition, they offer insight into potential causes for the vicissitudes, to encourage more equal access for all students going forward.				
	Cohoon, M. J. (2002). Recruiting and retaining women in undergraduate computing majors. *ACM Special Interest Group on Computer Science Education (SIGCSE), 34*(2), 48-52. https://doi.org/10.1145/543812.543829	This paper recommends methods for increasing female participation in undergraduate computer science. The recommendations are based on recent and on-going research into the gender gap in computer science and related disciplines They are intended to work in tandem with the Computing Research Association's recommendations for graduate programs (see [18] in this issue) to promote a general increase in women's participation in computing professions.Most of the suggestions offered here could improve the educational environment for both male and female students. However, general improvements are likely to be of particular benefit to women because women in our society do not generally receive the same level of support that men receive for entering and	Literature review and qualitative method	Recommendations for recruitment and retaining women based on literature review and qualitative research findings	There is no specific theoretical framework; however, the recommendations are based on intersectionality and women's experiences.	1. Factors that attract women to computing include personal experiences, support from family and peers, career aspirations, and pay. 2. Recruitment from high school and community colleges is crucial 3. Support from faculty, institutional resources, and community experiences is necessary to recruit and retain women in computing majors. 4. Having women faculty is essential for retention. "Without adequate peer support, women are likely to leave computing programs at higher rates than men leave. When a department's gender composition is unbalanced, women have less access to support from female classmates. This lack of support leaves women particularly vulnerable to unfavorable departmental conditions." p. 3 “Actively recruiting women into the major is the single most effective means of increasing female participation in computing programs.” p. 1

		persisting in this field. Parents, friends, and classmates seldom encourage women to choose and continue in a computing discipline. Those few women who declare a computing major tend to experience continued lack of support throughout their education. They have few female peers to call on for help. Furthermore, students in their own and other majors may consider them odd. Even faculty can discourage women with unthinking remarks or with expectations based on the assumption that men's behavior and experience are the basis for success in computing majors. This lack of support can block or weaken women's commitment to computing. Moreover, when conditions in a department are generally unfavorable, those with a weakened commitment to the discipline often leave at higher rates than those who have sufficient support to overcome the conditions.				
	Cheryan, S., Ziegler, S. A., Montoya, A. K., & Jiang, L. (2017). Why Are Some STEM Fields More Gender Balanced Than Others? *Psychological Bulletin, 143*, 1-35. https://doi.org/10.1037/bul0000052	Women obtain more than half of U.S. undergraduate degrees in biology, chemistry, and mathematics, yet they earn less than 20% of computer science, engineering, and physics undergraduate degrees (National Science Foundation, 2014a). Gender differences in interest in computer science, engineering, and physics appear even before college. Why are women represented in some science, technology, engineering, and	Literature review from psychology, education, and sociology on women's underrepresentation in STEM	Compared findings across STEM fields to evaluate factors determining gender participation.	Intersectionality is used to identify women's social background, attitudes, and educational trajectories.	1. The male predominant in the STEM field creates a negative stereotype assuming that STEM is for men. 2. Insufficient early exposure to STEM due to few courses offered in high school 3. There is a lack of role models in computer science, engineering, and physics, which prevents women from choosing these fields. 4. The gender gap in STEM assumes that one gender has a better chance of success.

		mathematics (STEM) fields more than others? We conduct a critical review of the most commonly cited factors explaining gender disparities in STEM participation and investigate whether these factors explain differential gender participation across STEM fields. Math performance and discrimination influence who enters STEM, but there is little evidence to date that these factors explain why women's underrepresentation is relatively worse in some STEM fields. We introduce a model with three overarching factors to explain the larger gender gaps in participation in computer science, engineering, and physics than in biology, chemistry, and mathematics: (a) masculine cultures that signal a lower sense of belonging to women than men, (b) a lack of sufficient early experience with computer science, engineering, and physics, and (c) gender gaps in self-efficacy. Efforts to increase women's participation in computer science, engineering, and physics may benefit from changing masculine cultures and providing students with early experiences that signal equally to both girls and boys that they belong and can succeed in these fields.				"In STEM fields, a masculine culture is a social and structural environment that confers a greater sense of belonging and ability to succeed to men than women." p. 8 "Women and minority undergraduates are more likely to persist in STEM majors in departments with higher numbers of female and minority graduate students (Griffith, 2010)." p. 13
	Berg, T., Sharpe, A., & Aitkin, E. (2018). Females in computing: Understanding stereotypes through collaborative picturing. *Computers and*	This study investigates attitudes and perceived stereotypes that children have towards female computer scientists. Research was conducted	Collaborative drawing technique or Rich Picture (RP)	Three coders analyzed the pictures and transcripts	Grounded theory and inductive content analysis	1. Gender stereotypes in CS assuming that computer science is gender specific

	Education, *126*(1), 105-114. https://doi.org/10.1016/j.compedu.2018.07.007	within 2 high schools in Scotland across 7 workshops including 96 participants. Stereotype patterns and social expectations were identified giving insight into gendered world views. Data was derived through picturing. Collaborative picture drawing, as a means to investigate multiple opinions, is a powerful activity that has the capacity to break down barriers of education, language and culture. By use of content analysis on 24 workshop pictures three key areas were identified as significant when determining attitudes towards computing as a career choice for females; gender stereotypes, role models, and media influence. The conclusion determines there are stereotype misconceptions regarding physical appearance, personality type, and digital ability projected onto young females. These can influence their academic decisions resulting in poor uptake of computing science as a career choice. We determine that Computing Science is seen as a male gendered subject with females who select to work or study in this field having low self-worth, a sense of being different, a sense of being atypical, and a sense of being unattractive We further determine that positive role models and positive gender balanced media influences can broaden identities in computing.				2. Gaming is strongly associated with boys, assuming that females do not game; therefore, they cannot be computer professionals. 3. There are few role models in the CS industry, and education discourages female students from participating in CS. 4. The media influence noted a significantly low representation of women in computing media “girls are considered not being able to do computing because they are a girl. They should focus more on beauty, or on like childcare. And boys are told they should focus more on computing or building or manly stuff.” p. 8 “guys like to game more than girls” and “computer science is used for making games and gamers tend to be guys” and “only guys play video games.” p. 10

	Cohoon, M. J. (2001). Toward improving female retention in the computer science major. *Communications of the ACM, 44*(5), 108-114. https://doi.org/10.1145/374308.374367	Although many computer professionals believe that inherent or deeply ingrained gender differences make women less suited to the study and practice of computer science [5, 9], the results reported here demonstrate that female underrepresentation in computer science could be avoided. Women can and do succeed in computer science (CS) when conditions do not deter them. The variation that occurs in women's participation rates demonstrates that many women succeed as computer scientists in certain times and settings. Conditions affecting female retention in undergraduate computer science are identified in this article	Mixed Method (Qualitative and Quantitative)	Interviews and data analysis from transcripts and surveys using correlation and regression approaches	There is no specific theoretical framework; however, the study focused on departmental characteristics to retain women in CS.	1. Gender composition, such as faculty characteristics, mentoring, attitude, and attributes. 2. Institutional and community support predicted female retention 3. Increase the number of female role models to improve retention "Another faculty characteristic influencing whether female students left the CS major at disproportionately high rates was the presence of female faculty. Departments with no female faculty lost female students at high rates relative to men." p. 6
	Adya, M., & Kaiser, K. M. (2006). Factors influencing girls' choice of information technology careers. *Encyclopedia of Gender and Information Technology*, 282-288. https://doi.org/10.4018/978-1-59140-815-4.ch044	Many western nations have experienced declining numbers of women in the information technology (IT) workforce (Trauth, Nielsen, & von Hellens, 2003). Between 1996 and 2002, women in the U.S. IT workforce declined from 41% to 34.9% (ITAA, 2003). This can hamper diversity and reduce the talent pool that can address needs of diverse end-users (Florida & Gates, 2002). Why do women choose IT careers or reject them? Multidisciplinary research on career genderization reveals gender imbalance (Trauth, Nielsen, & von Hellens, 2003). Career decisions against math, science, and technology (MST) are often made as early as age	Literature review to identify the factors influencing female students to choose IT-related majors	Accessing factors based on gender stereotypes	There is no specific theoretical framework; however, the study focused on social influences to determine the factors.	1. The declining number of women in IT majors and the workforce must motivate IT educators and policymakers to improve programs. 2. Parental involvement positively affects female students to choose IT as a career. "Career choices are influenced by role models who are often familial or educational rather than famous societal figures (Dryler, 1998). Direct forms of parental influence, such as the degree to which students see their parents choosing IT careers or having contact with technology, are strong motivators to train for technical jobs." p. 3 "Women entering male-dominated fields come from families where mothers have four year degrees, mothers are working, both parents are highly

		11 without understanding long-term implications (AAUW, 2000). We examine influences on girls' choice of IT careers, modeling social, structural, and personal variables that affect IT career choice. Using Ahuja's (2002) classification of social and structural influences on women's IT careers, Beise, Myers, VanBrackle, and Chevli-Saroq's (2003) model of women's career decisions, and individual differences suggested by Trauth (2002), we extend literature to children and adolescents' career choices. Social influences bias internal and external gender perceptions and stereotyping, role models, peers, media, and family. Institutional support such as teachers and counselors, access to technology, and same-sex versus coeducational schools are structural influences. While both can influence career decisions, social factors have the most influence on children's early perceptions. Both factors can introduce gender-stereotyping effects on career choices. Gender stereotyping explains how girls perceive their role in society based on subtle societal cues. It can limit opportunities for both sexes. We also examine personality traits and external influences that make children unique. Their individual differences draw them to activities and content areas such as problem solving and interaction with people. Finally, ethnic				educated, and success is considered critical (Jackson, Gardner, & Sullivan, 1993; Smith, 2000)." p. 3

		culture can exert an influence on social and structural variables. Figure 1 from Adya and Kaiser (2005) presents our career choice model that is discussed in the next section				