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Reimagining summer school: Science and engineering enrichment for middle school students in the wake of COVID-19

Lindy L. Johnson, Meredith W. Kier, Janise S. Parker, & Evan J. Gallagher

Abstract: The COVID-19 global pandemic significantly impacted both the academic and social and emotional development of middle school students. This article describes the benefits of implementing an interdisciplinary, project-based summer school program to support middle school students as they adapted to in-person learning after school closures due to the global pandemic. Findings show that participation in the summer program contributed to students' engagement and interest in science and engineering activities and their social-emotional growth through peer collaboration and relational mentor support.

Keywords: *engineering, interdisciplinary curriculum, mentors, science, social-emotional development, summer school*

Successful Middle School **characteristics**:

- The school environment is welcoming, inclusive, and affirming for all.
- Every student's academic and personal development is guided by an adult advocate.
- The school collaborates with community and business partners.
- Curriculum is challenging, exploratory, integrative, and diverse.
- Health, wellness, and social-emotional competence are supported in curricula, school-wide programs, and related policies.

The COVID-19 global pandemic wreaked havoc on the state of public education when school buildings closed for the safety of students, teachers, staff, and communities at large. Nearly 40% of the nation's students were unable to experience face-to-face learning for over a year, resulting in a decline in students' mental health, academic learning loss, and missed milestones that were essential to students' social-emotional development (Margolius et al., 2020; Parker et al., 2021; Pattison et al., 2021; Styck et al., 2021). When public schools began to re-open, it became clear to school administrators that they would need to rethink their approaches to teaching and learning. At the same time, it was important for administrators to address students' academic learning loss as the pandemic limited students' access to high-quality teaching, technology, and other supports (Hope, 2022; Mize & Glover, 2021). The learning losses that took place during the pandemic were even more pronounced for underserved students, including African American and Hispanic students, English learners, and students with disabilities.

During the summer of 2021, many school districts offered in-person summer school programs that focused on students "catching up" through remedial instruction in the areas of English language arts and mathematics, as state standardized achievement tests regularly assess student learning in these subject areas (Carvalho et al., 2020). While summer school can be a time for enrichment and growth for young learners, there has been a long history of unequal access to summer school programming for marginalized populations. Students from economically disadvantaged backgrounds fall behind their more economically advantaged peers during the summer break months due to a lack of access to affordable opportunities for enrichment (Alexander et al., 2007; Downey et al., 2004). Approximately 18% of low-income students enroll in summer school, while 29% of more affluent households send their students to summer camp, where peer-interactions, mentorship, and life-long skills often develop (Augustine et al., 2016). Research has shown that when the instruction is of high quality, summer programming can have a positive effect on students' academic performance and can improve students' social-emotional development (Augustine et al., 2021).

The social isolation adolescents experienced during the COVID-19 pandemic served as a major source of stress and anxiety (Magson et al., 2021). To counteract the social isolation youth experienced, it is important to provide opportunities for them to engage in activities that promote their social-emotional wellbeing. Social-emotional wellness is a key contributor to students' academic success (Suldo et al., 2014), yet detailed descriptions of how educators can attend to the social-emotional well-being of students remain scarce (U.S. Surgeon General, 2021). This study explores a summer school program that included interdisciplinary, project-based learning opportunities and social-emotional skill development.

Middle school is a time when students begin making decisions about their interests and participation in future college and career pathways, including within the fields of science, technology, engineering, and mathematics (STEM) (Tai et al., 2006). Summer programming focused on STEM positively influences students' self-efficacy, interest, attitudes, and future goals for participating in advanced coursework and majors in these fields (Chan et al., 2020; Dubriwny et al., 2016; King & Pringle, 2019; Rahm & Moore, 2016). Highly effective STEM programming includes caring adults and role models invested in students' success (Carvalho et al., 2020), hands-on, constructivist-oriented learning activities (Phelan et al., 2017) directly aligned with students' interests and lived experiences, and opportunities for students to socially connect with their peers around relevant community issues (Shorty & Jikpamu, 2021).

This study describes the design of a one-week summer school program developed as an extension to traditional summer school offerings and that engaged middle school students in social experiences around STEM as they readapted to in-person learning. This enrichment opportunity, albeit short in duration, sought to attend to the needs of students who were transitioning out of nearly two years of virtual learning and isolation due to COVID-19. The purpose of this study is to explore the impact of an interdisciplinary, project-based learning curriculum in summer school. Specifically, we were interested in 1) how the program influenced students' engagement, interest, and identity in science and engineering and 2) what were the processes that enabled and constrained these outcomes?

Academic and social-emotional development of middle school students

Rapid biological, cognitive, and social-emotional development characterize early adolescence as young people explore who they want to be, where they want to go, and how they fit into the larger world (Kroger, 2004). A core task of young adolescents is developing a positive identity (Bishop & Harrison, 2021) and adults, schools, and communities play a crucial role in shaping adolescents' positive identity development during this time (Jansen & Kiefer, 2020). One's expectations for success and the values that they place on doing related activities and tasks in that field guide their motivation to become engaged and choose a particular field (Eccles & Wigfield, 1995). For example, middle school students who want to pursue more STEM classes in high school likely believe that they are good at STEM in middle school and find STEM-related activities to be enjoyable, useful to their future work, and important. Students' identity is also critical in shaping future interests in goals (Eccles, 2009). Middle school students who have an identity in STEM see the knowledge and practices as inherently a part of themselves and feel recognized as someone who is and should be part of the STEM community (Carlone & Johnson, 2007).

Arguably, COVID-19 took a toll on many of the factors that would influence middle school students' motivation in STEM. For nearly two years, middle school students had limited opportunities to participate in the authentic practices of STEM that shape their own understanding of whether they might be truly successful in these disciplines. Researchers have identified isolation from peers and adults at school as a major contributor to school-related stress among adolescents during the COVID-19 era (Margolius et al., 2020; Parker et al., 2021; Styck et al., 2021), which can serve as a barrier to academic success across subject areas (Suldo et al., 2014; U.S. Surgeon General, 2021). Given this unforeseen context, this implementation study sought to understand how teachers, mentors, and researchers might begin to reinvigorate students' excitement and membership in STEM in the wake of the pandemic.

Methods

Context

This study occurred within the context of an established research-practice partnership between the authors (university professors) and a large urban school district in the mid-Atlantic region of the US. When the academic year 2020–2021 came to an end, the school district leaders prepared six weeks of in-person summer school that focused on mathematics and reading remediation for students at the middle school level. Teachers and administrators purposefully identified students who had experienced challenges during virtual learning and who would benefit from additional enrichment opportunities. The district's STEM professional development coordinator approached the research team and inquired if it would be possible to host an additional week of summer school on the university campus for 6th-8th grade students who elected to attend (Kier & Johnson, 2021, 2022). Through collaborative discussions, we sought to design an experience that prioritized social connection, social-emotional well-being, and mentorship to support students in their adaptation to in-school learning for the fall of 2021. The team also sought to build student interest in engaging in collaborative problem-solving and the engineering design process.

Designing STEM enrichment experience

This week-long STEM program intentionally incorporated the following key components each day: team building and reflection, mentorship between students and undergraduates, and hands-on activities that engaged students in the practices and literacies associated with science and engineering.

Team building and reflection. Establishing and maintaining relationships with others and setting goals are critical aspects of social-emotional wellness (Collaborative for Academic, Social, and Emotional Learning (CASEL, 2022). As such, we embedded opportunities for team building and reflection among the middle school students and mentors each day. Such efforts included providing guiding prompts for small-group discussion at the beginning of the day. On the first day of the program, students and mentors shared their hobbies, strengths, concerns about the program, and goals for the week. In subsequent days students and mentors described their proudest moments, lessons learned, additional worries, and continued goals relative to the summer program and STEM-career field.

The researchers also met with the mentors at the end of each day to identify strengths and areas for improvement with respect to the social-emotional wellness activities and general experiences of positive youth interactions. During these discussions, the third author, with expertise in youth mental health and social-emotional support, asked the mentors to describe facilitators and barriers to maintaining helpful interactions with the youth coupled with focused problem-solving as needed. For example, one mentor noted that some students were neurodiverse, including youth diagnosed with attention deficit hyperactivity disorder (ADHD) and autism spectrum disorder. This presented one challenge as the mentors sought to identify how to keep youth engaged and connected with other peers. As a result, the third author worked with the mentors to identify strategies for responding to students with varying exceptionalities.

Mentorship. The university research team led a 2-hour workshop to prepare undergraduates to effectively collaborate with middle school teachers and mentor students in the engineering design process using disciplinary literacy strategies that encourage reading and writing guided by an engineering design notebook designed by the team. We also prepared undergraduates to engage in participatory action research (PAR) (Macdonald, 2012; Rowell, 2006). Participatory action research informs field-based practices impacting marginalized communities through a collaborative scientific process conducted by researchers and community members (Macdonald, 2012; Rowell, 2006). The goal of PAR is to foster the undergraduate mentors' capacity to identify and share effective strategies for supporting underrepresented youth. Undergraduate mentors learned how to reflect on and systematically document the processes and outcomes of students each day of the program.

Engineering design process. The teachers and the mentors came together for one half-day planning workshop, led by the authors and school district administration. We modeled a basic structure for the program and guided teachers and undergraduates through activities using a facilitation guide. We gave middle school students the choice to select one of two engineering challenges. One challenge focused on creating a cosmetic line of products for diverse skin tones and an advertisement that addressed diversity and inclusion in the make-up industry; the second challenge focused on designing and launching a rocket to carry food, materials, and people safely to space.

In the cosmetics challenge, teachers and mentors taught students the differences between synthetic and natural products and costs associated with the development of cosmetics products. Students participated in scaffolded research guided by an engineering design notebook to learn about chemical properties and processes associated with creating different textures, hues, scents, and coverage of makeup. Students experimented with natural ingredients (e.g., beeswax, beetroot, and natural dyes) and synthetic products such as powders and liquids to test products on mannequins with different skin tones. Throughout the process, students reflected on their learning through writing and small group discussions using prompts in their engineering design notebook. On the final day of the program, students presented their cosmetics line and advertising pitch for why people should purchase their product line to an outside audience of community members.

In the rocket launch challenge, students participated in mini experiments to build their background knowledge of weight, center of mass, momentum, and aerodynamics. Following each experiment, students reflected on how new understandings of concepts contributed to the design of a water bottle rocket that they would test and modify. On the final day of the program, each student shared their rationale behind their rocket's design and launched rockets outside, measuring the height of the distance traveled. All students had the opportunity to see the final showcase of products on the last day of the program.

In both projects, we included intentional opportunities for the students to participate in the disciplinary literacy strategies of engineering. For example, we included opportunities for explicit vocabulary instruction (Garlick & Wilson-Lopez, 2020) and writing to learn activities (Pearson et al., 2010). The research team showed undergraduates how to select high-interest multimodal texts to embed into students' engineering notebook to support students in researching the context of the engineering design challenge. We also included reflection prompts throughout the notebook to activate students' prior knowledge and reinforce questioning and writing skills as they explored problems.

Participants

Figure 1 provides a description of the middle school learners who participated in the week-long experience as well as the background and demographics of the teachers and undergraduate mentors who facilitated academic and social-emotional learning opportunities. Fifteen students selected the rocket challenge (13 males, 2 females) and 9 female students participated in the cosmetics design challenge. Two male mentors, Alan, and Paul, and one female mentor, Harmony, collaborated with the male science teacher, Mr. Russell, on the rocket challenge. Two female mentors, Roxanne and Katie, collaborated with the female teacher, Ms. Chapman on the cosmetics design challenge.

Data sources and analysis

We collected a variety of quantitative and qualitative data from students, teachers, and undergraduate mentors to provide a rich description of the influence that the summer school had on students' social-emotional development and interests and identities in STEM.

Student engagement. To understand the student engagement during each day of the summer program, we collected data through the mini science engagement survey (Chung et al., 2016) immediately following participation in science-related activities. The students responded to a series of statements on a scale, indicating their level of agreement with questions such as, *During the activities today: I was focused on the things we were learning most of the time* and *During this activity: I did not talk to others about stuff not related to what we were learning*. After cleaning and quantifying the data, we calculated the mean value of engagement for each day; we also disaggregated this data by male and female students.

Student interest. At the beginning and end of the program, students took the pre-post science and engineering career interest survey (Kier et al., 2014). This survey includes items that incorporate constructs found within Eccles' (2009) framework that explore the students' interest and goals. This includes students' expectations for success, future interests, and presence of role models who support potential goals in science and engineering careers. We performed a descriptive statistical analysis on the pre-post means of the data and reported the mean scores for males and females.

Students' perceptions of mentors. At the end of the program, students completed a brief nine-item survey that measured their perception of support from their undergraduate mentors using the *Mentor-Youth Alliance Scale* (Zand et al., 2009). The purpose of this survey was to gather mentees' perceptions of the mentorship

Figure 1. Program participants.

Participants	Demographics and Experiences (All names are pseudonyms)
24 Middle School Students	11 females and 13 males 21 African American students; 1 Latino student; 1 Native American/Black student; 1 White student
5 Undergraduate mentors	Alan: African American/Latino, male, computer science major Harmony: African American, female, mechanical engineering major Katie: White, female, English and government major Paul: White, male, physics major Roxanne: African American, female, psychology major
2 Teachers	Mr. Russell: White male middle school science teacher Ms. Chapman: White female upper elementary school teacher

relationship to inform ongoing support efforts, including needed adaptations. Items explored students' perceptions of whether they felt cared for by their mentor, enjoyed talking to their mentor, and trusted their mentor. We performed a descriptive statistical analysis on this survey data to determine the mean score for males and females.

Focus groups/interviews. Students participated in a focus group with Dr. Parker and a graduate assistant to discuss what they learned during the experience, what they enjoyed the most, how they benefited from the program, and suggestions for improvements in future years. The research team also took notes during daily meetings with the undergraduate mentors while they discussed daily intentions, observations of students, and their perspectives on collaborating with the classroom teacher each day. The authors also interviewed both teachers and each of the undergraduates to discuss their perceptions of the enrichment experience and their role as a facilitator. The authors descriptively coded these focus groups to develop themes related to students' motivation, interests, and identities.

Findings

In this section we discuss how the summer school programming influenced students' engagement, interest, and identity in science and engineering and explore the processes that enabled and constrained these outcomes. Our analyses of the data suggested that participation in the summer STEM program contributed to the middle school students' engagement in STEM activities and understanding of relevant concepts, based on the students' respective groups. The program also contributed to the social-emotional growth of the middle school students, particularly through peer collaboration and relational mentorship support. Alongside the middle school students, the mentors reported personal growth as well, which included being more aware of the needs of marginalized populations and integrating their understanding into their future practice. The following sections summarize these two core findings.

Student engagement and academic learning

Engagement surveys found that students were engaged during all the days of the program, as every student indicated a score of 1 (very engaged) to 2 (engaged) on every question. Females entered the experience slightly more engaged than their male counterparts, but male students increased their engagement over the course of the week. The lowest levels of engagement for both male and females were on the second day of the program when students were primarily involved with learning the science concepts behind their respective engineering challenges, including the science of rocket launches and basic chemistry concepts incorporated in the design of cosmetics.

According to the pre-post survey (Kier et al., 2014), mean scores for students' interest in science and engineering fields increased from 3.28 to a 3.80. Similar to the engagement surveys, female students indicated a higher initial interest in both science and engineering than males having a pre- mean score of 3.42 and a post-mean score of 3.82. Mean scores for male students increased .77 (increasing from 2.94 to 3.71 out of a maximum interest of 4) on the science scale and .87 (increasing from 3.09 to 3.96) on the engineering scale.

Our focus group with students highlighted the importance of hands-on investigations and problem-solving to learn concrete skills in science and engineering. For example, students in the rocket challenge explicitly discussed the science concepts that they learned, mentioning "aerodynamics" and how "different weights [affected] how high [the rocket] flew." Students also explained that they "learned how to build [a model rocket]" and that "different techniques made [the rocket] go higher." The mentors shared that the hands-on nature of the activities seemed to create a learning climate that made the students "invested" in their projects. One mentor explained that following the pandemic, "being in the same room with people, having hands-on activities, and being able to be present in the moment really helped them grasp the activities we were doing while having fun with learning." Another mentor in the cosmetics challenge observed students "who weren't really interested in the beginning" show excitement once they became involved in the activities. The district administrator who visited the camp also noted a shift in the "energy" of the students from their previous weeks in summer school when they seemed "bored" and "disengaged."

While there were clear benefits to students' academic development and interest in learning, both the mentors and teachers offered additional ideas for structuring the program in future iterations. Ms. Chapman suggested the need for additional planning time with the undergraduates to clarify roles of facilitation. Both teachers naturally assumed a role of managing and organizing learning tasks, while the undergraduates participated in activities in small groups with the students. She reflected that with more time, she could have planned to make "stronger connections" to the engineering design processes and the academic concepts that were present in the curriculum.

Social-emotional connection and development

Youth participants who completed the survey ($n = 18$) generally selected *True* and *Very True* ratings regarding their perceptions of mentor support. The average rating for male participants was 4.14 and 4.48 for female participants. The youth provided additional details about their experience during the focus group interviews, which further supported the positive perceptions they held about their connection with their mentors. The following section describes the themes identified from the qualitative data.

Valued and heard

During the mentor training and group debriefing at the end of the day, we emphasized the importance of developing trust and companionship with the students by engaging in joint decision making, allowing the youth to be open and honest without feeling judged, and recognizing the students' strengths. The students' accounts suggested that mentors adhered to these recommendations, as students shared that the mentors made them feel like they mattered, and people cared for them. They also noted that mentors "understood their jokes and why they play around," were "funny," "cool," and were easier to connect with because of their age. One Black male student who participated in the rocket challenge stated that the mentors were "cool because they tried to help us, and they didn't try to bring us down and disappoint us and not help us." The students also felt like they were "listened to" by the mentors, instead of silenced and disregarded. In the same vein, one of the mentors, Paul, described how the adults in the room benefited from student input, underscoring the mutual benefit of student-mentor communication:

> I think the part that was most rewarding was getting to see the kids use the instructions that I had made to

> design their rockets … and Alan, Harmony, and I launched our rocket, and it wasn't as good. And so, one of the kids was like giving us tips on how to make it better. And it actually did, which is kind of cool.

In the cosmetics challenge, one female student shared that a mentor helped her to "feel brave about showing their work." Throughout the program, youth presented their ideas and projects in front of peers and adults in small and large group formats. Considering that some of the youth expressed feelings of nervousness, participants in the first focus group explained that they appreciated the encouragement they received. Indeed, Roxanne, the mentor who supported the student, explained that because concerns about others' perceptions were one reason why the students felt uncomfortable sharing their work, she was intentional about encouraging the students not to let the opinions of others impact their own growth, "You're going to have people who say mean things … so you can't stop that from everyone. I wish you could, but it matters how you internalize that and then what you do with it."

Such encouragement from the mentors helped the youth gain confidence and leadership skills, as evidenced by youth stating that they learned "to cooperate" with others and "talk confidently to other people." Indeed, Roxanne explained how one female student developed her voice and leadership skills through the affirmation of her peers. She shared,

> I think she just really came into herself as a leader. And I think at the beginning, people told her that she was doing a good job as the leader and then she identified as a good leader … and she really did help lead the other girls and set a really good example for them. So, yeah, that was an, that's an example of just a really clear growth.

Cultural identities and social-emotional needs

Considering the demographics of the students served, Dr. Parker encouraged the mentors to recognize student diversity along several dimensions and respond to such through relational support (e.g., demonstrating care, understanding). Sentiments shared by the mentors during their individual interviews revealed different ways in which they strove to respond to the cultural and demographic backgrounds of the students, with specific attention directed toward their social-emotional needs.

Accordingly, the mentors described experiencing an increased awareness of the different backgrounds among students in K-12 schools, which propelled them to actively look for ways to support the students throughout the week. Paul, a white male mentor who helped facilitate the rocket challenge, for example, explained that he began to understand that some students may struggle more with social-emotional challenges. He specifically discussed the importance of collaborating with colleagues to support students' mental health. Likewise, Katie, the White female mentor who helped facilitate the cosmetics challenge group explained that she learned to "listen" and "research" more to better understand how to support youth from racially marginalized groups, especially students with different emotional needs. She noted that there were times in which she did not know how to respond to the students (e.g., students who expressed having difficult home lives); and sharing her fears with Roxanne, the Black female mentor in her group resulted in her receiving encouragement and developing valuable relationships with the youth. Roxanne supported this account by noting how she responded to the discomfort and self-doubt Katie experienced when supporting Black students from low-income backgrounds. Harmony, who helped facilitate the rocket challenge, was intentional about addressing the needs of students from neurodiverse backgrounds to make sure they had a fulfilling experience as well. She noted how students worked at different paces due to a variety of factors, including neurodiversity. She said, "It's like balancing all these three different speeds." This quote shows that she understood and actively responded to individual student differences with care. Harmony also gave students who experienced social-emotional challenges a space to work through their feelings, while being intentional about modeling positive interactions with the other students to show that she could be a source of support. According to this mentor, doing so helped the students who isolated themselves see her as a person to trust, which ultimately led the youth to engage with the group:

> I did notice where the kids who were quieter or more off to the side and didn't really want to be bothered at first opened up a lot more by the last day. I think they needed to gain trust and they needed to feel more

> comfortable to be vulnerable and actually talk … I think by him seeing that and seeing how the mentors interacted with the students made him want to be a part of it… And by the time the last day came, he told me everything he thought or everything that he thought could be done differently.

In addition to serving as a valuable resource and model for their peers, the three mentors who identified as a member from a racially/ethnically minoritized group described being conscious about how they responded to the students, recognizing that "representation matters." For example, Alan, the male mentor who identified as African American/Latino indicated that it was important for him to show up to the program every day to show the Black males in his group an example of a minoritized male who was in the STEM field:

> I think it definitely showed how it's important to have minority representation for minorities in certain STEM fields. It was interesting to see that. Even in middle school, there's still the disparity. So, it's like, how are we going to bridge the gap so that we can become more accessible and inclusive in that way?

Harmony and Roxanne, the two Black female mentors noted that they were committed to empowering the Black girls in their respective groups, considering that STEM is a field that is primarily composed of White males. Harmony, who helped facilitate the rocket challenge group explained that she strove to maintain a strong connection and presence with the two girls in the group to make sure feelings of being "the only one" did not preclude them from enjoying the content and being confident about their abilities. Roxanne, who mentored students in the cosmetics challenge, provided the following insights about what it was like being a Black woman in STEM:

> Even now in tech, I'm the only Black student in my class, or when I was at [an HBCU] I was the only woman in my class. So sometimes people don't look like you [are] doing the same thing. I know some people get discouraged from that. So, I just was excited that they could feel comfortable being themselves, talking about women, Black women issues in a safe space involving STEM … It made me realize that some students will see themselves being the only Black woman in the class, and that might impact them negatively. I know, we know that. But me, "I was like, I don't care. I'm not good at anything else. So, I have to do STEM." It made me realize that just me being in this space makes a difference. Just me being in this space, me having the title of a Chemical Engineer alone will impact them.

The teachers in the program shared similar sentiments about the importance of representation, as they reported that the mentors served as important role models for the students, especially those from marginalized groups. Mr. Russell, for example, emphasized how important it was for students to see successful role models who "look just like them." For Mr. Russell, it was important that the students also saw diversity in the mentors in terms of their gender and race. That way, he said, the students can see that "it's the individual that makes a difference" when it comes to being successful in science and engineering and learning in general. He felt that having diverse mentors showed the students that "anybody can learn and have fun and interact with anyone else." He shared that he believed this openness to diversity fostered a "positive classroom culture" that benefitted all students.

Similarly, Ms. Chapman discussed the importance of students' building relationships with mentors who looked like them. Ms. Chapman recalled how Roxanne was consistently present and worked alongside students during the cosmetics design challenge. She noted the role that this played in getting students to "get comfortable," noting, "I think those girls really connected with her and related to her like from the start … she was a good role model because she was a very bright young lady, and she would talk to the girls about what she was studying." She described students' positive shifts in engagement and attitudes and attributed this shift to their relationships with Black mentors. She shared,

> In the beginning we had a couple of girls who were very reluctant to put themselves out there … And I think [because of] the relationships that they built within the first couple hours [with their mentors], I saw girls do a complete 180 … [The students thought] this is really cool [that mentors

> were] accepting and encouraging, and weren't there to, you know, be hard on them like probably what they see in school.

She described another eighth-grade student who stated on the first day, "I'm not sure I want to make make-up." She recalled watching this student grow as she began to lead her peers and develop her cosmetics company called *Girls Just Want to Be Seen*. Ms. Chapman stated that she attributed this students' growth in confidence and leadership to her relationship with her mentor. Ms. Chapman explained that the atmosphere of the program was necessary for the students to develop these interpersonal and leadership skills. She emphasized that the summer experience was an ideal learning environment since teachers were not tied to end of course tests and had more flexibility in their curriculum. She especially liked the hands-on learning, the small group work, and the relaxed atmosphere where students could connect with one another and their mentors.

While both the teachers and mentors emphasized the importance of supporting students socially and emotionally, they also provided ideas for improving the summer programming experience in the future. They suggested, for example, that it would be helpful to further clarify the roles and responsibilities of the mentors and teachers by discussing who would attend to any behavioral issues. They also spoke to the importance of having more time for planning and wished for an opportunity to actually go through the design process and build models so that they had exemplars to show to the students. Finally, both teachers and undergraduates recommended additional structure to scaffold students' academic development. The teachers, especially, wanted to ensure that the students were making explicit connections between the content they were learning and how it would connect to the classroom when they returned to school in the fall.

Discussion

In this article, we have described the benefits of implementing an interdisciplinary, project-based summer school program to support middle school students as they adapted to in-person learning after school closures due to the global COVID-19 pandemic. As the nation moves forward into a post-pandemic landscape, there are some important considerations to glean from this study when designing summer school opportunities. Our study illustrates one possibility for how summer school can provide students with access to academic enrichment, connection, and mentorship. In addition to impacting K-12 students' academic outcomes, COVID-19 has a social and emotional impact on students' growth and development due to stressors associated with the pandemic (e.g., social isolation, virtual learning) (Margolius et al., 2020; Parker et al., 2021; Pattison et al., 2021; Styck et al., 2021). Researchers have offered interdisciplinary collaborations as critical for responding to the effects of the COVID-19 pandemic (Fortuna et al., 2020). Aligned with their recommendation, we implemented this program to support students' engagement in STEM while also attending to their social-emotional development. The interdisciplinary nature of our research team (two curriculum and instruction scholars and one school psychology scholar who each had prior experiences as practitioners in K-12 schools through their respective fields) made this objective possible.

Rather than using summer school as a time for remediation, we advocate for it to become a space for students to reconnect with their peers through instructional activities that enrich and motivate.

Rather than using summer school as a time for remediation, we advocate for it to become a space for students to reconnect with their peers through instructional activities that enrich and motivate.

Interdisciplinary, project-based curriculum can foster a sense of inquiry and discovery while also promoting collaboration among peers. We found that the peer-to-peer learning opportunities in the summer program helped students see themselves in new ways and try on new identities as engineers, leaders, and designers. This approach to teaching and learning contrasts to traditional summer school instruction, which often focuses on remediation through computer-mediated tasks completed in isolation (i.e., Read 180, or iXL).

Summer school also provides an opportunity to connect youth with community members, such as undergraduate mentors, who have more time and flexible schedules during the summer. These mentoring relationships can provide middle school youth with navigational capital, enabling them to see themselves pursuing college and career pathways. Recognizing that culturally responsive practices are critical for fostering Black students' social-emotional wellness and engagement in STEM (Coleman & Davis, 2020; Davis & Allen, 2020; King, 2017), our team was also intentional about creating an environment that responded to students' cultural backgrounds and demonstrated an ethic of cultural care (Shockley & Lomotey, 2020). Overall, our efforts in supporting students' social-emotional wellness appeared to foster their sense of belonging and connection to the program, key indicators of student engagement (Fredricks et al., 2004), as evidenced by the youth feeling valued and heard. Likewise, sentiments shared by the mentors and classroom teachers suggested that our commitment to acknowledging the shared and unique demographic characteristics of the students served positioned the mentors to create a welcoming and affirming environment that likely cultivated students' engagement as well. As educators begin to think about how to best support middle school students' academic and social-emotional development, we encourage them to reconsider the structure and curriculum of summer school. Doing so can help reimagine how summer school can be a space where youth can connect with their community, cultivate positive relationships, and engage with a challenging and integrated curriculum.

As educators begin to think about how to best support middle school students' academic and social-emotional development, we encourage them to reconsider the structure and curriculum of summer school. Doing so can help reimagine how summer school can be a space where youth can connect with their community, cultivate positive relationships, and engage with a challenging and integrated curriculum.

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