

Intersectional approach to inclusive mentorship of women in engineering disciplines

Jennifer S. Brown, Clemson University

Jennifer Brown earned her PhD in Engineering and Science Education from Clemson University in 2023. Her technical background is a Master's in Mechanical Engineering from Clemson University in 2020 with a concentration in advanced manufacturing and design. Her primary research foci include graduate student and faculty development, graduate well-being, intersectional approaches in qualitative research, and mentorship of women in STEM.

Marshal Fasika Rice, Clemson University

Dr. Karen A High, Clemson University

Dr. Karen High holds an academic appointment in the Engineering Science and Education department and joint appointments in the Chemical and Biomolecular Engineering department as well as the Environmental Engineering and Earth Sciences department. Prior

Intersectional approach to inclusive mentorship of women in engineering disciplines

Abstract

Despite women now comprising just over 25% of the engineering doctorate degrees awarded annually in the United States, women remain significantly underrepresented in both academia and industry, posing a considerable challenge for supporting the mentorship for women doctoral students in engineering. Positive mentoring experiences are crucial for retaining and advancing those who hold marginalized identities in STEM as it contributes to their persistence in their field in a variety of ways. Researchers have emphasized the mutual benefits when graduate students can connect with mentors who share their values and lived experiences; however, the severe underrepresentation of women contributes to the often-disproportionate burden of mentorship placed on women faculty and faculty with other marginalized identities.

Therefore, the intended aim of this work is to inform more inclusive mentoring strategies, expanding access to mentorship in engineering that is responsive to women's needs. This work used an asset-based case study approach with semi-structured interviews to explore existing, strongly positive mentorships between doctoral candidates in engineering disciplines who identify as women and their most influential mentors. The goal of the work was to address two research questions: 1) What does effective, inclusive graduate mentorship look like for women doctoral candidates in engineering, applying an intersectional lens? 2) How does this mentorship affect the way they navigated the dissertation process?

Fourteen total participants were recruited for this study, representing a total of seven mentoring pairs. Mentors were not limited by gender, and the study focused primarily on the mentoring that took place during the mentee's doctoral journey. Grounded in Yosso's Community Cultural Wealth framework, this paper presents results of the collective case analysis of the resistant and aspirational capital from the larger study and offers suggestions for applying these findings to improve current mentoring and advising practices for women graduate students in engineering disciplines who hold additional marginalized identities, such as BIPOC, neurodivergent, and first-generation college students.

Introduction

The pursuit for gender parity in engineering remains an ongoing challenge, as women still only constitute a quarter of annual engineering doctorate recipients in the United States [1]. This disparity and resulting hegemonic masculine culture persists into the workplace and associated leadership roles, both in academia and industry, which contributes to limited access to mentorship in engineering that is inclusive and responsive to women's needs [2]–[8]. When referring to mentorship throughout this paper, we adopt the operationalized definition developed by the National Academies of Sciences, Engineering, and Medicine (NASEM), which describes mentorship as “a professional, working alliance in which individuals work together over time to support the personal and professional growth, development, and success of the relational partners through the provision of career and psychosocial support” and contend also that mentorship is “essential to the holistic development of [engineers], including but not limited to developing a strong identity as an [engineering professional], developing confidence in one's ability to work as an [engineering] professional, and successfully navigating the culture of STEMM” (Science,

Technology, Engineering, Math, and Medicine) [9, p. 37]. Within this study, “positive” mentorship implies that both the mentee and mentor identify the mentoring relationship as enriching or beneficial to their lives in some way. The term “positive” does not however imply a specific length or depth of mentoring relationship, nor does it necessarily imply that the mentoring practices they use are inherently inclusive.

Researchers have frequently demonstrated the reciprocal benefit that is created when students are able to connect with mentors who “look like them” and shared similar lived experiences and values. For the mentee in particular, it often contributes to an improved self-efficacy and sense of belonging for those who hold marginalized identities in STEMM fields, including those who identify as women, BIPOC (Black, Indigenous, and People of Color), low-income, first-generation, neurodivergent, or as a member of the LGBTQ+ community [9]. Unfortunately, the underrepresentation of these identities in university engineering faculties oftentimes exacerbates the already reduced access to mentors with whom women doctoral candidates can identify or share similar lived experiences. This disparity along the lines of marginalized identities was highlighted in an iconic study by Nettles and Millett in 2006, wherein over 9,000 students from the top 21 doctoral-granting institutions in the U.S. were surveyed. The results indicated that while every respondent recognized a faculty advisor, 43% of Black doctoral students in STEM reported that they did not have a mentor, compared to 24% of their White counterparts [10].

Furthermore, the attrition of doctoral students remains remarkably high in STEM and disproportionately so for those who hold marginalized identities in their fields [11]; some studies estimate that over 50% of doctoral students will not finish their degrees [12], [13]. It may not come as a surprise that insufficient mentoring can negatively impact graduates students’ decision to persist in their degree programs, among a myriad of other factors; however, research has also demonstrated that well-intentioned but poorly informed mentoring can also be detrimental to the mentee [9]. When paired with the knowledge that most faculty in STEMM fields are not typically trained in mentoring strategies - let alone strategies that foster inclusivity and cultural responsiveness - this observation can be alarming. The culture surrounding graduate education, particularly in STEMM, propagates flawed power structures that introduce disproportionate challenges for those who hold marginalized identities within these spaces, especially as institutions of higher education are seldom created with them in mind [14].

With these inequities in mind, this research work strove to elevate the voices of a diverse group of women in engineering and highlight the nuances in their graduate mentoring relationships to contest the experiences of White, cisgender men as the normative standard in engineering spaces [15], [16]. This paper is part of a larger study that aims to delve into positive, effective mentoring relationships between women doctoral candidates in engineering disciplines and their most influential mentors during their dissertation research process [17]. The overall study is guided by the following research questions:

1. What does effective, inclusive graduate mentorship look like for women doctoral candidates in engineering?
2. How does this mentorship affect the way they navigate their dissertation process?

This subset of the research will focus on answering these questions specifically with regards to resistant and aspirational capital.

Using an asset-based case study approach, the work uses semi-structured interviews to explore how diverse women mentees navigate, sustain, and leverage positive mentoring relationships with their mentors through the lens of Yosso’s Community Cultural Wealth framework [14]. Fourteen total participants were recruited for this study, representing a total of seven mentoring pairs. An intersectional lens was employed to better understand how the mentees and mentors’ intersecting or conflicting identities beyond gender may introduce additional nuance into the mentoring relationships, as it recognizes that marginalized identities are not mutually exclusive [18]. For example, an intersectional lens recognizes that nuances introduced by gendered racism may appear differently than effects of racism or sexism in isolation.

By thematically analyzing the trends in resistant and aspirational capital accrued through this mentorship, this paper offers insights and recommendations to enhance current mentoring practices for faculty who are supporting women graduate students in engineering. By unpacking the impacts of the mentoring pair’s unique collections of identities through a lens of intersectionality, we aim to unpack facets of the mentoring relationship surrounding the accrual of resistance and aspirational capital by the woman mentee. In doing so, we aspire to contribute to a more equitable and inclusive engineering community that values diverse backgrounds and perspectives.

Theoretical Framework

The study used Yosso’s Community Cultural Wealth (CCW) framework (Figure 1) to re-center a growth mindset in developing mentoring skills, and “instead focus on and learn from the array of cultural knowledge, skills, abilities and contacts possessed by socially marginalized groups that often go unrecognized and unacknowledged” [14].

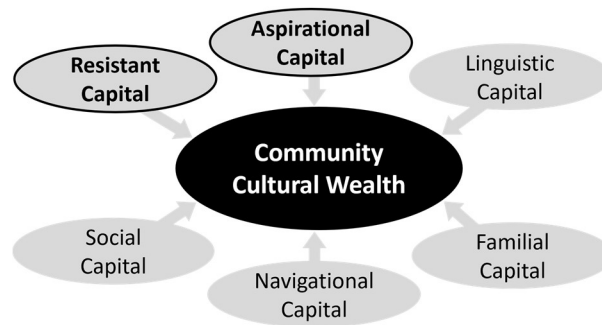


Figure 1. The cultural capitals that contribute to building Community Cultural Wealth [14]. The bolded capitals that have been outlined here (resistant, aspirational) are the focus of this paper.

While all six types of cultural capital were queried in the larger study [17], this paper narrows its scope to focus on resistant and aspirational capitals. Resistant capital (RC) refers to “knowledge and skills fostered through oppositional behavior that challenges inequality,” and to the practice of passing that knowledge on to others [14, p. 80]. In the context of the current study, evidence of RC could be the mentor informing the mentee about subtle structures of racism or sexism present in engineering higher education spaces with the intent of equipping them with the strategies to resist these structures, or even imbue mentees with a motivation to transform and

remove these barriers to promote inclusivity. Meanwhile, aspirational capital (AC) refers to “the ability to maintain hopes and dreams for the future, even in the face of real and perceived barriers” [14, p. 77] and is often evidenced by resiliency in the face of adversity. For example, a first-generation student may express how they aspired to become the first in their family to earn a doctorate degree. Much of the mentees’ aspirational capital appeared to have been accrued prior to their dissertation research; however, AC may also manifest in this study as statements about who or what inspired them to pursue a PhD or career in their field.

In existing literature, CCW has been more widely applied to studies in undergraduate education; however, it is being increasingly applied to the context of graduate education. In a recent 2020 systematic review of CCW in STEM education studies, Denton et al. [19] noted that only one qualitative study focused on graduate students that both presented empirical data and included at least one type of CCW capital in its results or discussion. Their findings inspired Jaumot-Pascual et al. [20] to conduct a qualitative meta-synthesis of empirical research on women of color in computing graduate education conducted between 1999 and 2019; their meta-synthesis of 11 qualitative and mixed methods studies found positive mentors to be a critical social factor in Women of Color’s motivation to persist in their fields when applying a CCW lens [20].

Other relevant applications of CCW in graduate education include applying it to mentoring practices for international students [21] and examining the origins of early STEM interests in Black males in engineering through qualitative interviews of Black male graduate students [22]. Espino (2014) used CCW as a framework to qualitatively analyze the life narratives of 33 Mexican American students who earned their doctorates prior to 2006 across a variety of disciplines, although it is unclear how many of the six STEM PhD recipients in the study were women [23]. In 2018, DeCrosta employed CCW to examine individual and institutional factors that contribute to the persistence of minority and first-generation women in STEM graduate programs; the drawbacks of the study is that it is limited to interviews of five participants that all graduated from a single large public research university [24]. Most recently, Flores (2023) examined the lived experiences of 10 Latina doctoral students from various STEM and non-STEM disciplines using a qualitative phenomenological approach [25].

With regards to existing literature, this study offers novel contributions to scholarly literature in that it:

1. Specifically explores the cultural capital that is accrued by women through positive mentorships in engineering fields,
2. Uses an asset-based approach to elevate the voices of marginalized mentees in STEM and challenge the deficit narrative, and
3. Triangulates the perspectives of both the mentee and mentor using individual interviews to provide a more holistic perspective on the mentoring that took place.

Methods

This paper presents a subset of the work of a larger study that used a multiple case study approach that was bounded by both time and activity (completion of the dissertation phase of an engineering doctoral program) [26]–[28]. The primary data collection was through conducting in-depth, semi-structured one-on-one 60–75-minute interviews with the women mentees and the

person whom they identified as being their most influential mentor during their dissertation process. Recruitment occurred through distribution of a pre-screening survey via “calls for participation” in popular listservs of professional engineering societies, such as ASEE, WEPAN, SWE, and IEEE, and direct emails to departmental graduate coordinators and chairs of engineering departments at large, research-intensive universities in the U.S. Over two months of recruitment, 28 mentees met all of the larger study’s inclusion criteria [17]. The most pertinent inclusion criteria were that the mentees must identify as women and be near their doctoral graduation (within eight months) or be recent graduates (within two years) from a highly research-intensive university, and neither they nor their mentors could be from the researchers’ home institution to support ethical validity. They also had to identify the mentoring relationship as “strongly positive” and provide at least one example of how their mentor had supported them in their doctoral journey.

Seven mentees were purposively sampled from these 28 responses to achieve a wide and diverse representation of marginalized identities in STEMM that was also representative of the demographics of those who completed the pre-screening survey, and then their self-identified “most influential” mentors were invited to participate in separate interviews to triangulate perspectives on their mentoring relationship. No two mentees shared the same mentor, and none of the seven mentoring pairs came from the same doctoral program. Roughly half of the mentees were Women of Color (including two Black women, one Asian woman, and one Latina), and half shared the same race or ethnicity as their mentors. Other identities that were represented included first-generation college students, international graduate students, members of the LGBTQ+ community, and neurodivergent women. In slightly over half of the mentoring pairs, women mentees had male mentors; half of the pairs were from engineering education research doctoral programs whereas the other half were from more disciplinary engineering doctoral programs. In some cases, the mentors also served as the mentees’ official faculty advisors, and in some cases the mentee was the mentor’s first official PhD student that they had mentored.

Fourteen total 60–75-minute interviews were conducted and recorded via videoconferencing software that were later transcribed and verified by a team of undergraduate and graduate researchers. The interview protocol focused most heavily on aspects related to navigational, social, and resistant capital as they were the emphasis of the larger study to explore mentoring strategies, although aspirational, familial, and linguistic capital were also captured in follow-up questions [17]. Findings regarding the other capitals beyond resistant and aspirational are presented in a different publication. Using MAXQDA 2022™ software, the transcripts were qualitatively coded using several cycles of *a priori*, *in vivo*, and emergent coding using a four-person coding team. All members of the coding team were trained on a subset of the interview data (two full transcripts) and achieved a high level of intercoder agreement ($\kappa \geq 0.90$) prior to coding the full dataset using Brennan and Prediger’s kappa co-efficient (κ) calculations [29]. Across all 14 finished transcripts, a high level of intercoder agreement ($\kappa \geq 0.85$) was maintained between the primary researcher and the other three members of the coding team. Thematic analysis was conducted on the coded data to explore emergent themes in both resistant and aspirational capital that was accrued by the women mentee through their mentoring relationship. Throughout the study, quality measures to support credibility and trustworthiness included, but were not limited to: peer debriefing, negative case analysis, conducting member checks, extensive bracketing by the researchers to reduce bias, and triangulating the perspectives of the mentee with the mentor during analysis [28], [30].

Discussion of Results and Implications

In the collective case analysis, the focus was on analyzing and identifying trends observed across the seven mentoring pairs. Resistant capital (RC) and aspirational capital (AC) are the focus of this paper, and the implications of the emergent themes within these capitals will be discussed. The emergent themes observed within RC included fostering dialogues surrounding inequities in higher education based on one or more of the mentee's marginalized identities, recontextualizing failures in academic publishing to promote resiliency, and leveraging the mentor's institutional power or social influence to advocate for positive change that would impact their mentees.

Resistant capital most commonly took the form of mentors intentionally fostering open and honest dialogues with the mentee about possible racist, sexist, or otherwise inequitable and prejudiced structures that the mentee may face in academia or engineering spaces based on one or more of their marginalized identities. The intent of promoting these dialogues was explicitly identified by the mentors was to promote transparency of the struggles that their mentees could expect to face, especially as it pertained to biases that are often exhibited more subtly in academia. In its transformational sense, resistant capital would then extend to equipping the mentees with strategies to resist the oppressive structures and inequality they encounter and motivate them to tear down such barriers to promote inclusivity.

It is worth noting that while all of the mentoring pairs gave examples of these dialogues that built resistant capital, the discussions surrounding racism appeared limited by the racial and ethnic identities of those in the mentoring pair. Namely, in pairs where neither the mentor nor mentee identified as BIPOC, the systemic impacts of racism were not discussed at length as part of the mentoring relationship. These impacts were, however, discussed among nearly all other pairs. This is a critical observation of an area where White faculty advisors and mentors could do better to help their mentees develop improved awareness of the negative impact of systemic racialized biases in engineering higher education in the U.S., especially as it relates to the intersectionality of multiple marginalized identities.

By sparking these transformative and challenging conversations among themselves and their White colleagues, they can act as agents of change in advancing diversity, equity, and inclusion in STEMM; the failure to engage in such pivotal discussions only allows those same racialized inequities to perpetuate [31]. Espino (2014) also noted this trend in RC in how the Latinx doctoral graduates they interviewed often built RC in learning how to acclimate (and work with) the system rather than challenge (or work against) the system [23]. It is not enough to give advice on adjusting to or acclimating to sexist or racist structures in STEMM; instead, mentors should be encouraging their mentees on how to actively challenge these inequities and thrive despite them, or at least helping guide them to resources or other individuals that could help them in this goal. There are many resources out there to facilitate such dialogues and reflections that faculty mentors or mentees could use to support these tough mentoring conversations, and the researchers of this work encourage interested mentors and mentees to seek these resources out [32]–[34]. By bringing these topics to the forefront of conversation, we can spark meaningful dialogues surrounding the positive, inclusive mentorship of all women in engineering disciplines that is responsive to their

intersectional identities, so that faculty advisors of any gender or background can feel more comfortable in reaching out for guidance in how to support their women mentees.

Other dialogues that mentors fostered with their mentees involved recontextualizing rejections in academic publishing to avoid damaging the mentees' self-efficacy in research and helping them build resiliency, as these rejections are often accompanied by baffling or contradictory feedback from reviewers that can be difficult to detangle (another problematic norm that mentors remarked upon). Mentors often reaffirmed the uniqueness or transformative nature of the mentee's work, especially when the mentee was engaged with social justice initiatives. Another theme across resistant capital was when mentors mentioned instances wherein they leveraged their social and political influence within their department or institution to push back against larger systemic issues affecting graduate students in academia, such as hostile or toxic lab environments, poverty wages for graduate assistants, and problematic academic mindsets (e.g., viewing traditional summative assessments as necessary and irreplaceable measures of students' performance, the "statistical impossibility" that all PhD students will pursue tenure-track positions post-graduation).

The other resistant capital that surfaced during analysis was attributed to other sources beyond their primary mentor and often included co-mentors, social justice organizations, friends, and colleagues, and previous lived experiences. Three of the mentees described knowledge and skills that resembled resistant capital but attributed its accrual through negative experiences at previous institutions. In fact, these same mentees also cited those experiences as what helped fuel their desire to transform those aspects of engineering or higher education for future students and ultimately inspired their final dissertation topic selection. This is consistent with findings from other CCW studies in graduate education, wherein negative past experiences for Latinx students drove their desire to overcome the adversity and aspire to pursue their PhD [23], [25]. Therefore, a link between the extent of accumulated resistant capital and resulting aspirational capital could exist, but further studies should be conducted to explore this link in further depth.

In contrast to the themes within RC, the two emergent themes observed within AC were less frequently attributed as being accrued from the mentor except as role models, but include resistant capital as aspirational capital for pursuing research or engaging in activities to promote diversity, equity, and inclusion (DEI) in STEM, and the potential for certain interactions with others in academic or STEM spaces to damage mentees' aspirational capital. Overall, there were very few instances in the interviews where mentees mentioned accruing or building aspirational capital through their interactions with their mentors. From the instances that were described, the mentor served as a role model where the mentees "see themselves" in their mentors or in how they treat people. Aspirational capital was nurtured through mentors helping their mentees pivot and forge new paths to follow new research passions, and acknowledging to mentees that they will not force them to "walk the same [professional] path" as the mentor.

While none of the seven mentees acknowledged an instance wherein their aspirational capital was damaged by their mentor, several noted ways in which their aspirational capital and desire to persist in their PhD program was damaged by interactions with others in academia (e.g., other faculty, students, administrators). These ways included 1) witnessing inauthentic engagement with their research area by others (e.g., in the case of Kianna, where she encountered

many faculty who treated DEI initiatives as transactional and required extrinsic monetary motivation to view the initiatives as “worthwhile”), 2) other faculty questioning the validity of their doctoral degree (e.g., as in the case of Mae, whose department had members voicing concerns about whether or not engineering education was a “real” engineering degree, leading to imposter syndrome), and 3) previous faculty advisors questioning their competencies or ability to achieve a goal (e.g., as in the case of Meredith, who recalled her previous faculty advisor, an “old White gentleman” who “kept shutting [her ideas] down and saying ‘No, no, no, I don’t think you’re capable of doing this’”).

It is worth drawing attention to the last example to clarify a key observation from the conversations with the mentoring pairs. In the larger study, researchers found that a valuable strategy used by mentors to help mentees accrue cultural capital and mature scientifically was to frequently question the research decisions that the mentee made and probing for the rationale behind them [17]. This behavior is not to be confused with this emergent trend in damaging AC, which is where past advisors would question the mentee’s abilities to conduct research or complete tasks. In the positive mentoring relationships explored, not a single mentee expressed at any time that their mentor questioned their capability or competence. Simply put, they would question why a mentee chose to do something in their research, but they never questioned their mentees’ ability to do that thing. Thus, this research suggests that as a mentoring strategy, questioning mentees’ research decisions and the rationale behind those decisions should be encouraged; questioning the mentees’ personal qualities, in terms of their ability to carry out those research decisions, should be strongly discouraged.

Limitations

Some limitations exist for the findings of the study. First, as it was originally scoped to better understand the nuances in doctoral mentoring relationships for women in engineering research disciplines at research-intensive universities, not all its findings may be transferable to the contexts of mentoring women in engineering master’s programs, as the demands of master’s programs differ widely between institutions, as well as the nature of the student-faculty advisor relationships. Further research would be needed to comment on the transferability of the findings to the master’s degree context. Another limitation of the data is that it was self-reported and often retrospective in nature, as it was collected via semi-structured interviews. To mitigate the risk of unreliable data, the research participants from those who were near graduation (within eight months of the interview) or had recently graduated (within the two previous years from the date of their interview) so that they would be more likely to vividly recall the evolution of their mentorship during their dissertation journey.

Further, it should be noted that the interview protocols were primarily designed to query participants about navigational, social, and resistant capitals; therefore, limited data was collected on the other types of capital (such as aspirational) and especially capital that came from another source that was not from their most influential mentor. Conclusions should therefore be drawn with caution and further research is encouraged in these areas, especially as it relates to exploring capitals accrued from a wider constellation of mentoring support that goes beyond the main mentor in this study. Lastly, the sample size remains relatively small (seven mentoring pairs), which limits the generalizability of its findings.

Conclusions and Future Work

This study employed a case study design to qualitatively explore the cultural capitals accrued by seven diverse women doctoral students in engineering disciplines through positive mentoring relationships. While the collective case analysis suggests that much of the mentees' resistant and aspirational capital was accrued prior to their doctoral studies (often based in past experiences in K-12, college, or the workforce), there was evidence that mentors could still positively influence the accrual of these capitals during the doctoral dissertation process. Based on emergent themes, mentors may be invaluable in helping mentees learn how to leverage and direct their accrued capital into conducting transformative research efforts that challenge inequities in engineering higher education and/or provide strategic career advice or serve as role models for mentees to pursue their aspirational career goals. The study's findings are bounded by certain limitations such as small sample size.

Despite these limitations, the study offers several critical insights that could enhance existing mentorship practices for women in engineering disciplines, such as university administrators and policymakers advocating for more inclusive and transformative dialogues surrounding the impacts of systemic racism on the U.S. higher education landscape and mentors reiterating the value of their mentees' work and contributions to the field to combat imposter syndrome. The research underscores the urgency for faculty advisors, irrespective of their backgrounds, to engage in meaningful conversations and proactive strategies that foster inclusive mentorship of women in engineering and promote a sense of belonging in STEM culture. By building on these insights in future work, the engineering community can foster an environment that supports and empowers all women pursuing higher degrees and leadership positions in engineering spaces.

References

- [1] U.S. Department of Education and National Center for Education Statistics, "Table 325.45: Degrees in engineering and engineering technologies conferred by postsecondary institutions, by level of degree and sex of student: Selected years, 1949-50 through 2019-20," in *Digest of Education Statistics*, 2022nd ed., 2022. Accessed: Jul. 02, 2022. [Online]. Available: https://nces.ed.gov/programs/digest/d21/tables/dt21_325.45.asp
- [2] E. Godfrey, "Cultures within cultures: Welcoming or unwelcoming for women?," in *2007 Annual Conference & Exposition Proceedings*, Honolulu, Hawaii: ASEE Conferences, Jun. 2007, p. 12.430.1-12.430.19. doi: 10.18260/1-2--2302.
- [3] A. Haverkamp, M. Bothwell, D. Montfort, and Q.-L. Driskill, "Calling for a paradigm shift in the study of gender in engineering education," *Stud. Eng. Educ.*, vol. 1, no. 2, pp. 55–70, Feb. 2021, doi: 10.21061/see.34.
- [4] S. A. Male, A. Gardner, E. Figueroa, and D. Bennett, "Investigation of students' experiences of gendered cultures in engineering workplaces," *Eur. J. Eng. Educ.*, vol. 43, no. 3, pp. 360–377, May 2018, doi: 10.1080/03043797.2017.1397604.
- [5] U. Nguyen, T. Russo-Tait, C. Riegler-Crumb, and K. Doerr, "Changing the gendered status quo in engineering? The encouraging and discouraging experiences of young women with

- engineering aspirations,” *Sci. Educ.*, vol. 106, no. 6, pp. 1442–1468, Nov. 2022, doi: 10.1002/sce.21748.
- [6] J. G. Robinson and J. S. McIlwee, “Men, women, and the culture of engineering,” *Sociol. Q.*, vol. 32, no. 3, pp. 403–421, Sep. 1991, doi: 10.1111/j.1533-8525.1991.tb00166.x.
- [7] S. Secules, “Making the familiar strange: An ethnographic scholarship of integration contextualizing engineering educational culture as masculine and competitive,” *Eng. Stud.*, vol. 11, no. 3, pp. 196–216, Sep. 2019, doi: 10.1080/19378629.2019.1663200.
- [8] S. S. Silbey, “Why do so many women who study engineering leave the field?,” Harvard Business Review. Accessed: Aug. 30, 2022. [Online]. Available: <https://hbr.org/2016/08/why-do-so-many-women-who-study-engineering-leave-the-field>
- [9] NASEM, *The science of effective mentorship in STEMM*. Washington, D.C.: National Academies Press, 2019. doi: 10.17226/25568.
- [10] M. T. Nettles and C. M. Millett, *Three magic letters: Getting to Ph.D.* Baltimore: Johns Hopkins University Press, 2006.
- [11] B. E. Lovitts, *Leaving the ivory tower: the causes and consequences of departure from doctoral study*. Lanham, Md: Rowman & Littlefield Publishers, 2001.
- [12] D. Jairam and D. H. Kahl, “Navigating the doctoral experience: The role of social support in successful degree completion,” *Int. J. Dr. Stud.*, vol. 7, pp. 311–329, 2012, doi: 10.28945/1700.
- [13] G. E. Walker, C. M. Golde, L. Jones, A. Conklin Bueschel, and P. Hutchings, Eds., *The formation of scholars: rethinking doctoral education for the twenty-first century*, 1st ed. in Carnegie Foundation for the Advancement of Teaching. San Francisco, CA: Jossey-Bass, 2008.
- [14] T. J. Yosso, “Whose culture has capital? A critical race theory discussion of community cultural wealth,” *Race Ethn. Educ.*, vol. 8, no. 1, pp. 69–91, Mar. 2005, doi: 10.1080/1361332052000341006.
- [15] M. Brabeck and K. Brabeck, “Feminist perspectives on research ethics,” in *The Handbook of Social Research Ethics*, 2455 Teller Road, Thousand Oaks California 91320 United States: SAGE Publications, Inc., 2009, pp. 39–47. doi: 10.4135/9781483348971.
- [16] V. Thomas, “Critical Race Theory: Ethics and dimensions of diversity in research,” in *The Handbook of Social Research Ethics*, 2455 Teller Road, Thousand Oaks California 91320 United States: SAGE Publications, Inc., 2009. doi: 10.4135/9781483348971.
- [17] J. S. Brown, “Embracing identities and affirming agency: Exploring effective mentorship for women doctoral students in engineering disciplines using an intersectional lens,” Doctoral dissertation, Clemson University, Clemson, SC, USA, 2023. [Online]. Available: In press
- [18] A. Burgess-Proctor, “Intersections of race, class, gender, and crime: Future directions for feminist criminology,” *Fem. Criminol.*, vol. 1, no. 1, pp. 27–47, Jan. 2006, doi: 10.1177/1557085105282899.
- [19] M. Denton, M. Borrego, and A. Boklage, “Community cultural wealth in science, technology, engineering, and mathematics education: A systematic review,” *J. Eng. Educ.*, vol. 109, no. 3, pp. 556–580, Jul. 2020, doi: 10.1002/jee.20322.
- [20] N. Jaumot-Pascual, M. Ong, C. Silva, and A. Martínez-Gudapakkam, “Women of Color leveraging community cultural wealth to persist in computing and tech graduate education:

- A qualitative meta-synthesis,” *Educ. Sci.*, vol. 11, no. 12, p. 797, Dec. 2021, doi: 10.3390/educsci11120797.
- [21] J. Kelley, A. N. Watson, and A. Bindamnan, “More than meets the eye: Community cultural wealth as a theory for mentoring international students,” *New Dir. Teach. Learn.*, vol. 2023, no. 175, pp. 83–92, Sep. 2023, doi: 10.1002/tl.20561.
- [22] B. A. Burt and J. T. Johnson, “Origins of early STEM interest for Black male graduate students in engineering: A community cultural wealth perspective,” *Sch. Sci. Math.*, vol. 118, no. 6, pp. 257–270, Oct. 2018, doi: 10.1111/ssm.12294.
- [23] M. M. Espino, “Exploring the role of community cultural wealth in graduate school access and persistence for Mexican American PhDs,” *Am. J. Educ.*, vol. 120, no. 4, pp. 545–574, Aug. 2014, doi: 10.1086/676911.
- [24] L. A. DeCrosta, “What’s culture got to do with it? An investigation into the individual and institutional factors that support underrepresented minority and first-generation women graduate students’ success in STEM fields,” Doctoral dissertation, University of Maryland, 2018. [Online]. Available: <https://www.proquest.com/docview/2186631820>
- [25] A. Flores, “The Latina doctoral student experience: A qualitative phenomenological study,” Doctoral dissertation, Texas State University, San Marcos, TX, 2023. [Online]. Available: <https://digital.library.txstate.edu/handle/10877/16501>
- [26] R. E. Stake, *The art of case study research*. Thousand Oaks: Sage Publications, 1995.
- [27] J. W. Creswell, *Educational research: planning, conducting, and evaluating quantitative and qualitative research*, 4th ed. Boston: Pearson, 2012.
- [28] M. Q. Patton, *Qualitative research and evaluation methods*, 3 ed. Thousand Oaks, Calif: Sage Publications, 2002.
- [29] R. L. Brennan and D. J. Prediger, “Coefficient kappa: Some uses, misuses, and alternatives,” *Educ. Psychol. Meas.*, vol. 41, no. 3, pp. 687–699, Oct. 1981, doi: 10.1177/001316448104100307.
- [30] Y. S. Lincoln and E. G. Guba, “But is it rigorous? Trustworthiness and authenticity in naturalistic evaluation,” *New Dir. Program Eval.*, vol. 1986, no. 30, pp. 73–84, 1986, doi: 10.1002/ev.1427.
- [31] S. Nolan, “It’s time for White people to have tough conversations with their White friends and relatives,” TIME. Accessed: Nov. 27, 2023. [Online]. Available: <https://time.com/6145211/white-people-tough-conversations-race/>
- [32] R. J. DiAngelo, *White fragility: Why it’s so hard for White people to talk about racism*. Boston: Beacon Press, 2018.
- [33] I. Oluo, *So you want to talk about race*, First edition. New York, NY: Seal Press, 2018.
- [34] L. F. Saad, *Me and White supremacy: Combat racism, change the world, and become a good ancestor*. Naperville, Illinois: Sourcebooks, 2020.