

Drexel University

Research Brief no. 12

**Bridging the Gap Between Urban Adolescent Females of Color and STEM:
A Hermeneutic Phenomenological Study**

By:
Van V. Truong, Ed.D.
Drexel University
April 2021

Supervising Professor:
Dr. Alonzo Flowers

Editors:

Dr. Penny L. Hammrich
Professor and Dean

Dr. Rajashi Ghosh
Associate Professor and Department Chair for Policy, Organization, and Leadership

Dr. Kathy Geller
Associate Clinical Professor

Christine Galib
EdD Student

Copy Editor:

Anthony Hopkins
Director of Marketing and Communications

Bridging the Gap Between Urban Adolescent Females of Color and STEM: A Hermeneutic Phenomenological Study

Abstract

Despite decades long efforts, current data continues to suggest that females of color are the one of least represented groups within the STEM career pathways. This research presents findings from a qualitative study utilizing data from an out-of-school (OST) STEM program that targeted adolescent females of color in a northeastern city in the United States. This study explored the perspectives of eight urban adolescent females of color to understand how their participation in an informal learning environment has shaped their STEM learning and interest in pursuing STEM careers. The research was done through the lens of critical race theory grounded in education, feminism, and situated learning theory.

Aim

The aim of this hermeneutic phenomenological study was to explore the lived experiences of urban adolescent females of color within the context of an OST STEM program, namely Program XXX. This study sought to advance understanding of the participants' experiences in a high school based STEM OST enrichment program, particularly their personal 'context' that is framed by gender, race, and ethnicity, and the influences of these demarcations on their STEM learning experiences, as well as their interest in pursuing STEM educational programs and careers. Data collected and analyzed from this research may provide guidance to researchers, policy makers, industry leaders, program leaders, district leaders, educators, and parents in advancing research on informal STEM learning and developing multiple STEM pathways for urban adolescent females of color.

Problem

There is a vast amount of literature documenting the need to diversify the United States STEM fields and the need to recruit more skilled workers to fill STEM positions. One common theme among the studies is the disproportionately low representation of females of color in STEM educational programs and subsequently careers. The limited recruitment of females of color to STEM has historically been described through a variety of causes, such as social factors (Cho, et al., 2013; Malcolm & Malcolm, 2011; Ong, et al., 2011), institutional structures (Espinosa, 2011; Alfred, et al., 2018), early education classroom environments (Alfred et al., 2018), and poor advising in higher education (Ong, et al., 2018; Ong et al., 2011). Based on the current data, however, females of color are not persisting in the STEM sphere (National Science Foundation, 2017). As such, a number of questions regarding the recruitment and persistence of girls of color in K-12 remain to be addressed.

Research Questions

The central question that this study sought to explore is:

How do the lived experiences in an OST STEM program influence the STEM learning and personal interest in pursuing STEM educational programs and professions for urban adolescent females of color?

The following research questions were designed to gain insights into the lived experiences of urban adolescent females of color:

- (1) How do urban adolescent females of color who attended an OST STEM program describe their perceptions about the barriers and challenges they have faced in STEM?
- (2) How did participating in an OST STEM program influence urban adolescent females of color perceptions of their ability to do science and mathematics?
- (3) How do urban adolescent females of color who attended an OST STEM program understand STEM career pathways?
- (4) How do the lived experiences of urban adolescent females of color who participated in an OST STEM program influence their personal interest in pursuing STEM educational programs and professions?

Research Findings

Framework

The guiding theories for this study are critical race theory (CRT) in education (Collins, 2000; Crenshaw, et al., 1995; Delgado & Stefanic, 2000), critical race feminism (CRF) and intersectionality (Crenshaw, 1991; Cho et al., 2013; Showunmi, 2014), and situated learning (Lave & Wenger, 1991). Conceptually, the notions of CRF, CRT in education, intersectionality and the double bind of race and gender (Cho et al., 2013; Crenshaw, 1993; Delgado et al., 2012; Malcolm et al., 2011; Ong et al., 2011) are equally important when exploring issues related to females of color in STEM. These foundational theories informed the methods, analysis of the data, and the interpretation and implications of the results. In addition, theory and practice from the world of situated learning theory in the context of informal STEM learning were employed to provide context for the results. It also provided the foundation for developing effective and holistic interventions that helped females of color build interest in STEM.

Method

The philosophical underpinnings that informed this study were phenomenology and hermeneutics which allowed for the exploration and provision of a deep understanding of the essence of the participants' experiences in Program XXX and the influence this program has had on their STEM learning, interest, and participation. The sample size of this study included eight urban, adolescent girls who identified as females of color. The participants were purposefully chosen. Qualitative methods such as in-depth semi-structured interviews, journaling, observations, audio recordings, and documents and artifacts analysis were used to collect data. The phenomenological thematic data analysis strategies, including the process outlined by Moustakas (1994) and Diekelmann, Allen, and Tanner (1989) were used to analyze and transform the data. Additional validation methods were used to ensure accurate representation

and interpretation of the participants' lived experiences in Program XXX. Furthermore, ethical issues and concerns were considered throughout the study in order to provide trustworthy outcomes.

Conclusions/Discussion

The major findings of the data collected in this study include the following:

- Parents, particularly mothers, females of color school-teachers, and STEM program leaders had the most influence on urban females of color's interest and participation in STEM.
- All of the participants made references to the factors that positively impacted their participation in the OST STEM program: exposure to informal STEM learning; flexibility in learning; access to STEM mentors, role models, and peer support networks; opportunities to work in the STEM fields; increased self-awareness and confidence through social engagement activities; and opportunities to travel.
- Factors such as racial-ethnic bias, gender bias, disparities in access to K-12 STEM education and activities, negative STEM perceptions, and discouragement from teachers had decreased urban females of color's early childhood interest and participation in STEM. These factors are collectively known as STEM barriers for urban adolescent females of color.
- The participants made references to educational factors that negatively impacted their STEM experiences around the lack of exposure to STEM learning, to quality teachers, to support systems, and access to STEM program and career awareness opportunities in K-12.

The findings from this study show that there is a need to develop STEM pathways beginning in primary grade levels and continuing on to secondary grade levels that focuses on building a strong mathematics and science foundation, as well as ensuring racial and ethnic equity. In addition, the findings in this study point to the need for collective efforts being made in terms of immense structural and policy *changes* to help advance females of color in STEM. For example, reversing the underrepresentation of females of color in STEM requires the education system to capture the imaginations of all learners starting from the elementary grade levels (Young, et al., 2017).

Conclusions & Research Implications

The findings in this study suggested that urban females of color interested in STEM are inspired and encouraged to participate in STEM educational programs and career activities by both internal and external factors. It is important to note that although findings in the literature showed that participation in STEM enrichment programs is a step toward increasing interest in pursuing STEM careers and participation in STEM educational programs for females of color, it is not enough to ensure participation in the STEM fields. As such, females of color need intentional support and guidance by all those around them to educate them on STEM opportunities and provide encouragement as they seek to pursue STEM classes and careers.

While this study is important in highlighting the participants' perceptions of how participating in an OST STEM program prepares them for imminent STEM learning, future research recommendations point to the need to examine the long-term impacts of participating in this type of informal learning (Roberts et al., 2018). Exploring participants' future course taking patterns, persistence in STEM related courses, choice of college majors and/or careers, and experiences in STEM careers are all areas needing further research.

References

- Alfred, M., Ray, S., & Johnson, M. (2019). Advancing women of color in STEM: An imperative for U.S. global competitiveness. *Advances in Developing Human Resources*, 21(1), 114-132. doi: <https://doi.org/10.1177/1523422318814551>
- Cho, S., Crenshaw, K. W., & McCall, L. (2013). Toward a field of intersectionality studies: Theory, applications, and praxis. *Signs*, 38(4), 785-810. doi:10.1086/669608
- Collins, P. H. (2000). *Black feminist thought: Knowledge, consciousness, and the politics of empowerment* (2nd Ed.). Routledge.
- Crenshaw, K. (1991). Mapping the Margins: Intersectionality, Identity Politics, and Violence against Women of Color. *Stanford Law Review*. 43(6), 1241-179.
- Crenshaw, K. (1993). Demarginalizing the intersection of race and sex: A Black Feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. In D. K. Weisberg (Eds.), *Feminist legal theory: Foundations* (pp. 383-95). Temple University Press.
- Delgado, R., & Stefancic, J. (2000). *Critical race theory: The cutting edge* (2nd Ed.). Temple University Press.
- Diekelmann, N., Allen, D., & Tanner, C. (1989). *The NLN criteria for appraisal o baccalaureate programs: A critical hermeneutic analysis*. (Pub. No. 15-2253). National League for Nursing Press.
- Espinosa, L. (2011). Pipelines and pathways: Women of color in undergraduate STEM majors and the college experiences that contribute to persistence. *Harvard Educational Review*, 8(2), 209-241. doi: <https://doi.org/10.17763/haer.81.2.92315ww157656k3u>
- Hatch, J. A. (2002). *Doing qualitative research in education settings*. State University of New York Press.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.
- Malcom, L., & Malcom, S. (2011). The double bind: The next generation. *Harvard Educational Review*, 8(1). 162-172. doi: <https://doi.org/10.17763/haer.81.2.a84201x508406327>
- National Science Foundation (NSF). (2017). *NSF Women, minorities, and persons with disabilities in science and engineering key report* (Report No. 17-310). Arlington, VA: National Center for Science and Engineering Statistics Directorate for Social, Behavioral and Economic Sciences. Retrieved from <https://www.nsf.gov/statistics/2017/nsf17310/static/downloads/nsf17310-digest.pdf>
- Ong, M., Smith, J. M., & Ko, L. T. (2018). Counterspaces for women of color in STEM higher education: Marginal and central spaces for persistence and success. *Journal of Research in Science Teaching*, 55(2), 206-245. doi: <https://doi.org/10.1002/tea.21417>

- Ong, M., Wright, C., Espinosa, L., & Orfield, G. (2011). Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics. *Harvard Educational Review*, 81(2), 172-390.
- Roberts, T., Jackson, Mohr-Schroeder, M. J., Bush, S. B., Maiorca, C., Cavalcanti, Schroeder, M. D. C., Delaney, A., Putnam, L., and Cremeans, C. (2018). Students' perceptions of STEM learning after participating in a summer informal learning experience. *International Journal of STEM Education*, 5(35), p. 1-14. doi: <https://doi.org/10.1186/s40594-018-0133-4>
- Saldaña, J. (2015). *The coding manual for qualitative researchers* (3rd Ed.). Sage Publications, Inc.
- Showunmi, T. (2014). *Feminist critical race theory and intersectionality: Complicating 'achievement' through the lens of Black girls' narratives*. Paper presented at the 2014 ECER Conference, Porto, Portugal. Retrieved from <https://www.eera-ecer.de/ecer-programmes/conference/19/contribution/30816/>
- Young, J. L., Young, J. R., & Ford, D. Y. (2017a). Standing in the gaps: Examining the effects of early gifted education on black girl achievement in STEM. *Journal of Advanced Academics*, 28(4), 290-312. doi: 10.1177/193220

Author Information and Biography

Van Truong's educational background includes an Ed.D. in Educational Leadership and Management with a concentration in Creativity and Innovation from Drexel University; a M.Ed. in Secondary and Special Education from Chestnut Hill College; and a B.S. in Chemistry from Temple University. As an educational researcher, Dr. Truong's research takes an equity and social justice orientation toward STEM education in the urban public school settings. Van's research explored STEM motivational pathways, particularly interventions that engage, support, and advance urban adolescent females of color in STEM educational programs and careers. Her other research interests include equity, diversity, and inclusion in STEM; intersectionality and STEM; integrative STEM education; and creativity and innovation in the educational field and workplace.

Dr. Truong has over 10+ years of experience as an educator, and has taught at the primary, secondary, and post-secondary grade levels of science in both urban and suburban school environments. She has also taught in various contexts including alternative, private, and public schools. In addition to teaching, Van has served as an assessment and curriculum specialist, instructional coach, educational consultant, and professional development trainer. Outside of the education sphere, Van has worked as a science research lab assistant, a program manager for a private tutoring firm, as well as a program coordinator for a youth mentoring program in the non-profit sector.