Empowering Underrepresented Undergraduates in Computing By Bridging the Digital Divide in Marginalized Communities

Abstract*– Can support from undergraduate mentors be the key to unlocking tech education for marginalized communities? As an effort to alleviate educational, financial, and health disparities in marginalized communities, this project explores the transformative potential of B2G Community Computing Learning Centers, a program developed at the University of Maryland, Baltimore County, and piloted in Anne Arundel County. The program provides in-person digital skills training to single mothers in low-income communities. By utilizing a "train-the-trainer" approach, B2G prepares women to become computing community leaders. The curriculum itself integrates diverse computing curricula, including. creative technology, cyber hygiene, digital literacy, and entrepreneurship to co-design the centers with the women. Culturally-relevant, inclusive, and trauma-informed pedagogies foster deeper connections and understanding. The B2G initiative goes beyond just technical skills by engaging undergraduate students as mentors to cultivate a safe and supportive learning environment with participants. Undergraduate mentors are trained to be sensitive to potential past experiences and foster a growth mindset by encouraging participants to embrace challenges and learn from mistakes. This space promotes cultural exchange among participants, mentors, and instructors who can share life experiences and advice, building a strong sense of belonging and inclusion for developing a computing identity amongst all those involved. Early findings indicate that this collaboration empowers undergraduate mentors in developing interpersonal and research skills, critical thinking, and self-efficacy in computing.

***Keywords*– digital divide, marginalized communities, undergraduate students, culturally-relevant pedagogy, trauma-informed pedagogy**

I. INTRODUCTION

Amidst the challenges of the digital divide, access to technology and digital literacy skills are crucial for economic self-sufficiency, navigating the digital landscape, and social inclusion. Marginalized communities face several barriers, and access to these resources is very minimal. The B2G Community Computing Learning Centers, pioneered by the University of Maryland, Baltimore County (UMBC), represent a progressive approach to addressing educational, health, and financial disparities single mothers face in low-income communities [1]. This initiative brings comprehensive tech training to empower women to navigate the cyber world and allow participants to create an inclusive learning environment for their community. The curriculum itself integrates diverse computing curricula, such as creative technology, cyber hygiene, digital literacy, and entrepreneurship to co-design the centers with the women. Using the train-the-trainers approach, B2G utilizes the knowledge of undergraduate mentors to establish a supportive and inclusive environment. The involvement of undergraduate student mentors in B2G is vital in providing individualized support and guidance to participants. Undergraduates will use prior knowledge and experiences from their academic and personal journeys to connect with participants and tailor their support to meet their specific needs. The following article delves into a pilot conducted in Anne Arundel County analyzing the impact of B2G on participants and mentors.

II. METHODOLOGY

Understanding the intricate dynamics of the B2G Community Computing Learning Centers demanded a multifaceted approach. This section delves into the methodological strategies used to gain an understanding of the program and to inform the role of undergraduate mentors, whose experiences were essential in shaping the initiative. Through direct engagement, the undergraduate mentors can gain insight into the challenges that the participants face when engaging with tech education. We utilized three primary methods for gathering data: research training, observations conducted within the learning centers, and a review of relevant literature to inform interactions with participants.

A. Research Training

To best inform interactions with marginalized communities, undergraduate mentors completed a thorough Collaborative Institutional Training Initiative (CITI Program), called CIP Course for Advanced Learners – Research with Vulnerable Populations and Consent Topics. By completing the different modules mentors were able to learn about Consent and Cultural Competence, Consent with Subjects Who Do Not Speak English, and Research with Persons who are Socially or Economically Disadvantaged, among other topics.

Undergraduate mentors also learned about how to conduct focus groups. They read and viewed different videos to help them understand how to facilitate and prepare to run these groups. The informal focus groups were essential for the teaching and leadership team to understand B2G participants' needs and aspirations. These focus groups helped inform and improve the B2G curriculum.

B. Observations

Firstly, observations allowed us to immerse ourselves in the program's environment, directly observing student-instructor interactions, the overall atmosphere, learning activities, and technology usage. As undergraduate mentors, they were involved in many of the activities taking the role of participants as observers [2]. This immersive experience proved invaluable in uncovering areas where undergraduate mentors could offer significant support as well as highlighting the need for culturally responsive and trauma-informed pedagogy. The following categories will be analyzed based on the observation data:

Need for Individualized Support. Our observations revealed situations where undergraduate mentors provided valuable assistance to participants. On more than one occasion, the instructors juggled between helping two or more students at one time. This often resulted in instructors not being able to provide individualized support to participants. With undergraduate mentors present, the workload is evenly distributed. Although finding and training instructors might have posed a challenge, having teaching assistants in the form of undergraduate students could help fill this gap. This way, participants would have been able to get the one-on-one support they need.

Culturally Responsive Pedagogy. The B2G program prioritizes culturally responsive pedagogy as a core component of its curriculum, acknowledging the diverse backgrounds and experiences of the learners. The curriculum itself is designed to be culturally relevant, incorporating diverse computing applications such as digital literacy and cyber hygiene that resonate with the participants' daily lives. This fosters deeper connections with the material and a sense of ownership over the learning process. The addition of undergraduate mentors can significantly enhance this approach. Ideally coming from similar backgrounds or with strong cultural competency training, undergraduate mentors can serve as role models and bridge cultural divides. They can provide participants with a safe space to ask questions and share experiences, fostering a sense of community and belonging. Furthermore, undergraduate mentors can identify areas where the curriculum can be further tailored to resonate with the participants' cultural contexts, ultimately leading to a more meaningful and impactful learning experience.

Trauma-Informed Approach. A trauma-informed approach is vital for the B2G program's success, as participants from marginalized communities may have experienced current and past traumas that can impede their learning process. This approach fosters a calm environment using techniques like patience, varied personalized paced instruction, and breaking down tasks. Undergraduate mentors can further a growth mindset by acknowledging accomplishments to motivate participants and build confidence. These techniques empower participants to take control of their learning and help build a supportive foundation for their journey in the B2G program.

C. Literature Review

Secondly, a review of relevant literature provided a strong foundation for interpreting our observations and informing the role of undergraduate mentors within the B2G program.

Culturally Responsive Computing Education. Research by Englash et al. emphasizes the importance of culturally responsive computing education, which utilizes pedagogical approaches that resonate with students' cultures and identities [3]. In the context of the B2G program, undergraduate mentors who share similar backgrounds with the participants or have received cultural competency training can ensure the curriculum and teaching methods are inclusive and address the needs of the diverse student population [4]. This aligns with the findings of Goedhart et al. [5], who highlight the importance of understanding the socioeconomic background of learners to bridge the digital divide and ensure access to technology goes beyond just hardware provision [5].

Trauma-Informed Computing (TIC). Trauma-informed computing is an emerging framework that highlights the potential impact of trauma on user experiences with technology [6]. Its concept offers valuable insights for creating a supportive learning environment. TIC principles such as safety, trust, and collaboration can be directly applied to the B2G program. Undergraduate mentors can help create a safe space by employing techniques like patience and acknowledging accomplishments. This fosters trust and empowers participants to take control of their learning journey, similar to the trauma-informed teaching methods used in educational settings.

By combining the rich data gathered through observations with the insights gleaned from the literature review, they were able to paint a comprehensive picture of the B2G program's strengths and weaknesses. This two-pronged approach ultimately allowed us to identify specific areas where the program could benefit from the inclusion of undergraduate mentors who can provide culturally relevant support and navigate the potential past experiences of participants with sensitivity.

III. PRELIMINARY RESULTS

Our pilot program at the B2G Community Computing Learning Centers yielded promising initial findings, particularly regarding the impact on undergraduate mentors:

Interpersonal Skills. Mentors gain experience in communication, active listening, and building rapport with

participants from diverse backgrounds. For example, one mentor described learning to tailor their explanations based on the participant's cultural references. Additionally, mentors can demonstrate their skills to adapt based on different circumstances and learners. The mentors engaged with the participants and demonstrated various features of the tool by providing hands-on guidance to ensure comprehension. Furthermore, mentors assist in developing a community with participants, allowing collaboration among participants, the exchange of ideas, sharing ideas, and offering support for one another. Moreover, mentors extend support beyond technical guidance by offering advice and sharing life experiences to help empower participants, fostering a learning community of personal and professional growth.

Critical Thinking and Problem Solving. Mentors learn to assess participant needs, identify learning gaps, and collaboratively develop solutions. For instance, a mentor recounted working with a participant to troubleshoot connectivity issues using online resources.

Self-Efficacy in the Computing Field. Mentorship strengthens mentors' understanding of computing concepts and their ability to explain them effectively. Both mentors highlighted gaining confidence in their technical skills through the teaching process. Another example, a mentor who helped in troubleshooting the Cricut device used for crafting, in which connectivity issues were present.

Teaching Skills. A mentor recalled that a scheduled lesson was not able to be held, and two mentors found a solution by teaching the participants how to utilize Google Chats, in so applying their problem-solving skills. They put into practice pedagogical elements they had observed in prior lessons, like using culturally relevant and pertinent topics for students to apply their digital skills. Also making the environment that fosters a growth mindset by encouraging participants to embrace challenges and learn from mistakes. For example, one of the mentors had very limited experience with some of the devices used in the creative tech lessons. Undeterred by the challenge, the student actively sought resources to enhance their understanding. They dedicated time to watching instructional videos to ensure they could effectively assist participants. He shared with participants his experience, in demonstrating the need to see the unknown as opportunities to continue growing and embracing mistakes as opportunities for learning.

Research Skills. Through the CITI training, mentors developed their analytical skills by reviewing several documents and answering questions tailored to them. This training honed mentors' abilities to assess research protocols and to understand ethical considerations when working with diverse communities. The focus group training prepared mentors to facilitate meaningful discussions and obtain feedback from participants. One of the mentors was confidently able to facilitate a focus group on his own. He fostered an inclusive environment where all members of the group felt welcomed and open to sharing. Due to their involvement with B2G, mentors found themselves interested in pursuing research. Through their participation in the program, mentors were exposed to various research methods, opportunities to engage with mentors and peers in research-related activities.

These findings suggest the B2G program offers valuable professional development opportunities for undergraduate mentors while simultaneously supporting participants in their tech education journey. Further research with a larger sample size is needed to confirm these preliminary findings, but it shows potential.

IV. FUTURE WORK

In envisioning the next steps for programs like B2G Community Computing Learning Centers, it is essential to identify key factors for future development and enhancement of the program. A critical direction the leadership plans to explore involves fostering partnerships with community colleges and developing tailored programs to engage undergraduate students in supporting marginalized communities through tech education.

Another imperative action is the formalization of training programs for undergraduate mentors. These trainings take priority for the development of interpersonal skills, cultural competency, and trauma-informed pedagogies. By establishing these comprehensive trainings, B2G programs can ensure that inclusive and empowering learning environments are being developed for participants. Additionally, establishing training for undergraduates that revolves around culturally responsive, inclusive, and trauma-informed practices will assist in meeting the needs of marginalized communities. By incorporating these trainings into the curricula, we can allow participants to have a more meaningful learning experience and create better teaching assistants and bring more local undergraduates, graduates, and faculty to IS Research

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