Developing A Growth Mindset

in an Out of School Program

BOYS & GIRLS CLUBS
Algonquin Barrington Carpentersville
Dundee Lake in the Hills Palatine

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We want to extend our gratitude to our passionate and dedicated staff, advisors, and curriculum team for making this project possible.

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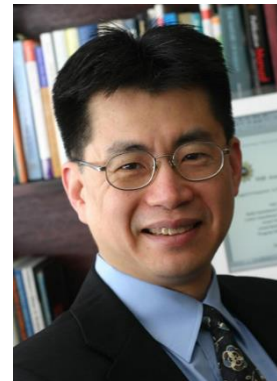*AmeriCorps*

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A Letter from BGCDT's CEO

As I begin my fifth year as the CEO of the Boys & Girls Clubs of Dundee Township, serving 2,000 youth in the Northwest Suburbs of Chicago, the challenges facing our youth are greater than ever. Prior to the pandemic, their lack of awareness, interest and preparation for well-paying local jobs in STEM fields presented significant barriers to their future success, and frustration on the part of local employers. I was fortunate enough to participate in the creation of STEMconnector's 2018 State of STEM white paper, which identified the barriers that exist for our youth, to try to understand the lack of effective progress to solve the STEM employment crisis across our nation.

Informed by this work and our commitment to remove these barriers, in 2019 our organization worked on creating a comprehensive strategy and focus for the secondary level, including expanding our engagement with our school district partners around academic tutoring and support, the design and construction of our new Impact Center, a state-of-the-art after school learning lab, developing custom curriculum around life skills and workforce competencies, launching our Impact Crew summer jobs program to create workforce experience opportunities, developing partnerships with local employers for tours, speakers, and internships, and creating a soft pre-apprenticeship credential with Elgin Community College around technical workforce opportunities. Six weeks after the program launched, the pandemic struck our nation. Three weeks later, all our programs pivoted to full-day Distance Learning Centers to provide our kids access to their classrooms. For two years we worked collaboratively with our school district partners to maintain a safe environment for them to remain connected to their teachers and allow their parents to be able to support their families.

In the Spring of 2022, as we were able to begin to re-engage with our more typical after school enrichment programs, it became clear that the social emotional needs of our members needed immediate attention. The alienation, isolation and learning challenges they experienced during the pandemic are profound. In response, we developed an entirely new department and program around Social Emotional Learning (SEL). We used the CASEL framework to assess and develop more effective support around SEL. In our surveys of our members and our staff, what stood out most was the need to rebuild self-confidence, determination, and resilience in our kids. As an out-of-school time service provider, we knew this was our opportunity and call to action. We engaged a curriculum writer to focus on Growth Mindset, using hands-on STEM projects to engage our kids and provide needed challenge and structure. We engaged our Director of STEM, site staff and a research assistant to implement a pilot program for our 3rd through 5th grade members. Our work was guided by Robert H. Tai, Ed.D., Associate Professor of Education at the University of Virginia, a renowned national expert on the efficacy of STEM education programs, particularly in out-of-school environments. The initial results were so compelling, we wanted to share them, as well as to help define our next steps in continuing our work. We are excited about the potential it has to not only help our kids recover from the pandemic's effects, but on the broader efforts to solve the Demographic and Belief Gaps, and help improve participation rates in STEM fields by under-represented populations. Together, we can make a difference for our kids who need us the most.

Drew Glassford
Chief Executive Officer
Boys & Girls Clubs of Dundee Township

About This Report

The success of the Boys & Girls Club of Dundee Township relies upon the collaborative efforts of our community partners, including our elected officials, community colleges, school districts, park districts, businesses, social service and counseling agencies, service clubs and volunteers to help deliver on our mission to help our children become caring, productive and responsible citizens.

Every member of our community ecosystem offers their elements of support and contribution toward achieving this goal, based on their expertise and sphere of influence. The purpose of this report is to present compelling findings relating to two key aspects of program impact BGCDT provides. The first is helping our kids to develop a growth mindset. The second is hands-on, project-based learning STEM programming to develop and maintain interest in future STEM careers, in either the technical or professional workforce.

To produce this report, BGCDT:
- Engaged our Director of Social Emotional Learning, STEM Director and hired a Research Associate to plan and deliver the program.
- Hired a curriculum developer to create a Growth Mindset Curriculum.
- Engaged Robert Tai at the University of Virginia School of Education and Human Development to assist with the curriculum development and surveys required to measure program efficacy, and to review and advise on the program results.
- Engaged our program staff to deliver the curriculum, and to compile and assess the survey data.
- Reviewed literature across SEL and STEM and related fields, including education and youth development, pandemic impact on minority and under-resourced youth, STEM workforce development, economic mobility, equity, and other disciplines.
- Reviewed state report card data provided by the Illinois Department of Education.

Executive Summary

STEMconnector is a professional services firm committed to increasing the number of STEM (Science Technology Engineering Math)-ready workers in the global talent pool by engaging stakeholders across the corporate, postsecondary, nonprofit, government and K-12 sectors to enable optimal outcomes for historically under-represented and underserved individuals.

In its 2018 report titled "The State of STEM," STEMconnector identified five major gaps that are creating the under-represented populations in STEM fields:

1. **Fundamental Skills Gap**: industry and education have identified skills that young people need to succeed as lifelong workers and active citizens, but not enough young people are developing that foundation.

2. **Belief Gap**: young people, and adults around them, hold incorrect beliefs about the aptitude or traits young people must have to belong and thrive in STEM fields.

3. **Postsecondary Education Gap**: the new knowledge economy requires credentials beyond a high school diploma, but not enough young people are earning those credentials.

4. **Geographic Gap**: hubs of economic growth, particularly for businesses requiring STEM skills, are often far from large concentrations of qualified job seekers or far from population centers.

5. **Demographic Gap**: there is disproportionate participation in STEM jobs based on race, gender, and income, despite decades of focus on diversity and inclusion. The economically changed minority youth BGCDT primarily serve to constitute the population included within the Demographic Gap.

BGCDT wanted to understand the challenges and provide solutions regarding the Belief Gap for the members we serve. The purpose of the white paper is to analyze the curriculum, survey results and narrative responses of members to determine if the project-based STEM program was successful in either developing or maintaining a growth mindset while a student experiences significant challenges, setbacks or failure, and what conclusions could be reached or projections made in relation to providing a growth mindset STEM program to mitigate or overcome the Belief Gap.

Introduction

Background: In the Fall of 2022, the US Department of Education announced its "You Belong in STEM" initiative targeted at under-represented students, to improve access to opportunities and increase their participation in post-secondary STEM education and careers. A 2018 "State of STEM" white paper issued by STEMconnector identified the "Belief Gap" as a significant contributor to the lack of participation and engagement of this population in STEM fields.

The Belief Gap: Beyond beliefs about skill, many young people feel they do not "belong" in STEM because of their race, ethnicity, gender, or other personal characteristics. Parents, teachers, employers, and others reinforce this belief due to their own conscious or unconscious biases, creating a culture that neither welcomes nor values the contributions of those who are traditionally under-represented in STEM. In addition, the lack of role models, including teachers and employers, who share the same background contributes to a student or employee's general sense that people "like them" do not belong in STEM.

Pandemic Academic Learning Loss: Under-resourced youth have experienced a significant deficit in academic performance compared to resourced peers. The latest Illinois State Board of Education data shows that 40% of Title 1 students are significantly behind in meeting state standards, many by two to three grade levels. Their struggle to be successful has created much anxiety, uncertainty and stress, negatively impacting their self image and confidence.

SEL and Growth Mindset Program: In the Fall of 2022, the Boys & Girls Clubs of Dundee Township initiated a comprehensive SEL strategy based on the CASEL Framework to help improve program site culture, staff and member wellness, sense of belonging, self-confidence and perseverance. BGCDT also piloted a STEM Growth Mindset program, which involved a formalized curriculum using project-based learning to develop and cultivate a growth mindset in members in grades 3 through 5. Working with Robert Tai at the University of Virginia School of Education and Human Development, the Growth Mindset program consisted of one-hour sessions two times a week that focused on building problem-solving, teamwork, collaboration, caretaking and self-reliance in a STEM-oriented formalized curriculum. Participants were surveyed periodically to determine their level of engagement and evolving perspectives about themselves as it relates to dealing with and/or overcoming challenges and failure.

The purpose of this report is to analyze the curriculum, survey results and narrative responses of members to determine if the project-based STEM program was successful in either developing or maintaining a growth mindset while a student experiences significant challenges, setbacks or failure, and what conclusions could be reached or projections made in relation to providing a growth mindset STEM program to mitigate or overcome the Belief Gap.

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I.   The STEM Demographic Gap

It goes without saying that STEM fields have traditionally attracted and retained students and professionals from distinct demographic groups while deterring those from other groups. In the world of STEM careers, only about one-third of employees are people of color (POC).[9] Women, too, remain underrepresented, except in healthcare-related STEM fields.[5]

BGCDT currently serves 1,156 youth in our after-school programs. 736 of these youth are Hispanic (64%), and 212 are Black (18%). 483 (42%) of our members are female. 926 members (80%), receive free or reduced lunch, and 45% come from single-parent households. According to the statistics, our members' futures do not trend towards careers in STEM fields.

The demographic gap correlates closely to the achievement gap.[11] Race and income can effectively predict academic achievement from fourth grade through post-secondary education.[17] The reasons vary–students may not have access to resources such as technology, and by family circumstances, may not have routine schedules for studying due to an unpredictability in guardians' work hours.[6] Families may also not be able to afford enrichment activities or post-secondary education pathways.

Students in underrepresented demographics have fallen behind their peers in STEM-related academic achievement. Nationally an income-based achievement gap has been growing so that currently, upon graduation the wealthiest students academically place four years ahead of their poorest peers.[10] In the state of Illinois, if we compare District 300, where most of our members attend school, and District 36, one of the wealthiest districts in the state that is 87.9% white, the gap in academic performance is significant. In the mathematics section of the Illinois Assessment of Readiness (IAR) in 2022, 17.4% of District 300 students fully did not meet state requirements, while only 2.4% of District 36 students did not. In the English and Language Arts section, 22.9% of District 300 students did not meet performance level, while 2.8% of District 36 students did not.[7]

Despite national, state, and local efforts to balance opportunity regardless of background, this demographic gap will likely continue to grow. Research shows that by 2045, people of color will be the majority of the population of the United States. Already most public schools have majority students of color (SOC), and there are growing numbers of English as a second language (ESL) students.[8]

II.   The STEM Belief Gap

A staggering number of youth gravitate away from STEM solely because they feel they do not "belong" in STEM. Sense of belonging is often tied to personal characteristics such as ethnicity, gender, socioeconomic class, or race.[3, 12] Youth do not know of or see professionals in these fields who look like them or who come from similar backgrounds. The Belief Gap first emerges with youth as young as elementary school, and many of our members are challenged with this mindset.

Youth are influenced by role models such as close relatives, teachers, and even peers, all of whom can reinforce the belief gap consciously or unconsciously. For example, when a mentor is not confident in their own STEM ability, they may unthinkingly reflect this in their teaching, commenting on the supposed difficulty

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of STEM studies and reaffirming that they are "only for certain types of people." Mentors may not encourage their mentee to pursue STEM if they're performing only averagely in school, or due to stereotypes, which can often be tied to biases that cause one to automatically align or disassociate oneself or others with STEM. Moreover, youth may lack role models. When youth aren't exposed to people in STEM fields who share the same background, the sense that people "like them" aren't part of STEM is reinforced.[17] At BGCDT, 64% of our members are Hispanic, but nationally only 7% of STEM industry employees are Hispanic, so there are not enough role models for them to know and want to emulate.[9]

Because of these factors, youth develop incorrect beliefs about their abilities in STEM fields. Many develop a fixed mindset around STEM, believing that STEM is "too hard," or as one of our members declared, "I'm not built for STEM." Youth often experience imposter syndrome, losing all confidence that they belong in or could be successful in a STEM field. Further, there are widespread beliefs that STEM jobs are available only in certain industries and focused around specific skills, as opposed to the wide variety of fields that actually incorporate STEM.[17]

III.   Decline in STEM Interest

STEM fields of study are facing an epidemic of declining interest that starts at a young age. The University of Virginia School of Education and Human Development collected data for two years measuring youth attitudes toward learning science in the fall and spring of each school year.
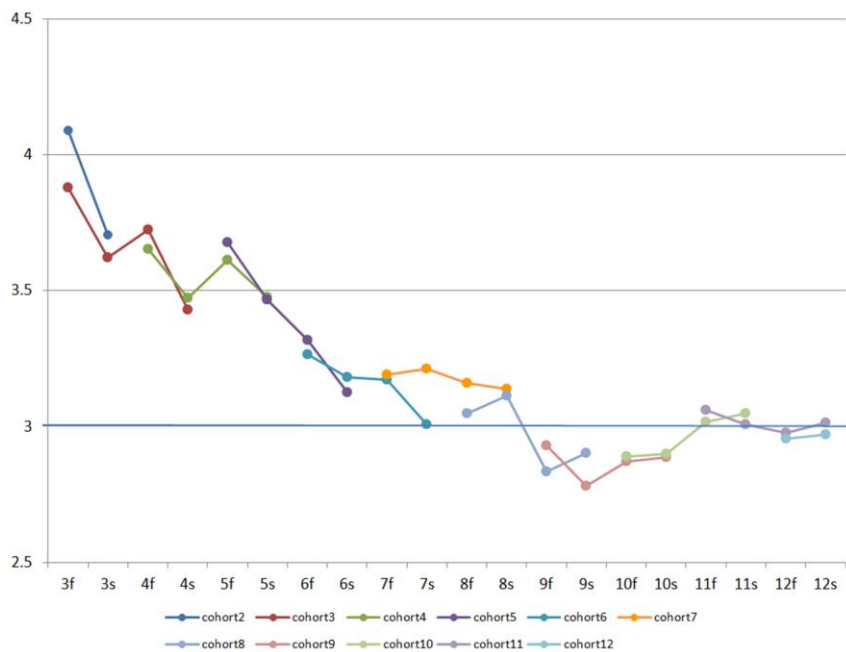
This graph is based on data collected through Project Spark to Flame (2011 – 2014), Principal Investigator Robert H. Tai, Ed.D. Associate Professor University of Virginia. Used with the permission of Dr. Tai.

Youth in grades 3-12 show a clear downward trend in positive attitudes toward STEM as they proceed through each grade level. In the fall of third grade, most students' attitudes positively align with enjoying learning science. By spring, however, these numbers have already dropped. This drop continues in each grade, and by seventh grade, attitudes toward learning science are neutral−youth are ambivalent, unable to confirm whether or not they like to learn science. By ninth grade, student responses reflect that they do not enjoy learning

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science, whether at the beginning or end of the school year, and this negative attitude continues through twelfth grade. It can be seen that girls' interest in particular is waning.

Reasons for this decline have not been explicitly established, but a highly likely contributing factor is the prevalent school learning environment. One element may be teachers who discourage students from following STEM, or there may simply be lowered achievement expectations in the classroom. Additionally, the way a teacher teaches science also seems to largely influence student interest. Of teaching approaches, problem-based learning, centered around investigation and inquiry, has been proven to improve student attitude toward learning science, as has hands-on learning, versus rote memorization methods. Beyond school, career expectations may seem too intense for youth to feel it possible for them to pursue. However, research shows that when students spend time engaging with STEM outside of school, their interest in STEM grows. BGCDT has taken note of this, intentionally incorporating STEM projects and concepts into activities we provide for our members.[1]

IV.   Pandemic Impact on Learning and Mindset

The Covid-19 pandemic highlighted the role BGCDT plays in providing a safe, encouraging, and productive environment for youth. Only three weeks after schools initially shut down in March 2020, in collaboration with our school district partners, BGCDT opened and maintained in-person distance learning centers to mitigate several impacts of the pandemic, including access to learning and food scarcity. Here, we will review the impact from economic disruption and deteriorating social and emotional health on academic mindset.

Those who were already under-resourced continued to fall behind their peers in academic performance for a variety of reasons. Families were often supported by guardians who needed to continue working in-person jobs, more frequently exposing them to Covid-19.[14] Without school, families also suddenly needed to provide full-day childcare. Guardians either had to take time off or pay for a caretaker, neither of which could be afforded. Additionally, under-resourced students are often served by under-resourced schools, so the pandemic resulted in a shortage of teachers, specialists, and technology that more-resourced peers continued to access. Moreover, students learning English as a second language were disadvantaged as they were no longer exposed to English for the duration of the school day.

Economic impact on academic performance has been shown by numerous credible studies. Nationally, the gap in test scores between high-poverty and low-poverty students has grown by 20% since the start of the pandemic.[4] The latest Illinois State Board of Education data show that 40% of Title 1 students—or those from low-income families—are significantly behind in meeting state standards, many by two to three grade levels. Further, from 2019 to 2021, the number of students in District 300 who did not meet IAR mathematics requirements grew by a full 9.3%, while excellent performance dropped by 1.9%.[7]

Adolescents were severely emotionally impacted by the global pandemic as well, further affecting academic performance. Poor mental health had already been a growing epidemic in the nation: since 2007 previously stable rates of major depression have risen by 60%, and suicide rates have also drastically increased—among Black adolescents, the numbers of suicides have risen by 80%.[16]

The pandemic has only exacerbated this issue. Isolation and a struggle to be academically successful have created much anxiety, uncertainty, and stress, negatively impacting self-image and confidence. Many have faced emotional trauma, especially people of color. About 52% of Hispanics have had a close friend or family member who was hospitalized or died from Covid-19, while 20% of children who lost a parent to Covid-19 were Black (despite only making up 14% of children in the nation).[13, 2]

Unfortunately access to effective mental health treatment is not improving at the rate that mental health problems are growing. Therapy is expensive and frequently unavailable due to the lack of capacity. Medication is cheaper and simpler, so it is being employed more widely. However, it is often misused by professionals: many of the medications used for minors are only FDA approved for adults, or approved for solo-therapy, as opposed to in combination with others.[16]

V.   The Afterschool Learning Environment

BGCDT currently operates nine primary Club sites at elementary schools, three at middle schools, and one secondary site at a high school as four-hour after school programs. All members receive one hour of homework assistance during "Power Hour," and are then provided two hours of structured programs focusing on six pillars: Academics, Creative Arts, Character & Leadership, Healthy Lifestyles, Life Skills, and STEM. These programs are typically delivered in spaces that are conducive to learning, including individual classrooms, LRCs and gymnasiums as are appropriate, with members grouped by adjacent grade levels: 1st and 2nd, and 3rd through 5th. Club sites are run by a full-time site director and part time Youth Development Professionals at a maximum ratio of one leader to 15 members. Program Impact Specialists are skilled and trained in providing STEM program content, athletic programs, creative arts programs, academic support, and Social Emotional Learning strategies and positive behavior supports.

VI.   BGCDT's Use of Hands-On STEM to Develop and Maintain a Growth Mindset

In Fall of 2021, BGCDT worked with Robert Tai and a curriculum developer to pilot a STEM growth mindset program, which engaged a formalized curriculum and project-based learning to cultivate a growth mindset in members in grades 3 through 5. The growth mindset program consisted of 45-minute sessions two times a week that focused on developing collaboration, empathy, emotional regulation, innovative problem-solving, adaptability, and self-reliance in a STEM-oriented formalized curriculum.

BGCDT defines growth mindset as the understanding that intelligence and skills are not stagnant—that abilities can be advanced through learning from mistakes and overcoming challenges. We identified the following goals for our members:
- To recognize a lack of self-belief and/or frustration
- To develop an expanding capacity to find motivation and a strategy to overcome a challenge from oneself
- To have faith in one's own abilities and not be discouraged by disappointing grades, mistakes, or outside conflicts, all which may cause a belief that one does not belong in STEM
- To discover how one's interests and talents can positively impact one's life and the world
- To gain a greater appreciation for
  - One's own creative capacity
  - One's potential to innovate and grow

- ○ Failure, risk, and adversity, as they can catalyze growth
- ○ The benefits of collaboration with others

The curriculum was centralized around four core skills competencies: mindfulness, empathy, agency, and adaptability.

First, **mindfulness** is emphasized because to overcome challenges, one must recognize and acknowledge possible accompanying emotions, including fear, frustration, envy, helplessness, and apathy, understand they are harmful, and learn to lessen and eventually prevent such reactions. It incorporates activities such as grounding, stretches, self-check-ins, and positivity, self-compassion, and self-regulation practices.

Second, we involve **empathy** to develop the capacity for our members to better feel and appreciate another person's background, needs, challenges, and successes, helping them learn to empathize with themselves as well, and respect each of these traits for themselves. Empathy-building encompasses discerning one's own emotions and needs, being able to share one's emotions, figuratively putting oneself in another's place, appreciating differences, finding value in helping others (caretaking), expressing gratitude, and engaging in teamwork.

Third, **agency** drives the development of a growth mindset, stimulating improvement and self-confidence by challenging the way one thinks about facing challenges and the limit of their abilities. To have agency, one should be able to create goals, identify challenges and one's attitudes toward challenges, self-advocate, ask for help, have the ability to make something new, and author one's own path.

Fourth, **adaptability** is imperative to growth because one must be able to tailor their way of problem-solving and be prepared to approach challenges from many perspectives. Adaptability involves innovative thinking, determination, an emphasis on the importance of practice and revision, and reflecting on challenges and changes in one's mindset along the way.

These four competencies directly correlate with self-awareness, self-management, and resilience. Self-awareness includes understanding and valuing one's own strengths, but also being able to identify external needs and support systems. Self-management means having control over one's own learning process, such as emotional regulation, because one understands that thoughts and actions can dictate short- and long-term outcomes. Finally, resilience involves building one's belief in their own ability to succeed by being able to persist through complex problems.

We delivered our program twice a week for eight weeks. The first session of each week was social and emotional learning (SEL)-focused, and the second was STEM-focused. Every week had a different theme emphasized: personal growth, positivity, treasures (personal strengths), kindness, goals, obstacles, vulnerability, and reflection. The SEL sessions incorporated mindfulness and meditation while implementing hands-on activities that created a better understanding of each week's focus. For example, during Session 1, exploring growth, members tried throwing bean bags at a target with and without distortion goggles before learning about neuroplasticity. The STEM sessions concentrated on innovative thinking, agency, determination, collaboration, and maintaining interest to overcome the belief gap. While sessions included mindfulness, the main activity began with a reader's theater about a fairy-tale character in trouble. After reading, members spent the remainder of the session building a project to help the character overcome their challenge (for example, Rapunzel is stuck in her tower because she cut her hair short, so members built a ladder, or stairs, or elevator for her).

At its introduction and throughout the eight weeks, our instructors explored how to best ensure that members would both enjoy the program and absorb the content.

The following six core practices were used by instructors to frame the member's experience during each session:
- Vulnerability
  - Admit when you don't know something
  - Encourage asking for help *after* participant tries multiple times
- Positivity
  - Use positive language *only*
  - Reframe mistakes as opportunities
- Collaboration
  - Encourage participants to ask each other for help before asking mentor
  - Encourage participants to actively look to help each other
- Justification and reflection
  - Give work that encourages mistakes, and then have participants explain their process with reasoning and evidence
  - Recognize that even if participant doesn't overcome challenge, they're working hard[15]
- Normalization of challenges and mistakes
  - Do not use the word "failure" (it implies finality), instead use "obstacle" or "challenge"
  - Verbalize that participants have not failed, every mistake is an opportunity
- Identification and value of personal strengths
  - When participants do something well, affirm or reward

Instructors strived to improve engagement and learning through:
- Positive discipline
  - When instructing participants, commend or reward those following directions
  - Encourages others to follow instructions in a positive environment without needing to be authoritative
- Positive reinforcement
  - Identify good efforts and encourage participant to continue these practices
  - Fosters less frustration, offers incentive to behave and keep trying
- Being consistent
  - Encourage patience, interact with optimistic attitude, no emotional outbursts or frustration with participants
  - Creates healthy environment with trust and reliability
- Observation
  - Walk around classroom with hands behind back–don't do work *for* participants
  - Encourages participants to continue working themselves while being able to provide constructive feedback

- Creating personal authority
  - Have participant perform jobs (hand out paper, door-holder)
  - Creates sense of being needed, improves self-confidence

VII.   Project Results

To assess the impact of BGCDT's project-based STEM program on developing and maintaining a growth mindset, we developed a survey for members to complete at the start, middle, and end of the program; instructors completed personal experience reflections every session; and instructors interviewed members periodically.

Survey Description and Analysis
BGCDT worked with Robert Tai to develop a survey measuring eight skills that fall under the four core competencies:
- The ability to create goals and envision success
- Identification of unhelpful attitudes and a transformation to a positive attitude
- Identification of one's own strengths and needs
- Persistence through struggles
- Understanding and appreciating the successes and failures of others
- Taking responsibility for one's actions
- Finding purpose in one's work
- The ability to guide one's own educational journey

Members participating in the growth mindset program (treatment group) took this survey at weeks 0, 4, and 8. A group of members who did not participate in the program (control group) also took this survey at week 8.

Overall, the average response to every question in the treatment group positively aligned with a growth mindset, and the majority of members maintained neutral and positive answers, or gave more positive answers over the 8 weeks. All members had a previous understanding of what a growth mindset is from school, which accounts for initial survey results positively aligning with a growth mindset.

When comparing pre- and post-program survey results of the treatment group, two significant results were found.
- Findings around two survey questions assessing mindfulness and agency indicate that youth participating in the growth mindset program had higher mean ratings after program participation than before program participation. The significance levels were $p = 0.055$ for one question regarding positivity and determination, and $p = 0.068$ for the other regarding personal authority.
- After a comparison of the treatment group (n = 17) and the control group (n = 19), findings produced a significant result at the $p = 0.057$ level for a question regarding perseverance, determination, and adaptability.

Overall, the inferential statistical analysis shows three significant results,
1. Youth participating in the program were more likely to "feel motivated to overcome my challenge" than "feel angry and quit" with respect to the question "When I get frustrated I might…" after program participation than before program participation.
2. Youth participating in the program were more likely to agree than disagree with respect to the question "When I am trying to learn new things I know how to learn them well…" after program participation than before program participation.
3. Youth participating in the program were more likely to agree than disagree with respect to the question "If I practice things that I struggle with, I am able to get better at them" than youth who did not participate in the program.

After members completed the last survey, instructors reviewed the results, and if members gave an answer that didn't match with what the instructors had observed, they asked the member the same survey question, but in a way that related more personally to the member. For example, in the survey one member stated that

when they try something over and over but cannot do it, the first thing they do is quit. Instructors framed the question around BMX (the member's hobby), asking what the member does when they are unable to "make a jump." Instructors found that with every member to whom they asked an individualized version of the question, all responses aligned with a growth mindset. A possible explanation is that members misunderstood the survey questions. It is also likely children sometimes change the way they act but not the way they respond to questions because the emotional impact of what they've learned hasn't yet affected their response. They *apply* the skills more than *thinking* about the skills because there is less visceral impact. The results of this survey are promising, but more work is necessary to further establish the significance of the program participation impact on youth growth mindset.

Maintaining Student Interest in STEM

One of the compelling potential impacts of the Growth Mindset program is to mitigate the loss of STEM interest Robert Tai's research has indicated occurs in 3rd through 5th grade students. Based on survey results, BGCDT members participating in the program maintained a consistent or improved interest in STEM. This "flattening of the curve" offers promise in combining growth mindset and project-based STEM program curriculums to maintain or improve interest in late primary education, secondary education, and after school programs. More research with Robert Tai's team in this area is planned.

Mentor Observations

Over the course of eight weeks, BGCDT instructors observed four major improvements in members: a shift from competition to collaboration, a shift from needing outside motivation to self-motivation, a shift from not verbalizing challenges to being able to verbalize challenges, and increased self-confidence.

Collaboration: At week 1, members preferred to work individually or with already established friends. If they finished their own work, they'd find something else to occupy themselves. Throughout the program, members expanded, working with peers in other grades and social groups. When they finished their own work, they went to their peers and helped them finish their work. At one site, when building a corn maze out of legos, members decided to come together as a team to create parts of a maze and combine them into one large maze with a ticket booth and rest area. They assigned roles and responsibilities while allowing each member to bring unique design ideas. In week 6, a member said that the most significant thing they'd learned was "friendship and teamwork."

Self-motivation: In week 1, when members worked on a STEM project and weren't able to succeed after the first try, most of them threw their project away immediately. By week 8, members worked until the very last minutes of the session to complete their projects without persuasion from their instructors. They were even encouraging their peers to succeed.

Self-confidence: Initially, one of the most-used phrases was "I can't do this," whether "this" was completing a STEM project or identifying personal strengths. In week 3, every member happily described "treasures" about themselves, and turned these treasures into an art project. One described personal strengths as "what makes me *me*." By week 8, members were answering each other's questions before instructors could answer–they were confident in their knowledge and abilities to complete all projects. One member struggled with body dysmorphia, and was able to speak about it with her peers. The group collectively made a safe space for everyone to open up and encouraged one another to become more confident through collaboration and support. In week 3, this member volunteered to take the stage and participate in a reader's theater using silly voices and humor to make everyone laugh. By week 5, she'd entered the elections for BGCDT junior leadership at her school and won.

Verbalization of challenges: Many members greatly improved their ability to communicate when they struggled. In early weeks, most got frustrated and/or quit when things didn't go as planned. By the middle of the program, members were able to comprehend the issue, and after trying numerous times if it still didn't work, they were able to ask for help (from their peers, then mentors). For instance, in early weeks if one

member in particular made mistakes, he would quit and sulk. In week 3, he didn't want to participate in the STEM project because "it never works," but he did so anyway, but at the end of the session he was upset. Instead of being silent, though, he told an instructor that he was upset because he hadn't been able to test his project to see if it was successful. This same member's survey results regarding how much one likes challenges went from neutral, to positive, to extremely positive and, he told instructors that his favorite activities were the STEM projects "because they're challenging."

Member Interviews
Throughout the program, instructors carried out informal interviews with members participating in the growth mindset program to gain a greater understanding of their personal progress and enjoyment of the program. Overall feedback showed that all members greatly enjoyed the program, and predominantly the aspects involving teamwork, challenges, innovation, and being silly. They told instructors that they learned:
- To not give up, but to keep trying
- How to use small things to create something larger
- How to reflect on and use problems and mistakes and change one's approach next time, overcoming their challenge
- How to come up with new and creative ideas
- How to achieve goals

Members also reflected on much growth surrounding self-awareness and confidence, perseverance, and collaboration.

Regarding self-awareness and confidence, members
- Reflected that they showed more emotional self-control
  - When facing a challenge, members were able to recognize and acknowledge initial emotions such as
    - Pressure
    - Embarrassment
    - Fear
    - Worry
    - Stress
    - Anxiety
    - Frustration
    - Surprise
- Were proud of themselves for
  - "Being smart"
  - "Trying hard"
  - "Being more outgoing than I used to be"
  - "Helping others"
  - "I keep trying when something is difficult"
  - "Achieving my goals and doing better in school"
  - "My personality"
  - "Being playful"

Regarding perseverance, members
- Said that when facing a challenge, although sometimes initially having a negative reaction, they would
  - "Try to overcome the challenge, because it is not as scary when I do it… Instead I feel good"
  - "Create a different solution"
  - "Figure out what is going on"
  - "Feel motivated to beat the challenge"

- ○ "Talk with my teacher"
- ○ "Encourage myself"
- Said that they would rather learn a new skill than become an expert at one they could already do
  - ○ Because "it's challenging which is fun and more interesting"
  - ○ Because "I get to have more skills"
  - ○ Because "I get new experiences and I can learn something new that I like"
- Said that when they used their skills of trying again and in different ways in their math class
  - ○ "My grades got better"
  - ○ "I don't give up when I do school work now"
- Said that they like creating and trying to meet goals because
  - ○ "I can focus more on myself"
  - ○ "Achieving goals means moving forward"
  - ○ "It gives me a challenge, which is fun"
  - ○ "It teaches me to keep trying"
  - ○ "It is fun and when I succeed I can do something new"
  - ○ "It can help you get better and go further in life"
  - ○ "People cheer me on and I don't give up"
  - ○ "When I get to the goal I'm happy, joyful, and proud"

Regarding collaboration, members explained that working with their peers could be beneficial because
- "We both have idea, so we can share them"
- "I get an extra helping hand"
- "We can help each other"

VIII.   Conclusion

Initially, BGCDT's growth mindset program was developed to address our member's belief gap and help mitigate the effects of pandemic learning loss by improving self-confidence. Not only did the outcomes reflect significant improvements in these areas, but we believe our members developed critical skills that will benefit them as they face future challenges in academic, professional, and social and emotional areas of life.

Many of our members face the challenges identified as components of the belief gap due to their demographics, including the lack of role models with similar backgrounds and a reinforcement of their perceived limits by their mentors, caregivers, and peers, leading them to develop fixed mindsets. Initially, we saw that if our members made one mistake when confronted by a challenge, their reaction was to believe they could not succeed and to quit. However, by the end of the program after intentionally giving members the opportunity to work on teams with peers and mentors they could relate to (females, people of color), they were enthusiastic and determined to complete their projects. Mentors emphasized positivity and helped members learn to reframe mistakes as a necessary aspect of learning, building self-trust, and breaking the cycle of their belief gap. One member stated, "You guys give me so much positivity that I feel like I can do anything in the world."

As their growth mindset perspectives improved, we saw a positive shift from the negative trends identified in research done by Robert Tai, which demonstrated that youth interest in STEM begins to drop in 3rd grade, and by 9th grade, most youth "don't enjoy learning STEM." Not only did we see their STEM interest maintained, but their self-confidence also grew–they were engaged in their STEM activities and committed to overcoming their challenges. As a result, we believe our members who participated in the program feel they are able to be more successful in STEM than their peers who did not. Additionally, by incorporating varied elements of STEM

and encouraging members to be creative and innovative when faced with unique challenges, they demonstrated more thoughtful and intentional actions.

In relation to the pandemic, we believe our program helped our members progress from the effects of the major learning losses suffered because of their economic and mental health challenges. Given that many of our youth reside in under-resourced communities, they suffered a greater impact from the pandemic. Their families struggled with balancing jobs and childcare and were often unable to afford enrichment opportunities. Our program addressed these challenges by providing STEM enrichment activities without an economic burden. In addition, the associated isolation and academic struggles they experienced resulted in anxiety and a lack of self-confidence for many. Several faced the added trauma of losing a loved one. To help handle these impacts, our mentors equipped our members with self-ascribed mental health tools, such as meditation and taking breaks. As a result, members were able to be vulnerable, learning to verbalize their challenges, ask for help, and support each other. They identified and further developed their personal strengths as well as adding others, notably, problem solving and determination.

BGCDT's mission is to develop our youth into caring, responsible, and productive community members, and we believe our growth mindset program has furthered our member's ability to achieve this goal. Members' self-confidence improved to the point where they stated that they believe they're able to accomplish whatever they set their minds to. They developed greater proficiency in establishing goals and helping and teaching each other, and they were proud of their work. Regarding managing social and emotional challenges, our members learned emotional regulation and coping mechanisms, reflection strategies, vulnerability, and perseverance. Members developed a greater sense of agency, demonstrating an improved motivation to overcome challenges. They became excited by challenges, found they preferred to learn something new rather than something old, and discovered they know how they themselves can best learn. Finally, members demonstrated a stronger ability to collaborate through caretaking, took leadership roles and assigned each other tasks, and developed an understanding that by working with each other, they can generate more ideas and make better use of resources. The skills our members gained can be applied not only in academics, but also when faced with other life challenges such as those of mental health, personal relationships, careers, and other pandemic impacts.

Based on our encouraging results, we are thrilled to continue to advance our growth mindset program. We are revising our primary program strategy, and plan to implement it in several new sites this Spring. We are also developing a middle school growth mindset program that incorporates hands-on STEAM projects involving engineering, cooking, and biology, as well as SEL practices. Our goal is to integrate our growth mindset program in the curricula of every BGCDT primary and secondary site. We plan on continuing to work closely with Robert Tai and his research team to further assess and revise the curriculum as a precursor to a greater expansion through our role as a pilot organization with the Boys & Girls Clubs of America national SEL team.

IX.   End Notes

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