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How youth-staff relationships and program activities promote Latinx adolescent outcomes in a university-community afterschool math enrichment activity

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ABSTRACT

Youth-staff relationships and program activities are important elements in designing high-quality afterschool activities that promote a broad range of outcomes. Using a qualitative approach, Latinx adolescents were interviewed ($n = 28$, 50% girls) about their experiences in a university-based afterschool math enrichment activity. Findings under the first goal of the study suggest that Latinx adolescents perceived changes in their math-specific outcomes (e.g., problem-solving skills), future science, technology, engineering, and mathematics (STEM) pathways (e.g., envisioning a future career), and social-emotional skills (e.g., relationship skills) as a result of participating in the activity. Under the second goal of the study, findings identified the specific practices that adolescents thought promoted those outcomes, including incorporating advanced math concepts and engaging in collaborative learning, engaging in campus tours and informal conversations, and using culturally responsive practices. The findings from this study can be leveraged by scholars and educators to design, further strengthen, and evaluate high-quality afterschool activities.

Even though the population of college-age Latinx students has increased in recent years, the percentage among Latinx individuals with a bachelor's degree (15%) remains low compared to White (41%), Black (22%) and Asian (63%) US populations (Chapa & De La Rosa, 2006; Cole & Espinoza, 2008; Krogstad, 2016). The numbers are particularly alarming in science, technology, engineering, and mathematics (STEM) where Latinx individuals earned 14% of science bachelor's degrees and just 6% of math-related bachelor's degrees (i.e., engineering and mathematics) (National Science Foundation [NSF], 2019). Scholars argue that these dismal statistics are partly due to K-12 institutional inequalities, such as academic tracking that may hinder Latinx students' access to high-quality STEM curriculum (Conchas, 2001; Flores, 2007; Gandara, 2006).

One way to help Latinx adolescents succeed in their K-12 STEM learning and to prepare them for STEM college or career pathways is through university-community partnerships where local universities and communities can work together to provide enriching STEM afterschool activities for Latinx adolescents attending under-resourced schools (Mahoney et al., 2010; Yu et al., 2020, 2021). University-community partnerships serve as a way to tap into the resources of local universities to support the needs of the community, in this case to offer STEM resources via an afterschool activity (Mahoney et al., 2010). STEM afterschool activities have the potential to spark adolescents' interest in STEM and strengthen their skills (e.g., Calabrese Barton & Tan, 2010; Lyon et al., 2012; Vandell et al., 2015).

Little research examines whether afterschool activities developed through university-community partnerships provide additional enriching experiences that are associated with adolescents' STEM outcomes as well as a broader array of outcomes that will help them for future STEM careers (Cole, 2006; Deutsch et al., 2017; Rhodes et al., 2006). Most of the existing research on STEM afterschool activities focuses on science and on outcomes that closely align to the activity content, such as changes in science motivation for youth at a science camp (Krishnamurthi et al., 2014; Rahm et al., 2005). Adolescents not only need to gain skills in STEM areas, but also need to have knowledge about different STEM pathways and learn how to work with people to thrive in STEM careers.

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University-community partnerships provide adolescents with opportunities to interact with undergraduate mentors and campus resources that can support these broader outcomes (Cole, 2006; Mahoney et al., 2010; Yu et al., 2021). For example, adolescents can gain knowledge about college and social-emotional skills as they interact with diverse undergraduates who can expose them to potential STEM pathways (e.g., Cole, 2006).

The goal of the current study is to explore how participation in a university-community math afterschool activity benefited Latinx adolescents and what practices can be leveraged to design high-quality afterschool activities based on adolescents' voices and perspectives. This study specifically focuses on a math afterschool activity as scholars argue math is a gateway subject to a variety of STEM domains and Latinx are underrepresented in math degrees (e.g., Gottfried, 2015; Maass et al., 2019; NSF; 2019; Watt et al., 2017). First, it is important to examine whether Latinx adolescents perceive that participation changes their math outcomes, future STEM pathways, and social-emotional skills. Secondly, in order to help design afterschool activities and continue to improve these contexts for underserved populations, it is important to understand what specific practices in an afterschool activity support these adolescent outcomes.

STEM organized afterschool activities and adolescent outcomes

Given that few studies focus on math organized afterschool activities, we draw on the broader STEM afterschool activities literature to provide an overview of how participation is associated with various adolescent outcomes. Our study focuses on three adolescent outcomes: math outcomes, future STEM pathways, and social-emotional skills. First, we focus on math outcomes as prior research suggests that afterschool activities promote skills related to the focus or content area of the activity, in this case we are focusing on a math outcomes in a math afterschool activity (e.g., Krishnamurthi et al., 2014). Secondly, we focus on future STEM pathways to examine whether afterschool activities have the potential to change adolescents' perspectives about their future career pathways. This is important because one reason why few Latinx students persist in the STEM pipeline is because they are not exposed to possible STEM careers (e.g., Gandara, 2006). Lastly, we focus on social-emotional skills as we believe that these are crucial to navigating and succeeding in STEM pathways and afterschool activities have the potential to promote these skills (Garner et al., 2018; National Research Council (NRC), 2015). For Latinx adolescents to thrive in a STEM-oriented 21st century it is important to strengthen their STEM skills, help them learn about future STEM pathways, and help them develop social-emotional skills to thrive in a STEM field.

First, STEM afterschool programs can help adolescents thrive in STEM by bolstering their STEM skills, such as strengthening the math skills of adolescents who participate in programs that provide math enriching activities (Krishnamurthi et al., 2013, 2014; Lyon et al., 2012). STEM afterschool activities that offer both science and math enrichment activities have been shown to increase adolescents' math achievement and motivation (Assouline et al., 2017; Duran et al., 2014; Morales et al., 2011) as well as promote a strong STEM identity (Calabrese Barton & Tan, 2010; Kang et al., 2019; Krishnamurthi et al., 2014). However, because afterschool programs typically focus on a wide range of STEM enrichment activities (e.g., technology, math, science), it is not clear the extent to which activities focus on math enrichment promote students' math outcomes (e.g., Assouline et al., 2017; Duran et al., 2014; Krishnamurthi et al., 2013). Moreover, studies often focus on general STEM outcomes (combining math and science outcomes) or science outcomes with less work focusing on math outcomes specifically (e.g., Chittum et al., 2017; Morales et al., 2011; Nation et al., 2019).

Secondly, in order for adolescents to pursue STEM, it is important to bolster their STEM college and career knowledge and interest, which is particularly important to increase the representation of Latinx individuals in STEM (Afterschool Alliance, 2011; Aschbacher et al., 2009; Dabney et al., 2012; Kitchen et al., 2018; Krishnamurthi et al., 2013; NRC, 2015). A longitudinal study focusing on robotics afterschool programs for middle- and high-schoolers found that participants were more likely to develop STEM college and career interests and more likely to enroll in STEM majors compared with non-participants (Burack et al., 2019). Retrospective studies have also shown that college students in STEM majors often credit afterschool activities for their interest to enroll in college and pursue a STEM career (Dabney et al., 2012; Maltese & Tai, 2011; Price et al., 2019; Wai et al., 2010). For under-represented minority (URM) adolescents, afterschool activities may provide them with opportunities to gain knowledge and explore

different career pathways as they interact with adults (NRC, 2015).

Lastly, afterschool activities also have the potential to promote social-emotional skills that prepare adolescents to succeed in school and the workforce (Durlak et al., 2010; Durlak & Weissberg, 2007; Hansen et al., 2003; Shernoff, 2010). Scholars have identified the importance of developing core competencies, such as relationship skills (e.g., working well with others) and social awareness (e.g., showing empathy for others), to succeed in life (CASEL, 2020; Durlak et al., 2010; Wallace & Palmer, 2018). Studies have found that adolescents who participate in afterschool programs strengthen their social and emotional skills while interacting with diverse individuals and can apply these skills to other contexts (e.g., school) (e.g., Fredricks et al., 2017; Hurd & Deutsch, 2017; Yu et al., 2021). In this study, adolescents in the university-community math afterschool activity engage in group-based work that fosters collaboration with diverse individuals and may promote adolescents' social-emotional skills.

Youth-staff relationships and program activities as mechanisms of change

Hirsch and colleagues' (2011) Program-Activities-Relationships-Culture (PARC) model suggests that within afterschool activities, adolescents have opportunities to form relationships with staff and engage in various program activities that promote a range of positive outcomes. In fact, studies have found that Latinx adolescents often attribute their participation in afterschool activities to their interest in the program activities and strong relationships with program staff (Akiva & Horner, 2016; Fredricks et al., 2010). This is consistent with the National Research Council's Committee's (NRCC) indicators of high-quality activities which include program activities and youth-staff relationships as core indicators of program quality (Eccles & Gootman, 2002).

Though the literature suggests that youth-staff relationships and program activities are important aspects of high-quality afterschool activities for positive youth development (e.g., Deutsch & Spencer, 2009; Hirsch et al., 2011; Rhodes et al., 2006), it is unclear how they matter and for which specific outcomes. Several studies, for instance, have demonstrated that general youth-staff relationship quality, that encompasses a wide range of features (e.g., building trust and providing support), is positively associated with academic and social outcomes (Deutsch et al., 2017; Deutsch & Jones, 2008; Deutsch & Spencer, 2009; Ettekal et al., 2016; Kataoka & Vandell, 2013; Price et al., 2019; Rhodes et al., 2006). Similarly, studies highlight that academic outcomes are supported by various program activities, such as learning environment (e.g., collaborative learning), curriculum (e.g., real-world activities), and activity structure (e.g., youth-focused) (Krishnamurthi et al., 2014; Lyon et al., 2012; NRC, 2015; Yu et al., 2020). However there is little research examining what specific features of youth-staff relationships and program activities are related to which outcomes. Complementary findings are needed that identify specifically what staff can do on a day-to-day basis to support adolescent development, such as making flashcards to help build adolescent study skills (Deutsch et al., 2017). Because youth-staff relationships and program activities have often been conceptualized more broadly in the literature, the field has limited concrete advise to best prepare staff, improve activities, or design activities to promote specific outcomes.

Another important aspect of the PARC model is culture; specifically, the model suggests that programs designed for low-income and URM adolescents need to be responsive to adolescents' cultural backgrounds and their needs in order to be effective (Hirsch et al., 2011). Simpkins and colleagues (2017) conceptual framework of culturally responsive practices in afterschool activities describes ways in which staff can engage in practices at the program level and when developing relationships with adolescents, such as having relationship-building activities where adolescents and staff can learn about each other and having positive attitudes about diverse individuals. Though this culturally responsive framework provides a general layout addressing the importance of staff practices that are responsive to adolescents' culture, it does not provide specific practices that staff engage in. Moreover, little empirical work exists on culturally responsive practices and the extent to which they promote positive development. Additionally, studies often focus on racial and ethnic culture (Ettekal et al., 2016; Gutiérrez et al., 2017; Lin et al., 2016; Simpkins et al., 2017) and only a few studies focus on other aspects of culture that are also salient to adolescents such as youth culture (e.g., hip hop trends) (Eglash et al., 2013). Therefore, this study will focus on a broader dynamic view of culture that considers other aspects of youth identities (e.g., interests) in addition to Latinx students' ethnic identities (e.g., traditions, values, language). With a more dynamic view of culture, we will focus on youth-staff relationships and

program activities and the mechanisms by which cultural features may lead to adolescent outcomes in order to understand *why* they matter and *how* we can leverage these features to design more effective and responsive STEM afterschool programs and practices.

Current study

Drawing on the PARC model (Hirsch et al., 2011), the aim of this exploratory qualitative study is to examine how Latinx adolescents benefit from participating in a university-community math enrichment activity and identify practices that can be implemented to design high-quality afterschool activities. We utilized qualitative data to provide a more in-depth understanding of what specific program elements and practices can be leveraged to help provide high-quality, effective afterschool activities. This study explores (a) adolescents' perceived changes in math outcomes, future STEM pathways, and social-emotional skills as a result from participation and (b) specific practices that promote the three outcomes. Qualitative interview methods allow adolescent participants to describe their perspectives and experiences in their own words that can help us better improve the quality of afterschool activities based on adolescents' voices.

Study context

The math afterschool activity, Math Community Educational Outreach (Math CEO), was created by Mathematics faculty at a Hispanic-serving university institution through a university-community partnership. The mission of the afterschool activity is to serve middle school students in nearby under-resourced schools in southern California. Students were recruited from local middle schools and were selected through an application process. Middle school math teachers played an important role in recruiting and selecting participants as they often referred students to Math CEO who they thought would benefit from participating in the afterschool activity. Therefore, a large proportion of participants who attended Math CEO were students who teachers thought would benefit from more math support.

The data in this study were collected during the 2018-2019 school year when Math CEO served approximately 120 students from two lower-performing schools. In School A[1], only 11% of the students met or exceeded state standards for math and in School B, only 15% of the students met or exceeded state standards for math. Demographic data revealed that the majority of the 120 students self-identified as Latinx (90%) of which 95% self-identified of Mexican-descent followed by multiracial (5%), Asian (2%), Black (1%), and White (1%). Moreover, 98% qualified for free or reduced lunch price, 71% lived in a household with an income below $35,000, and 87% were potential first-generation college students as none of the parents earned a college degree.

Approximately 80 college undergraduate students (69% female) served as staff working with middle schoolers and are referred to as mentors in the program. Mentors came from various majors: math (40%), science (33%), education (30%), engineering (15%), and other (20%). Additionally, 55% percent of mentors were Asian and/or Pacific Islander, 25% Latinx, 14% White and 14% mixed race/ethnicity or other; approximately 40% were first-generation college students. The undergraduate mentors attended 2-hour weekly training sessions, where they learned about the math content and activities for the week before they implemented them at the weekly math enrichment sessions. The undergraduate mentors were encouraged to form positive relationships with the adolescent mentees and to share their experiences as college students with their mentees.

Each week, middle school adolescents from these two schools took a bus to the university campus immediately after school and attended a 2-hour math enrichment session afterschool. During the weekly sessions, 2-3 mentors worked collaboratively with a group of 6-10 adolescents. Mentors played an important role in shaping how the math activities were introduced to students; in particular, they were tasked with engaging students in collaborative learning and making the content relevant to them.

The program curriculum included a wide range of real-world activities that promote collaborative work as adolescents were introduced to different math concepts to strengthen their math skills as well as workshops to provide students with information on STEM and college pathways. The math enrichment activities were designed to involve scaffolding to expose students to math concepts through abstract and real-world applications. For example, one activity focused on developing students' skills in using ratios, fractions, and percentages as they worked together to manage a hotel, where they had to calculate profit, sales, and expenses. Another activity focused on using real-world applications of the stock market to help students

[1]Names of schools were not identified to ensure confidentiality under IRB guidelines.

develop skills in algebra. As part of the program, students also took STEM-focused field trips where they visited university science labs and learned about different majors. Mentors also organized college workshops where they spoke about their own experiences attending college.

Method

Research design and participants

Interview data were drawn from a larger mixed-methods study examining high-quality culturally responsive practices in a math afterschool activity. For this study, 28 Latinx adolescents (Female: 50%; grade levels: 6th – 8th grades) were purposively selected to participate in qualitative in-depth interviews during the spring quarter based on (a) how long they have been in the program (at least two quarters), (b) changes in their perceptions of program quality, and (c) a range of student demographics so that they were representative of the larger program population. Our approach to selecting 28 participants was also based on reaching saturation – when no new data emerged from the interviews and themes were consistent across the interviews, continuing to interview was no longer needed (Saldaña, 2016). All of the participants selected for the interviews identified as Latinx, 25 (89%) self-identified as Mexican-descent, one as "American Indian and Mexican," one as "Guatemalan," and one as "Latino." The majority of the students who were interviewed (82%) had a household income of less than $35,000. For participating in the interviews, each participant received $10 honorariums.

Interview procedures

The semi-structured interview scripts contained multiple open-ended questions to elicit conversations around adolescents' experiences and perspectives of the math afterschool activity and lasted an average of 60 minutes (ranged 45 to 85 minutes long). Interviews were conducted in participants' preferred language. One interview was conducted in Spanish and translated by a bilingual research assistant; all other interviews were conducted in English. Interviews were audiotaped and transcribed verbatim by the interviewer in the language in which the interview was conducted. All transcribed interviews went through secondary checks, where a research assistant inspected the work of the first transcriber. The interview protocol contained sections on adolescents' general background information, adolescents' perspectives and experiences in the math afterschool activity, youth-staff relationships, cultural responsiveness, and their perspectives on what they have learned or gained (see Appendix A).

When coding the interviews, all of the interview sections were read and coded in their entirety. However, for the first research question, particular attention was placed on three questions from the section on what they have learned or gained: "How has Math CEO changed the way you a) think or feel about math, b) think about things or the way you act in school, c) think about your future?" For the second research question, particular attention was placed on three questions from the sections on adolescents' experiences in the math afterschool activity and youth-staff relationships: "What is the best part of Math CEO for you?," "What are your favorite activities and why?," and "Can you tell me something you think you have learned from your mentor?" Research assistants used both standard probes that were developed with the interview script (e.g., "Why" and "In what ways?," see Appendix A for the standard probes) and personalized probes tailored to elaborate on participants' specific experiences and to obtain detailed responses from participants.

Four main steps were taken to ensure trustworthiness, which is a standard of quality for qualitative research also referred to as validity, credibility, and rigor (Morrow, 2005). First, to ensure that the interview protocols were consistently followed, all research assistants attended a training session to help them become familiar with the interview script, practice interview skills, have questions answered, receive feedback, and learn how to effectively probe during the interview. All research assistants also observed an interview session before they conducted their first interview and received feedback on their first interview from the principal investigator to strengthen their interview skills. Second, meetings were held during data collection to provide the team with the opportunity to debrief and talk about any issues or concerns with the interviews. Third, analytical memos (i.e., a collection of the first author's notes, queries, interpretations, perspectives) were written and reviewed frequently during coding and analysis (Morrow, 2005; Saldaña, 2016). Lastly, in addition to discussion between the authors, the larger research team was consulted during coding and analysis.

Researchers' positionality and reflexivity

It is important for researchers to discuss their experiences, perspectives, and biases and how they may be

operating in the research process to control for potential biases influencing data analysis (Hill et al., 2005; Morrow, 2005). The lead author is a bilingual, second-generation Latina raised in California who has worked with adolescents in afterschool settings. She used her experiences and cultural knowledge to examine interviews and to interpret participants' responses to gain as many insights as possible from the interviews. The second author is an Asian and Pacific Islander male from Guam who has had several years of professional experience working with youth, and who has research interests related to STEM afterschool programs. The third coauthor is a White, female raised in Italy with expertise in pure mathematics and in the teaching of mathematics. Finally, the last coauthor is a White, female raised in California whose research expertise is on organized afterschool activities. The data collection team consisted of bilingual research assistants from different racial and ethnic backgrounds and at different education levels (e.g., graduate students and a postdoctoral researcher). Research assistants who spoke Spanish conducted the interviews when participants preferred to speak in Spanish. Additionally, the data collection team had general knowledge about the program but were not involved with program planning or mentoring. Taking an outsider perspective ensured confidentiality and that adolescent participants were comfortable in sharing their experiences in the program. The rest of the research team involved with coding and analysis consisted of the authors of this study.

Coding and analysis

The present study utilized a thematic analysis to qualitatively analyze, interpret, and report findings from the interview data. Coding of the interviews occurred in multiple iterative stages where both inductive and deductive approaches were utilized to identify patterns in the data (Saldaña, 2016). We used Microsoft excel spreadsheets to assist in data analysis (Meyer & Avery, 2009; Ose, 2016). The interviews were broken down into segments by each section of the interview protocol. Codes and categories were developed by considering each line, as well as the words or phrases of the segments in the interview transcripts. Coding and analyzing the interviews occurred in three stages described below.

In the first stage of coding, the first author addressed the first research question by reviewing each entire interview and focusing on specific questions that probed what adolescents had learned or gained from participating in Math CEO. Separate codes and categories were developed for each outcome (i.e., math outcomes, relationship skills, and future STEM pathways). A set of codes were developed using inductive and deductive approaches, where keywords and phrases from participants' own words were used to summarize topics (in-vivo codes) or keywords and phrases from prior literature were created to summarize topics (descriptive codes) (Saldaña, 2016). For each of the three outcomes, a preliminary coding framework was developed and refined by returning to the data, using prior literature, reviewing memos, and using codes that reoccurred in the data (Saldaña, 2016).

In the second stage of coding, the author addressed the second research question by reviewing adolescents' responses to the three interview questions on outcomes and their responses to other sections in the interview where they were asked about their experiences with mentors and the program activities, such as "What is the best part of Math CEO for you?," "What are your favorite activities and why?," "Can you tell me something you learned from your mentor?" Separate codes and categories were developed for the second research question and the preliminary coding framework was further refined after having discussions with the coauthors, reviewing memos, and returning to the data. This process yielded a stronger coding framework that captured the mechanisms by which youth-staff relationships and program activities shape adolescents' outcomes. All authors discussed and reached consensus on issues such as whether the categories captured content of all of the codes and whether codes fell under multiple categories.

The final step in analyzing the data was to create themes for each outcome (research question 1) and the specific practices related to the outcomes (research question 2). Themes were developed using the coded interviews, the coding framework, and existing literature. For example, the theme on gaining new math skills was developed from prior literature suggesting that STEM afterschool activities promote STEM skills and competences (e.g., Krishnamurthi et al., 2014). They were further refined through conversations among the coauthors. As a diverse team, we discussed our perspectives and checked our biases throughout the research process (Hill et al., 2005). Questions and concerns were discussed in group meetings. When there were disagreements, the themes were discussed until consensus was reached. The final themes discussed in this paper were common themes across the adolescent interviews (Ryan & Bernard, 2003). Table 1

Table 1. Outline of the coding framework.

Outcomes	Themes	Selected examples
Math Outcomes	Gaining new math skills and concepts	"The way I think about things, because before, I used to always need a piece of paper. Now, I can just do mental math. That actually helps me because every time I'm in the test and they forget to give me paper, I can just do it in my mind."
	Gaining new problem-solving skills	"Now I pay more attention to my math class because some things that we're learning here, we learned in math … If I already learned it here, I could teach them and go over them."
	Sustaining or gaining interest in math	"I like math and science … one of my favorite subjects and now I want to learn more and the different ways we can be using the math and science and how we could help the world."
Relationship Skills	Gaining social skills and confidence to interact with peers	"Yeah. I act a bit—I can be more confident with myself. I can talk a little bit more with more new people. That's getting better over time."
	Interacting with diverse individuals or groups	"I have learned how to interact with people more … and get to learn about new things and learn about new personalities and adapt to things, to different situations."
Future STEM pathways	Envisioning future careers	"Before I thought I would only finish high school and enlist in the army and that's it but now … I can do more things like engineering."
	Gaining knowledge & interest about college/careers	"Cause I didn't want to go to college but then [now] I – I have an idea."
Characteristics	Specific practices	Selected examples
Youth-staff relationships	Mentors engaging in informal conversations with adolescents *Undergraduate mentors have conversations about STEM pathways or about their sociocultural backgrounds.*	"And they talk about college sometimes … Well I [will] know what to do like if I asked them about this college … they tell me what courses they are so like if I want to apply here in the future something like that."
Youth-staff relationships and program activities	Engaging in collaborative learning *Collaborative learning involves moral support from mentors and incorporating teamwork in program activities.*	"Amy, she was also one of my mentors. And like, she [would say] 'Oh, you got this, you know how to do this,' and stuff and I guess that's the way they help me." "Sometimes they force us to work together. I'm like okay and I'll do it and I get my teamworking skills like more better."
Program activities	Incorporating advanced math concepts and real-world problems *The math afterschool program designs math activities based on real world problems that encourage students to use various problem-solving skills*	"When they use examples like real life, it makes me think that you don't have to do the way they teach you, that you can also use other examples that you think might help you understand it more clearly."
	Including campus tours in the program activities *Mentors organize and provide campus tours.*	"For example, when they said in the [campus] tour—like there's this [study] where you can sleep and then you earn money, that's something I never knew that they did here [at the university]."

outlines the themes with examples for both research questions. This is further addressed in the result section with selected excerpts.

Results

Research question 1 findings: Outcomes that adolescents reported in the program

This section addresses our first research question on whether Latinx adolescents perceived changes in their math outcomes, future STEM pathways, and social-emotional skills as a result of participating in the math afterschool activity. Responses from adolescents revealed that they perceived changes in their math outcomes (i.e., gaining math skills and math concepts, problem-solving skills, math interest), future STEM pathways (i.e., gaining knowledge about college/careers, gaining interest, and exploring future careers), and relationship skills (i.e., social skills and interacting with diverse individuals) in unique ways. Interview excerpts are used to illustrate each theme within the corresponding outcome (Table 1).

Math-related outcomes

Latinx adolescents felt that participating in Math CEO changed their math outcomes in three ways including

1) improving their math problem-solving skills, 2) strengthening their math skills and concept knowledge, and 3) helping to develop their math interest. First, Latinx adolescents described acquiring various skills to help them solve different math problems. As stated by the following students:

> Adam: Pretty much new ways of solving problems. They have cool tricks that they've explained to me on how to do certain things.
>
> Teresa: … seeing that there are more than like one solution.
>
> Salvador: The way I think about things, because before, I used to always need a piece of paper. Now, I can just do mental math. That actually helps me because every time I'm in the test and they forget to give me paper, I can just do it in my mind instead of actually writing it down.

Developing problem-solving skills is important given that in mathematics conceptual understanding and applied knowledge often build on each other; learning how to use different strategies to solve new problems will allow Latinx students to do well in math. As mentioned by Adam, the 'cool tricks' that he learned will eventually help him solve math problems that he may encounter in the future.

For the second theme under math outcomes, students mentioned gaining math skills and concept knowledge (e.g., concepts related to fractions) while attending Math CEO. Some adolescents spoke about the importance of learning similar or more challenging mathematics than what they normally were exposed to at school. Several adolescents gave specific examples:

> Ramon: It has changed me a lot at school because now that I'm here, I know more – the same - sometimes we use the same subject, so now I know more when I'm in math class. Now I know more math than I knew before.
>
> Adrian: I like how it challenges us a bit more than what we are usually used to. Meaning like to what our grade level is … the type of math is a little bit more advanced and well [it] helps us learn a bit more.
>
> Via: I also like the new math that I learned that's above my grade level.

The math skills and concepts that adolescents are learning at Math CEO reinforces or supplements the knowledge that they are gaining at schools. Several students mentioned learning new advanced math concepts at Math CEO which better prepared them for their math classes at school.

For the third theme under math outcomes, some adolescents mentioned that they began attending Math CEO because they had an initial interest in mathematics and that after attending Math CEO their interest in the subject was sustained because they learned that math could be fun. For students who had very limited initial interest in mathematics, attending the math afterschool activity sparked their interest in math. This is indicated in the following statements made by adolescents:

> Jasmine: This year … I wouldn't really like math, it would be the worst subject, in like, school. Then, coming to like the program, um, it helped me a lot, like, showed me that like math was actually fun.
>
> Santiago: I'm starting to come back to math again. Originally it was my favorite subject, but I didn't like it anymore, but now I'm starting to respect it.

Overall, adolescents described making changes in various math-related outcomes including their problem-solving skills, math skills, and math interests. These outcomes are consistent across adolescents' experiences in our study. In addition, adolescents alluded to the relevance of these outcomes across different settings, such as at school. The following are specific statements made by adolescents:

> Alex: Most of this math that I'm getting from Math CEO, I am applying it to my math classes and even my English classes. And it helps me a lot to know this knowledge now than if I would have learned it afterwards in school.
>
> Kassandra: I pay more attention in my math class and my grade is going up. And questions that they have asked here are sometimes asked in school and when other people don't know it, then I could answer it.

Being able to apply these math-related outcomes to other contexts is very important because it may lead to long-term effects. If students are able to transfer their math interests, knowledge, and skills to other settings, they will be able to continue to build on these outcomes. Overall, the themes support the goals of the afterschool activity in helping adolescents gain problem-solving skills, math skills and knowledge, and math interest to excel in the subject.

Future STEM pathways

In the interviews, Latinx adolescents were asked to reflect on how Math CEO has changed how they think about their future plans and aspirations. Adolescents revealed not only developing future plans, but how their plans had been changed as they gained more insights and knowledge about various STEM pathways. Latinx adolescents mentioned gaining more knowledge about various STEM and non-STEM

college and career pathways which helped them have a better idea of the possible range of choices for the future. At the same time, adolescents mentioned gaining interest in and being able to explore future college/career pathways that they may or may not have been familiar with before participating in Math CEO. For example, adolescents discussed gaining interest in attending college and described the type of information they learned about college.

> Via: I've been here like a year–almost two years now, and it's been something great and at the end since we get to learn more about how the college campuses is, especially here now, and I think that it's amazing.

> Vanessa: Um, you get to know little bit more about the school [university] so like maybe I could join later on in the years.

In terms of career pathways, adolescents mentioned that gaining more knowledge helped them envision what they could become in the future. In other words, they could explore new careers and had more options they could choose from. Although the majority of Latinx adolescents described math-related careers some mentioned other STEM careers, such as becoming a scientist. As described in the following statements:

> Amy: When I know math, maybe in my future, I could become a math teacher or when I'm somewhere in the future, I could know how to do math.

> Kassandra: … after I've been here I want to do more math-related careers or also engineering or a scientist.

The themes reveal that Latinx adolescents thought they gained insight into different STEM pathways. This is important as Latinx individuals remain underrepresented in colleges and in STEM careers (NSF, 2019). For many adolescents, who may come from lower-income backgrounds, attending Math CEO might be the first time they are introduced to a university campus where they can interact with college students and learn about different majors and careers. Although students specifically mentioned their interest in STEM majors and careers, adolescents may also interact with undergraduate mentors who come from non-STEM majors, providing them with the opportunity to learn about other majors in college.

Relationship skills

In order for Latinx adolescents to succeed academically, it is important that afterschool activities also strengthen adolescents' social-emotional skills (Hurd & Deutsch, 2017). In the Collaborative for Academic, Social and Emotional Learning (CASEL) (2020) framework there are five core competencies that adolescents can develop. Of these five, relationship skills were the main competency that was highlighted in adolescents' responses. Relationship skills involve gaining social skills, developing positive relationships, and interacting with diverse individuals or groups (CASEL, 2020). The first theme under relationship skills describes the ways in which adolescents gained social skills and confidence in interacting with their peers. This is indicated in the following statements:

> Karen: How I talk here and anywhere else, I get to express myself more in school how I do here, because in school I really don't talk a lot. They [are] teaching me new things and making me be not that scared as how I used to be in cases.

> Interviewer: Scared about Math? Or talking in general? What did you mean?

> Karen: Talking

> Via: Yeah because now that I socialize a bit more here. I know how to socialize a bit more at school too.

For the second theme under relationship skills, adolescents perceived that their relationships skills were strengthened as they learned more about diverse groups. When asked what they have learned or gained from working with mentors, they highlight having the opportunity to interact with diverse mentors when learning about their mentors' culture as well as when sharing their own culture with their mentors. As described in the following statements:

> Evelyn: It just helps me know more things about other people's cultures and that I don't know.

> Juanita: Pretty interesting because sometimes if they're the same [cultural background] we could relate but if they're different, I learn things about the culture … like the things they celebrate, that they don't celebrate.

Students responses revealed that Latinx students felt that their relationship skills were strengthened in a context where they felt comfortable interacting with diverse individuals. Moreover, they highlighted how these interactions do not occur in settings they are normally in, such as in their schools or neighborhoods. Math CEO provided a space for Latinx adolescents to interact and form relationships with individuals form diverse sociocultural backgrounds. For example, Juanita mentioned the ability to create co-ethnic and cross-ethnic relationships with her mentors and learned to value their similarities and differences.

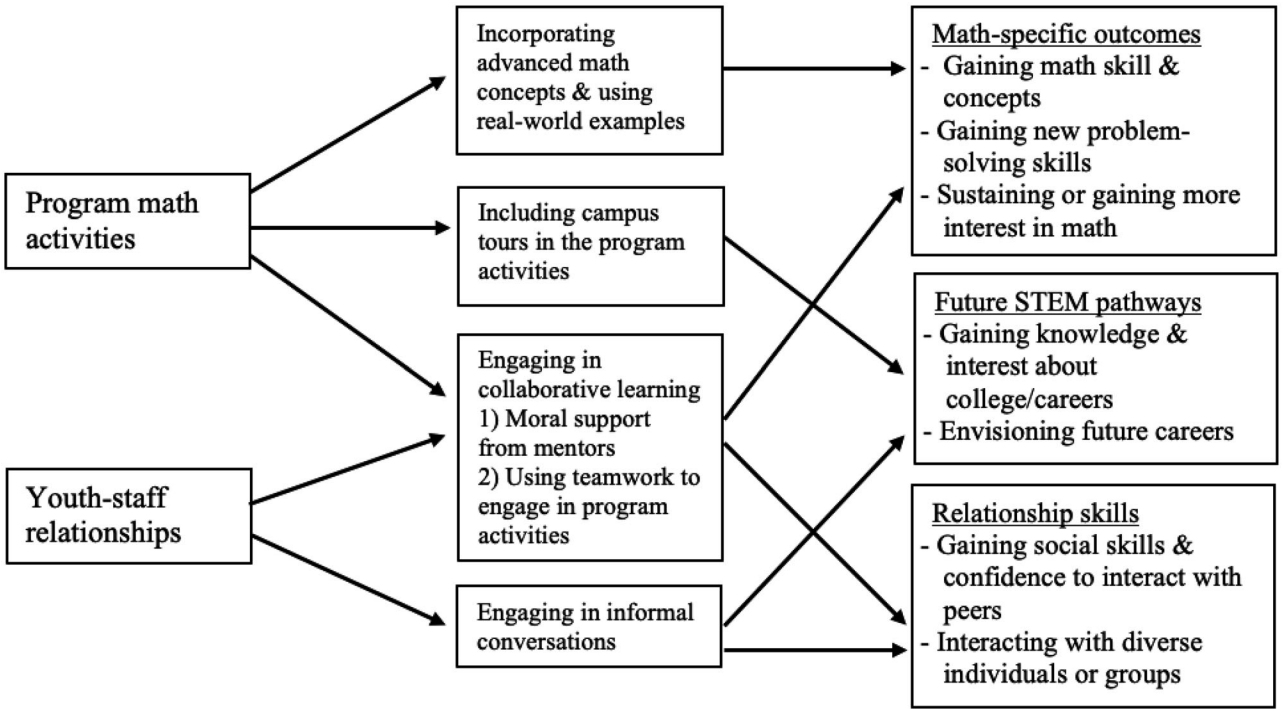

Figure 1. Presentation of findings in a conceptual model.

Research question 2 findings: Specific practices by which Youth-Staff relationships and program activities shaped adolescent outcomes in the program

To address our second research question, we examined Latinx adolescents' interview responses to understand the specific practices by which youth-staff relationships and program activities Latinx adolescents believed supported their development. The goal was to better understand the practices mentors engage in and the specific program activities that may lead to specific outcomes. In this section, specific practices are organized by the outcomes mentioned in the prior section. Latinx adolescents revealed specific practices that they perceived made changes in their outcomes (see Figure 1)

Math-related outcomes: Incorporating advanced math concepts and real-world examples

When describing the math activities, adolescents consistently mentioned that activities were fun and engaging because they dealt with real-world problems and situations (e.g., learning about the stock market, identifying mathematical tessellation patterns using nature). As stated by the following student:

> Izzy: When they use examples like real life, it makes me think that you don't have to do the way they teach you, that you can also use other examples that you think might help you understand it more clearly.

Although the mentors played a role in the learning process by leading and facilitating these program activities (e.g., providing real-life examples during activities), the activities themselves served a specific role in promoting adolescent outcomes.

In addition to its real-world applications, adolescents described the significance of the program activities incorporating advanced math concepts. Adolescents mentioned that they gained new math skills when they struggled to solve a problem or complete an activity.

> Jennifer: When we do the little puzzles and try to solve the answers and in general, everything. It just helps you in math and you get to learn new ways to solve equations. I'm more advanced in math now. I got my math test higher and I'm better at math. I like them [puzzles] because they're kind of hard, but in the end, it all ties up to one big thing and you understand what it is.

> Kassandra: Some of my favorite activities [are] … when the problems are difficult so we could challenge ourselves and in order to learn and not like easy with the stuff you already know and you don't learn anything.

> Alex: Mostly my favorite activity in Math CEO has been Contigo … to me it's like bingo with more of a math twist … you actually have to think about what you are doing, before you do it, because you need to think about all the possibilities that could happen afterwards in your next roll.

At Math CEO, adolescents were introduced to advanced concepts in math through real-world and

engaging activities. Additionally, incorporating advanced concepts allowed students to develop math skills as they tried to solve problems they had not encountered at school. In the interviews, adolescents described how these activities helped them improve because they had to use different problem-solving skills and incorporate different math skills and concepts.

Engaging in collaborative learning

Collaborative learning scholars argue that learning is a social, relational process where learning occurs between a group of learners working together (Johnson & Johnson, 2009; Laal & Ghodsi, 2012; Yu et al., 2020). Some elements of collaborative learning highlighted in the adolescent responses were (a) promotive youth-staff interactions (e.g., encouragement), and (b) using teamwork to engage in program activities. The elements of collaborative learning share similar dimensions as those emphasized with social-emotional learning, such that they both highlight the importance of teamwork in learning and gaining math and relationship skills. In this section, we focus on the math skills Latinx adolescents perceived to gain through collaborative learning.

As described above, one element of collaborative learning is engaging in promotive interactions. This was highlighted in the responses when Latinx adolescents mentioned that their undergraduate mentors used moral support (e.g., encouragement) to build their confidence in math which allowed them to feel more comfortable with learning new math skills. Two adolescents stated:

> Leslie: They, like, if I don't understand a problem, they help me, and they're like 'you got this.' Like Amy, she was also one of my mentors. And like, she [would say], 'Oh, you got this, you know how to do this,' and stuff and I guess that's the way they help me.

> Kassandra: I think something I've learned is to not give up when problems might be difficult because when he [mentor] sees that we're not getting really into the problem because we don't understand it and when we want to quit, he goes over and he tells us to try our best. To not worry if we get the wrong answer … it could benefit you and you need to try your best in order to do the best you can.

When students have the opportunity to work together or engage in collaborative activities, adolescents are not just learning from the activities, but also from the undergraduate mentors and peers who are also engaged in the activities. More specifically, adolescents perceived gaining new math skills and confidence when their undergraduate mentors provided them with encouragement to move forward or try their best. This is different from schoolwork because at Math CEO, both the mentors and adolescents were working together and at school teachers may not necessarily work with the students and instead just show them what to do.

Future STEM pathways: Engaging in informal conversations with mentors and participating in campus tours

Youth-staff relationships, specifically engaging in informal conversations with mentors, played a role in adolescents' future aspirations. Latinx adolescents and undergraduate mentors engaged in conversations on a variety of topics related to college (e.g., applying, student life, courses). Adolescents described being able to talk to their mentors about college, given that they were undergraduate students, and learning more about what being a college student looked like based on their mentors' experiences. Students also mentioned learning more about colleges by attending campus tours organized by Math CEO where they had the opportunity to observe things on campus and ask their undergraduate mentors questions about college. As described by several adolescents:

> Juanita: And they talk about college sometimes … I ask them questions. They tell me like how expensive it is and all the things they need to pay and all that. I'm like "oof. I need to save money." Well I know what to do like if I asked them about this college especially, they will tell me oh this and they tell me what courses they are so like if I want to apply here in the future something like that.

> Belen: Every once in a while, he will go up to the front and he'll say, "College tip of the day," then he'll give us a tip … some of the people here have experiences because, well, they're in college. If we ask, they'll tell us.

> Eduardo: Yeah they kind of talk about how being in college is different and how you could find [studies] that pay you. For example, when they said in the tour, if you sleep and then do some kind of—like there's this [study] where you can sleep and then you earn money, that's something I never knew that they did here [at the university].

The quotes describe in detail how the conversations between youth and undergraduate mentors might look like in regard to proving adolescents with information about college. Mentors at Math CEO are undergraduates who have first-hand experience with navigating higher education and can impart some of the knowledge they have acquired to the adolescents. This is important as many Latinx adolescents come from

under-resourced schools and underprivileged communities where knowledge about college and STEM careers might not be readily accessible (Conchas, 2001; Gandara, 2006).

Relationship skills: Engaging in informal conversations

During informal conversations, youth and undergraduate mentors shared various things about their sociocultural backgrounds, allowing the Latinx adolescents to learn more about diverse individuals. At Math CEO, adolescents were more likely to engage with mentors that come from a different racial or ethnic background than theirs, therefore it is important to understand how undergraduate mentors were connecting with adolescents in more nuanced ways. Latinx adolescents said they learned how to interact with others that may not look like them or that may have different interests by learning about their undergraduate mentors' sociocultural backgrounds. Additionally, for the informal conversations to be beneficial for Latinx adolescents, undergraduate mentors had to be open and responsive to adolescents' sociocultural backgrounds as well. Simpkins and colleagues (2017) emphasize the importance of being responsive to adolescents' cultural backgrounds in order for them to have positive and meaningful experiences in afterschool activities. In this case, undergraduate mentors were responsive to Latinx adolescents' sociocultural backgrounds by engaging in conversations where adolescents and undergraduate mentors learned more about each other where adolescents perceived to learn how to communicate and interact with diverse individuals. As described in the following statements:

> Olivero: I think he's learned, of course since we're younger than he is, we've taught him other things like things that kids do different. You don't say 'that's hip' or 'that's on fleek' like we taught him new things and stuff. One time he dabbed and we're all like, 'No. Don't do that. It's cringey.'

> Adam: The one that stood out to me was probably … we were talking about … I think it was about how other people grow up because it gave me new sights on how actually other people grow up. Like some people grow up poor, they grow up rich, and how that affects the way they talk to people or the way that they actually act towards other people. He actually told me about how he used to live and then that made me understand him more.

The mentors were responsive to adolescents' sociocultural backgrounds as they embraced learning new things from their students as well as sharing their own sociocultural backgrounds. Particularly for Olivero, it was important that their mentors connected with them by embracing youth culture and learning what topics and interests were relevant to adolescents. Through these informal conversations, adolescents learned how to respect and connect with diverse individuals. Just like another adolescent mentioned, "I learned how to respect people more." Adam's mentor also engaged in culturally responsive interactions by sharing his life experiences and strengthening his social awareness of people's varying socioeconomic status and how that may play a role in communicating with individuals that come from similar or different socioeconomic backgrounds.

Engaging in collaborative learning

As presented in the section on math outcomes, through collaborative learning Latinx adolescents have the ability to learn how to work well with other. Another element of collaborative learning is using teamwork to engage in program activities, thus placing an emphasis on developing teamwork and relationship skills. During group-based activities, Latinx adolescents believed they gained relationships skills. As described in the statement:

> Olivero: Getting to do problems with teams, and the partners, and the mentors. When we had the puzzle activities … everyone gets involved and you help one another … they help you get better … When you have to figure out other ways to do stuff. If there's one really easy way and one really hard way to do it, but then the mentor shows us, "this is a shorter and easier way." Learning shortcuts to math and stuff.

The quotation describes the importance collaborating on an activity as a way to learn how to work well with others and how to interact with undergraduate mentors and peers. Engaging in teamwork and collaborative learning also allows adolescents to have the opportunity to learn from others in the group. This is important in order for Latinx adolescents to succeed and navigate contexts where relationship skills are needed to interact with diverse individuals.

Discussion

Drawing from the PARC model (Hirsch et al., 2011), this study examined Latinx adolescents' perceptions on how youth-staff relationships and program activities in a university-community math afterschool activity supported their development. First, we explored whether Latinx adolescents' perceived changes in their math-specific outcomes, future STEM pathways, and social-emotional skills. Second, we

documented the specific mentor practices and program activities adolescents thought supported those outcomes. Figure 1 showcases the specific practices and mechanisms that may lead to the outcomes described by Latinx adolescents. . While contributing to the growing literature on STEM afterschool activities, our findings have direct applied implications concerning what specific practices matter and how they may be implemented to design and further strengthen high-quality culturally responsive afterschool activities.

Perceived activity impacts on adolescents' math development and beyond

This study revealed the extent to which adolescents' felt participating in a math enrichment activity promoted a wide range of outcomes. Prior research, suggests that STEM afterschool activities, typically focused on science or a wide range of STEM enrichment activities, promote adolescents' performance, achievement, and motivation in those domains and in math as well (Assouline et al., 2017; Morales et al., 2011). These findings extend the literature by examining a math afterschool enrichment activity and by looking at a broad range of outcomes. Starting with outcomes aligned with the math activity curriculum, adolescents felt the activity helped them with their math problem-solving skills, math skills and concept knowledge, and math interest. It is possible that changes in these fundamental math skills and motivational beliefs provide the foundation for program gains in adolescents' math performance and achievement demonstrated in prior research (e.g., Krishnamurthi et al., 2013; Morales et al., 2011). Indeed, adolescents commented that they felt the skills they learned at the activity helped them in a variety of contexts, including school. Therefore, afterschool activities have the potential to strengthening adolescents' math skills and motivation as well as to further support adolescents' learning in schools.

The findings also suggest that adolescents are not only strengthening their math skills, but are gaining new perspectives into future STEM pathways and social-emotional skills. Generally, studies on STEM afterschool activities typically focus on outcomes related to the activity content, in this case STEM outcomes, and less on broader outcomes that will help adolescents succeed in STEM careers (e.g., Afterschool Alliance, 2011; Krishnamurthi et al., 2014; NRC, 2015). As revealed by the findings, participating in this math afterschool activity helped adolescents gain knowledge and interest about college and STEM careers. Such knowledge and motivation is vital for potential first-generation college students like the majority of students in this activity to be able to envision a wide range of future possibilities. For many of these students this activity can provide information and resources that may not be readily available at their under-resourced schools or among their family members who may have more limited STEM and college experience (e.g., Gandara, 2006). In this regard, afterschool activities like this one serve as a structural resource that could counter some of the structural barriers students face at school.

Another important aspect in supporting Latinx adolescents' STEM pursuits is learning how to navigate and succeed in STEM pathways. Although scholars agree that it is important to promote social-emotional skills to better prepare adolescents to succeed at school and in the workforce (e.g., CASEL, 2020, Durlak et al., 2010; Hansen et al., 2003; Shernoff, 2010), few studies focus on social-emotional skills within the context of a STEM afterschool activity (Fredricks et al., 2017; Garner et al., 2018). Aligned with CASEL's (2005) social and emotional framework on the key core competencies that adults can help adolescents cultivate, our study found evidence for strengthening adolescents' relationship skills. As mentioned by adolescents, participating in the afterschool activity helped them gain confidence in interacting with their peers and adults across a variety of contexts. Another important element of developing relationship skills, is learning how to interact with diverse individuals and showing cultural competency (e.g., CASEL, 2020; Yu et al., 2021). Our findings reveal how adolescents gained these skills when interacting with their mentors and learning about each other's interests and racial/ethnic backgrounds. These social-emotional skills can help adolescents successfully navigate various STEM opportunities (Fredricks et al., 2017; Garner et al., 2018).

Best practices to support adolescent development

Our second goal for this study was to identify the specific best practices that promote adolescent development. Aligned with the PARC model (Hirsch et al., 2011) and the framework of culturally responsive practices in afterschool activities (Simpkins et al., 2017), youth-staff relationships and program activities serve as two core aspects of high-quality afterschool activities. The current findings extend prior work by identifying the specific practices and program

activities that helped promote adolescents' outcomes. Such information is critical to help support staff on the ground working with youth. First, we identified specific practices through which Latinx adolescents felt undergraduate mentors influenced them, which to our knowledge has not been addressed by prior literature. Much of the prior literature on youth-staff relationships, for example, demonstrates that the quality of youth-staff relationships are associated with youth's academic outcomes and social development (e.g., Kataoka & Vandell, 2013); however, these studies provide less insight into what specific practices or interactions help foster those outcomes. One simple but critical best practice was youth engaging in informal conversations with their undergraduate mentors who had many insights about college and careers in STEM and non-STEM fields. Within afterschool activities, it is important to allocate time for these informal conversations to occur between the youth and undergraduate mentors who have the potential to inspire future college students. A second critical best practice for mentors is being responsive to adolescents' sociocultural backgrounds to effectively cultivate positive youth-staff relationships and help adolescent gain relationship skills (e.g., Eglash et al., 2013; Yu et al., 2021). By highlighting these practices, we found that undergraduate mentors were not only responsive to adolescents' racial or ethnic backgrounds, but also to other sociocultural aspects (e.g., youth culture) that adolescents bring with them. Prior literature focusing on undergraduate mentor and mentee relationships, reveal similar findings in that they emphasize the importance of fostering these relationships where adolescents interact with diverse individuals through culturally responsive practices (Yu et al., 2020, 2021).

Contributing to the literature on program quality (e.g., Hirsch et al., 2011), our findings reveal that specific practices in terms of program activities help promote math outcomes, future STEM pathways, and social-emotional skills. Literature suggests that program activities matter because they promote academic outcomes (Lyon et al., 2012; NRC, 2015; Yu et al., 2020), however it is less clear what aspects of program activities matter and for which outcomes. Research suggests that group-based learning or collaborative learning helps support adolescents skills and development (e.g., Duran et al., 2014; Yu et al., 2020). Our study found that collaborative learning provides adolescents with many opportunities to develop relationship skills and strengthen their math skills. Particularly, while working in a group setting, youth reported learning how to work well with diverse individuals as they tried to solve a problem. As a result, it is important to think about the learning environment when designing afterschool activities and understanding what adolescents might gain from group-based learning compared to other forms of learning. Another aspect of program activities that we found to promote adolescents' math skills and future STEM pathways was curriculum. Studies suggest that designing curriculum to meet students' academic needs further supports their learning (e.g., Morales et al., 2011). We found that in addition to designing math content that used real-world examples, adolescents benefited from being exposed to possible STEM careers by learning about them through campus tours or having conversations about them with their mentors. These findings reveal the importance of designing programs that are intentional in providing adolescents with more resources and opportunities that will not only support their math outcomes, but also other outcomes that will help them succeed in STEM.

Our findings also have applied implications concerning how to design, further strengthen, and evaluate high-quality afterschool activities that may be leveraged by afterschool advocates. Our study provides concrete examples and evidence-based recommendations of how specific practices can be implemented. First, our findings highlight the importance of youth-staff relationships and how mentors can establish connections with their mentees by leveraging different cultural aspects, such as learning more about their interests (e.g., youth culture), sharing their traditions (e.g., race/ethnic culture), or working together through group-based learning. Adolescents stated that even though their racial/ethnic cultural backgrounds were different from their mentors, they were interested in learning more about their mentors' racial/ethnic backgrounds and enjoyed discussing similarities based on other interests. This provides insights for how mentors and adolescents can bridge differences by connecting based on their shared interests or by learning about each other's sociocultural backgrounds. Another way to promote positive youth-staff relationships is by allocating time for informal conversations or designing learning environments, such as collaborative learning, that will provide mentors and mentees with opportunities to learn from one another. These interactions also provide a space for adolescents to learn more about possible careers while establishing a strong foundation for the youth-staff relationship. Second, our findings highlight the importance of program activities and describes how collaborative

learning, incorporating advance math concepts and real-world applications, and organizing campus tours can benefit students. Our findings reveal the importance of making activities meaningful and connecting them to real-world examples to help students make connections and strengthen their skills. In order to continue improving the quality of afterschool activities, it is important to understand the specific practices that shape adolescents' experiences.

Limitations and future directions

Although the present study contributes to the literature on STEM afterschool activities and the importance of program characteristics on adolescent outcomes, limitations remain. First, underreporting of certain topics or events can occur with open-ended questions as participants are more likely to report things that are more salient to them. For example, in our interviews we asked adolescents how Math CEO changed the way they think about math. Adolescents likely mentioned the most salient ways rather than reporting a more exhaustive list. Future studies could utilize a broader research questions that include all of themes mentioned in this study and also question that focus on other STEM domains, given that math serves as a gateway into other STEM pathways (Watt et al., 2017).

We focused on common themes across adolescents. An important next step is to understand how person-environment fit matters for these processes. In other words, we need to ask which activity experiences are most impactful for which students so that we can leverage different program characteristics to maximize adolescent learning.

This study also focused on Latinx adolescents' experiences in a math afterschool program. Because Latinx individuals remain under-represented in STEM domains (NSF, 2019), it is important to understand how afterschool activities can serve as a structural resource to support Latinx adolescents' STEM pursuits (Mahoney et al., 2010; Yu et al., 2020, 2021). However, it is important to note that there are other student populations who are under-represented in STEM fields (NSF, 2019). Therefore, future studies might include students from other racial and ethnic backgrounds attending other STEM afterschool activities. It is important that future work continues to examine how these processes shape URM adolescents' experiences and outcomes in STEM afterschool activities and how we can build upon these practices or adapt them to create high-quality afterschool settings.

Conclusion

The findings from this study provide scholars and educators with a better understanding on how program characteristics can shape Latinx adolescents' experiences in afterschool activities. In order to create high-quality afterschool settings, it is important to understand *why* specific practices matter and *how* staff are engaging in responsive, effective best practices. While the findings are situated within a math afterschool activity, our findings revealed that adolescents felt that they are gaining math outcomes as well as broader outcomes (e.g., relationship skills). This is of great importance as educators and scholars focus on designing programs that could benefit student in various ways and not just in helping them build STEM skills. Moreover, these skills may serve as critical elements for succeeding in STEM careers.

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Data availability statement

The data that support the findings of this study are available from the corresponding author, SS, upon reasonable request.

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Appendix A

I'd like to start by asking you to tell me a little bit about yourself.

1. How would you describe yourself as a student?
2. What are your favorite subjects in school and why?
3. How do you feel about math and science?
4. Do you think math and science are important? Why or why not?

General questions about math CEO

1. What made you want to join Math CEO?
2. What has been the best part of MATH CEO for you?
3. What do you like about the program? Favorite activities?

Not all the kids at Math CEO like everything about Math CEO and that's ok.

1. What about you? Are there things about Math CEO that you do not like?
2. Which parts of Math CEO are just OK or aren't very exciting or interesting to you?
3. How is Math CEO similar from the classes that you take in school? How are they different?

Youth-staff relationships

1. Who is/are your mentor(s) at Math CEO?
2. Describe your mentor(s) to me.
3. What is the best part about your relationship with your mentor(s)?
4. Tell me about some of the ways you are alike. How do you feel about the similarities between you?
5. Tell me about some of the ways you are different. How do you feel about the differences between you?
6. [If it hasn't already come up, ask about mentor gender] – How do you feel about your mentor being the same/different gender as you?
7. Does your mentor do things so that you know he or she respects you?
8. Tell me something you think you have learned from your mentor(s).
9. Tell me about something you think mentor(s) learned from you.
10. We know that no one is perfect. Imagine you had super powers and could change something about your mentor or your relationship with your mentor to make them the best mentor ever. What would you change? Why?

Cultural responsiveness

1. *In the survey that you completed for us in beginning of the school year you noted that your race and/or ethnicity is (_____).* Does that sound like you?
2. *The next few questions ask you about the idea of Culture as it relates to your race and ethnicity.* Have you heard of the word "culture" before?
3. [Regardless of their answer, provide handout of the definition of Culture and read it aloud]: People use the word Culture to basically describe the ways people of

different racial or ethnic groups do things based on things like their beliefs, languages, family values, customs and activities.
4. Does this definition make sense to you?

[Pause to make youth reflect on the definition; provide examples or help as needed]

1. Based on this definition, how would you describe your culture? (for example, your Mexican or Family culture?). [Provide key examples/questions if students struggle answering]:
2. *Let's start by thinking about how your family does things.*
3. What language do you speak at home?
4. What types of activities or customs do you do with your family?
5. What personal or educational values are important to you and your family?

[Interviewer notes about how youth describe their culture]

1. Can you describe a place, any place, where you feel like you fit-in culturally versus places you feel like you don't fit-in? (so for example where do you feel like your Mexican and/or Family culture is valued and/or respected?)
2. What makes you feel that way?
3. How do you feel at Math CEO? Do you feel like you fit-in culturally at Math CEO?
4. [Before moving on to the sub-questions below, remind youth about what they said about their culture]
5. How is your culture represented or reflected, if at all, at Math CEO?
6. What about in terms of the people (so both your peers and mentors) in Math CEO and how you interact with them?

1. *Sometimes students have said they like to have a mentor who is the from the same ethnic and cultural background and sometimes students have said that wasn't a big deal to them or prefer to work with someone who is different.*

1. How do you feel about your mentor(s) being from a (*similar/different*) culture as you?
2. How is it helpful to have a mentor that is from a (*similar/different*) cultural and ethnic background as you?
3. How do you feel about the other students at Math CEO being from a similar cultural or ethnic background as you?
4. In what ways are the things done at Math CEO similar from your Mexican and/or family culture? How are they different?

1. What about in terms of the activities or what you learn in Math CEO?

a. ., ., ., In what ways, if at all, does Math CEO support your culture?

1. Is it important to you that Math CEO support your culture? Why?

a. In , , , what ways can Math CEO can change or improve to better support your culture?

Outcomes and skills

1. Has being in Math CEO changed the way you think about things or the way you act in school?

a. In , , , what ways?
b. What things has it changed?

2. Has being in Math CEO changed the way you think or feel about math and science?a. ., ., ., In , , , what ways?b. , , , What things has it changed?3. How *has* Math CEO changed how you think about your future?

Closing

1. Is there anything else you would like to tell me about your life or your experience at Math CEO that we haven't covered?
2. Thank you so much for taking the time to do this interview. If I need to have some things clarified later, can I contact you again?