

Partnering to Develop STEM- & Career-Ready Youth

Report on 2023 LETS GO Boys & Girls Data Collection

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Chris Zieminski, Grace Davis, and Dr. Dawn McDaniel

Background

Between 2022 and 2032, STEM employment opportunities are expected to grow by nearly 11% (U.S. Bureau of Labor Statistics, 2023). Science, Technology, Engineering, and Mathematics (STEM) careers are a key gateway to economic prosperity (Change the Equation, 2017). STEM professionals tend to have higher earning potential and lower rates of unemployment than non-STEM professionals (National Science Board, 2021). As such, pursuing STEM careers offer a way for individuals and families to increase their potential for upward mobility and create greater generational wealth (Espinosa et al., 2019).

STEM education is important for cultivating STEM interest and proficiency, both of which are critical to progressing through the STEM pipeline (Beier & Rittmayer, 2009; Business-Higher Education Forum, 2011). However, gaps in access to STEM learning opportunities are evident and have long-term consequences on youth pursuit of STEM careers and future opportunities (Hill et al., 2010). Youth in low-income communities are disproportionately impacted by these access gaps with fewer STEM resources and courses in school, as well as, less access to afterschool STEM learning (Afterschool Alliance, 2021; Lynch et al., 2019; Tyson et al., 2007).

Even when youth do have access to STEM learning, programming quality varies, and there is inequitable access to high quality STEM programs (Freeman et al., 2009). Research on “promising practices” of STEM programming suggests that hands-on, real-world, collaborative learning is most effective at cultivating STEM engagement and career interest (Bouvier, 2011). Building instructor capacity through training is another powerful lever for systematically

improving STEM program quality and youth outcomes, especially when the training is tied to curriculum and offers opportunities to regularly discuss program implementation (Freeman et al., 2009; Lynch et al., 2019). Also, STEM programs are more likely to exhibit high quality programming when they leverage partnerships with other organizations that are also interested in ensuring all youth have equitable access to STEM (Little et al., 2008). Indeed, partnerships that include strong communication between staff from each organization, have alignment between curricular goals and objectives, and share funding or other tangible resources are more integrated and unified, and consequently more effective (Noam, 2003).



LETS GO Boys and Girls

Founded in 2009,
LETS GO

(Leadership, Engineering, Technology, Science Generating Opportunities) Boys and Girls is a nonprofit organization that strives to increase equitable access to high-quality STEM learning and workforce development opportunities in order to “equip a diverse, skilled workforce to take on the challenges of the 21st century” (LETS GO Boys and Girls, 2023). Through partnering with schools, youth-serving nonprofits, and other organizations in historically under-resourced communities, LETS GO aims to promote STEM literacy and identity, increase school and organizational capacity to implement high-quality STEM learning (see **Appendix** for more information on capacity-building efforts), and provide workforce development opportunities to prepare youth for STEM careers.

The LETS GO model was first implemented in Baltimore City, MD and has since expanded. In 2023, LETS GO served four regions: Baltimore City, MD; Anne Arundel County, MD; Washington, DC; and Transylvania County, NC. Across regions, LETS GO collaborates with partner organizations to deliver a scaffolded approach to STEM learning, as well as instructor professional development (PD).

Elementary youth (**Figure 1**) participate in hands-on, minds-on exploratory STEM activities in areas such as science, engineering, robotics, and computer programming. In addition to continued STEM learning, Middle and High School youth have opportunities to expand their learning via competitive STEM teams, career workshops with STEM professionals, and STEM field trips. Workforce development training focused on building professional relationships, college preparation, financial literacy, and career exploration is integrated into STEM learning to prepare students with the soft skills needed to excel in the 21st-Century workforce. As High School and Post-Secondary youth pursue STEM internships/apprenticeships, LETS GO provides individualized support and mentoring throughout the internship/apprenticeship experience.

Figure 1. Youth Design & Build with LEGO



In addition to supporting STEM learning experiences, LETS GO equips instructors to deliver high-quality STEM experiences through professional development services including program planning and coordination, instructor training workshops, one-on-one coaching, and technical assistance with STEM curricula. With this layered approach, LETS GO creates equitable access to STEM and works to “empower and actively position every [youth] as belonging in STEM” (LETS GO Boys and Girls, 2023)

Data Collection

In 2023, LETS GO collected data using the Common Instrument Suite at the end of each program (see **Table 1** for a description of data tools). Participants in data collection included fourth through twelfth grade youth and their program instructors. Between spring and fall 2023, 551 LETS GO youth in grades 4-12 completed the youth survey. Program instructors included 48 instructors, representing all 4 regions, who completed the educator survey.

Table 1. Data Tools

Type	Description	Response Options & Reliability
<p>Student Survey (CIS-S)</p> <p>Reliabilities for these scales were high, ranging from 0.82 to 0.92 across gender and age groups (Price 2018).</p>	<p>The CIS-S was administered in a Retrospective Self-Change (RSC) format. The CIS-S is a 59-item youth self-report measure of six STEM attitudes (STEM activities, career interest and knowledge, engagement, enjoyment, and identity) and four social-emotional skills (critical thinking, perseverance, relationships with peers, and relationships with adults) (Allen et al., 2020; Noam et al., 2020; Sneider & Noam, 2019). Youth in 6th grade and above completed the full version of the survey. Youth in 4th and 5th grade completed an abbreviated version of the CIS-S, which includes 6 scales: STEM engagement, STEM identity, critical thinking, perseverance, relationships with adults, and relationships with peers.</p>	<ul style="list-style-type: none"> ● A 5-point Likert scale is used with responses ranging from “Much Less Now” to “Much More Now.”
<p>Educator Survey (CIS-E)</p> <p>Reliabilities for these scales are also high, ranging from 0.74 to 0.94</p>	<p>The CIS-E is an educator self-report survey that asks educators about several aspects of being a STEM educator. In addition to program context (e.g., where STEM activities are taking place), educators are asked to rate their perceptions of their own STEM identities, the ease of implementing practices aligned with high-quality programming, and their perceptions of change in their youths’ STEM confidence, STEM skills, and social-emotional skills.</p>	<ul style="list-style-type: none"> ● A 4- or 5-point Likert scale is used. Responses for STEM identity range from “Strongly Disagree” to “Strongly Agree”, DoS-aligned practice implementation range from “Very Hard” to “Very Easy”, and perceptions of youth change range

Student Survey Findings

Demographics

Table 2 reports the demographics of LETS GO participants who completed the youth survey. Most youth surveyed were either from Anne Arundel County (42%) or Transylvania County, NC (39%); the remaining youth were from Baltimore City (18%) and Washington, DC (2%).

Between 15% and 21% of youth did not report their demographics. Of the total sample of youth, we found a similar distribution of females (38%) and males (37%). Two-thirds of youth (67%) were in sixth to eighth grade, the remaining youth were in fourth to fifth grade (14%) or ninth to twelfth grade (5%). The distribution of youths’ racial and ethnic identities revealed that over one quarter of youth identified as White, Caucasian (non-Hispanic) (28%). The other major racial identities represented were African-American, Black (17%), multi-race (10%), and Latino or Hispanic (8%). Less than 5% of youth identified as American Indian, Native-American, or Alaskan Native (4%); prefer to self-describe (3%), and Asian, Asian-American (2%).

Overall Outcomes

A one-sample *t*-test revealed that youth reported statistically significant positive change (p 's < 0.05) on all 9 outcomes that measure STEM-related attitudes and 21st-century skills (**Figure 2**). To conduct this analysis, we first examined if the youths’ average self-change scores differed significantly from 3, a rating of “About the Same.” Then, if the *p*-value of a given scale was below 0.05, its mean difference was considered statistically significant, meaning that the change is unlikely to be a result of chance. Finally, a mean change score greater than 3 indicated positive change; scores less than 3 indicated negative change; and those equal to 3 indicated no change.

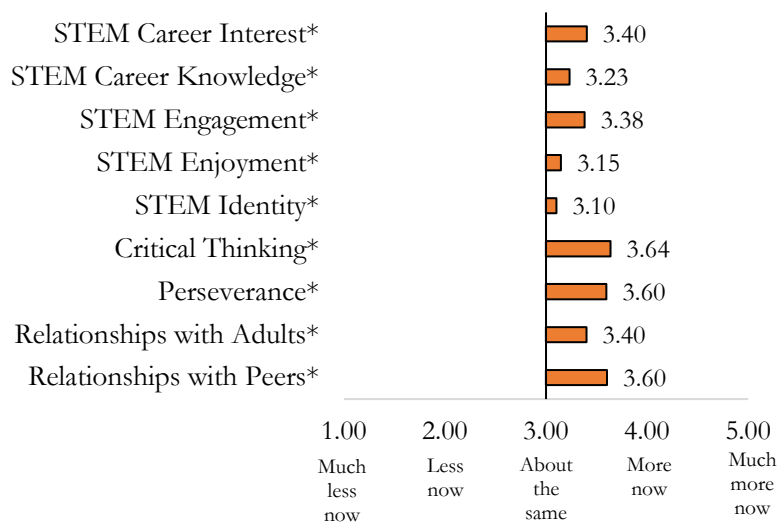
By Demographic Variables

We disaggregated the data to examine outcome differences by gender, grade groups, and race/ethnicity. For analyses with subgroup sample sizes greater than or equal to 20, parametric tests were performed. For those less than 20, non-parametric tests were performed. Subgroups with 20 or fewer youths were either regrouped or excluded to increase statistical power. Statistical tests were not

Table 2. Youth Demographics (n = 551), LETS GO Boys and Girls, 2023

Variable	Sample size (%)
Region	
Anne Arundel County	231 (42%)
Baltimore City	97 (18%)
Transylvania County, NC	213 (39%)
Washington, DC	10 (2%)
Gender	
Male	202 (37%)
Female	207 (38%)
Prefer to self-describe	10 (2%)
Prefer not to answer	15 (3%)
Did not report gender	117 (21%)
Grade	
4th – 5th	76 (14%)
6th – 8th	367 (67%)
9 th – 12 th	28 (5%)
Did not report grade	80 (15%)
Race/Ethnicity	
African-American, Black	95 (17%)
American Indian, Native-American	21 (4%)
Asian, Asian-American	10 (2%)
Latino or Hispanic	44 (8%)
White, Caucasian (non-Hispanic)	153 (28%)
Multi-Race	54 (10%)
Prefer to self-describe	18 (3%)
Prefer not to answer	46 (8%)
Did not report race/ethnicity	105 (19%)

Figure 2. LETS GO Youth-Reported STEM Outcomes (n = 550), 2023



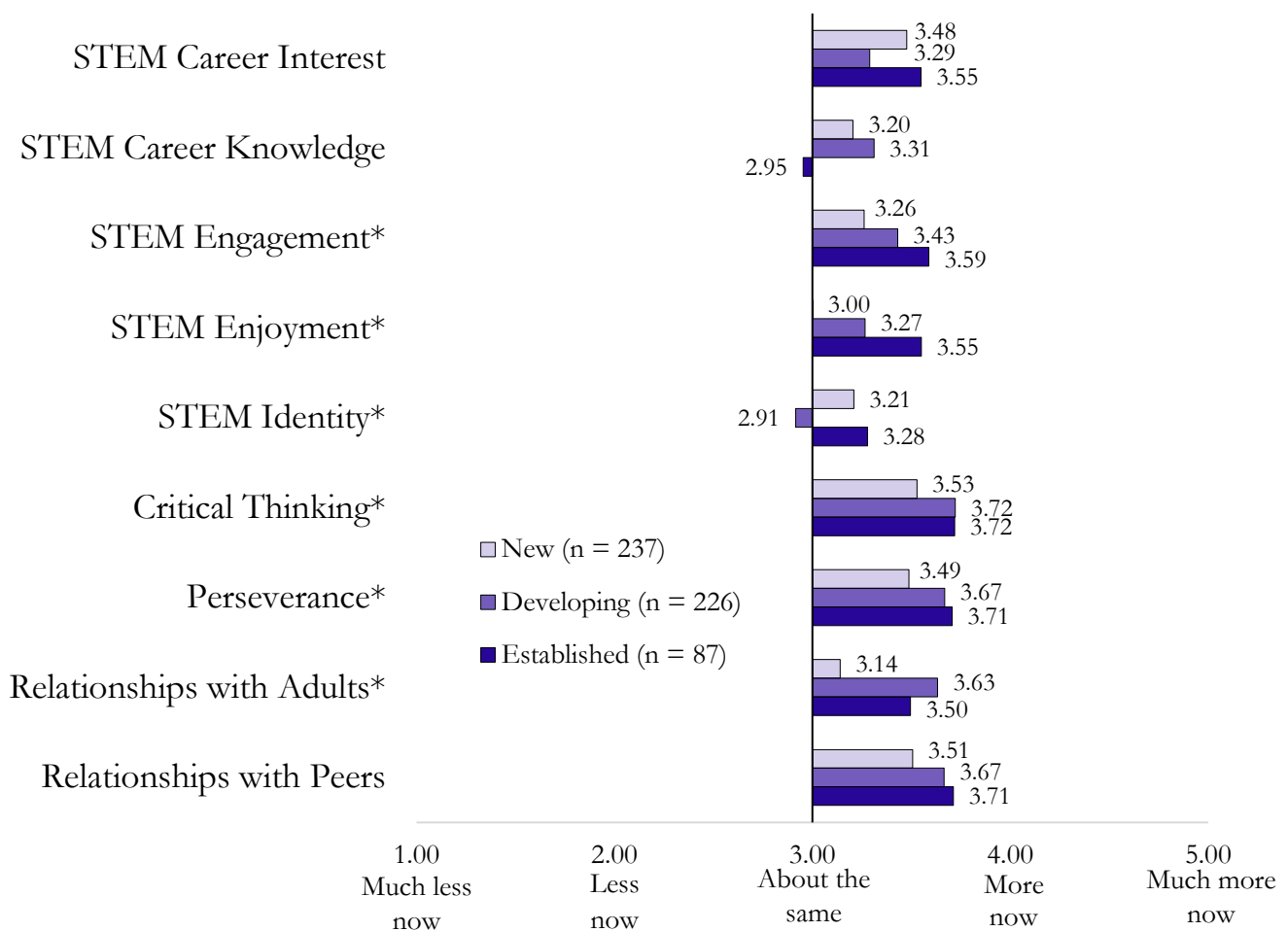
performed for any group with 5 or fewer responses.

A two-sample independent *t*-test revealed that between male and female youth, there were statistically significant differences (p 's < 0.05) on 1 scale: STEM career knowledge. For grade, we included 6 of 9 scales because we had two versions of the student survey and those 6 scales were included in both survey versions. A two-sample independent *t*-test comparing 4th-5th and 6th-8th graders revealed that there were statistically significant differences (p 's < 0.05) on 5 of the 6 CIS-S scales: STEM engagement, STEM identity, critical thinking, perseverance, and relationships with adults. Finally, across race/ethnicity groups – African, American, Black; American Indian, Native-American, or Alaskan Native; Latino or Hispanic; Multi-Race; White, Caucasian (non-Hispanic); Other / Not Listed, and prefer not to answer – an ANOVA test revealed there were statistically significant differences (p 's < 0.05) on 3 CIS-S scales: STEM career knowledge, perseverance, and relationships with adults.

By Partnership Type

To analyze differences between partnership types, partner sites were grouped into three categories depending on how long they have partnered with LETS GO – new (less than or equal to 1 year of partnering), developing (1 to 3 years of partnering), or established (more than 3 years of partnering). An ANOVA test revealed that between partnership types, there were statistically significant differences (p 's < 0.05) on 6 of the 9 CIS-S scales (**Figure 3**): STEM engagement, STEM enjoyment, STEM identity, critical thinking, perseverance, and relationships with adults.

Figure 3. LETS GO Average Outcomes by Partnership Type (n = 550), 2023



Instructor Survey Findings

Instructor Perceptions

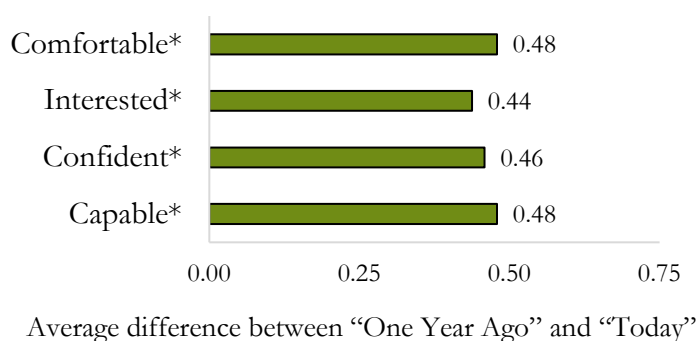
Of program instructors that completed the educator survey, most instructors (85%) identified as women, and 13% identified as men and 2% preferred not to answer the gender identity question. Almost a third of instructors were 30- to 39-years old (30%) and slightly less than a quarter were either 20- to 29-years-old (23%) or 40- to 49-years old (23%). The remaining instructors were either 50- to 59-years-old (17%) or 60- to 69-years old (6%). For race and ethnicity, the majority of instructors identified as African-American, Black (57%) or as White, Caucasian (non-Hispanic) (30%) with less than 6% identifying as Latino or Hispanic (6%), Asian, Asian-American (2%), Caribbean Islander (2%), or they preferred not to answer (2%). Nearly half of instructors (45%) held master's degrees, slightly more than a quarter held bachelor's degrees (26%), and the rest held high school or GED degrees (15%), an associate degree (9%), or other degrees (6%). We examined instructors experience leading in-school or out-of-school STEM learning experiences. For in-school, 54% of instructors had less than 4 years of experience, and for out-of-school 84% had less than 4 years of experience (with 27% having no experience).

When asked about their training and professional development with LETS GO, 81% of instructors reported receiving professional development from LETS GO within the last year. Of those instructors, 79% reported having less than 10 hours of professional development from LETS GO within the last year, 18% reported having 10-15 hours and 3% reported having 16-30 hours. When asked if they had received enough professional development, either from LETS GO or otherwise, 83% of instructors reported that the training and support they received was sufficient for leading STEM activities. Finally, when asked for suggestions around additional training, instructors recommended topics such as practice with engineering projects, more details on how to implement curriculum in an engaging way, support with making lessons more engaging, more hands-on activities, more time to complete STEM lessons and prep for them, and more support with coding and programming.

In addition to collecting data about instructor characteristics, the educator survey asks instructors about their own STEM identities, attitudes towards teaching STEM over time, and ability to use practices that are associated with high-quality STEM learning. On a scale of 1 to 4, instructors' average STEM identity was 2.94. Overall, instructors reported statistically significant positive change on all 4 attitudes toward teaching STEM over time (p 's < 0.05) (**Figure 4**); that is, instructors reported feeling more comfortable, interested, confident, and capable of teaching STEM at the time of the survey compared to a year prior.

Instructors also self-assessed their ability to use teaching practices aligned with PEAR's Dimensions of Success (DoS), a framework for assessing high-quality STEM learning experiences, on a 4-point scale from "Very Hard" to "Very Easy" (Shah et al., 2018). The two DoS-aligned practices with the highest ratings (i.e., teachers had the easiest time using these teaching practices) included "choosing activities that allow for hands-on exploration of STEM content" and "leading activities that allow youth to engage cognitively with STEM content." Instructors also reported that "delivering STEM content accurately" and "Helping youths make connections between different STEM concepts" were "Somewhat Easy" to implement.

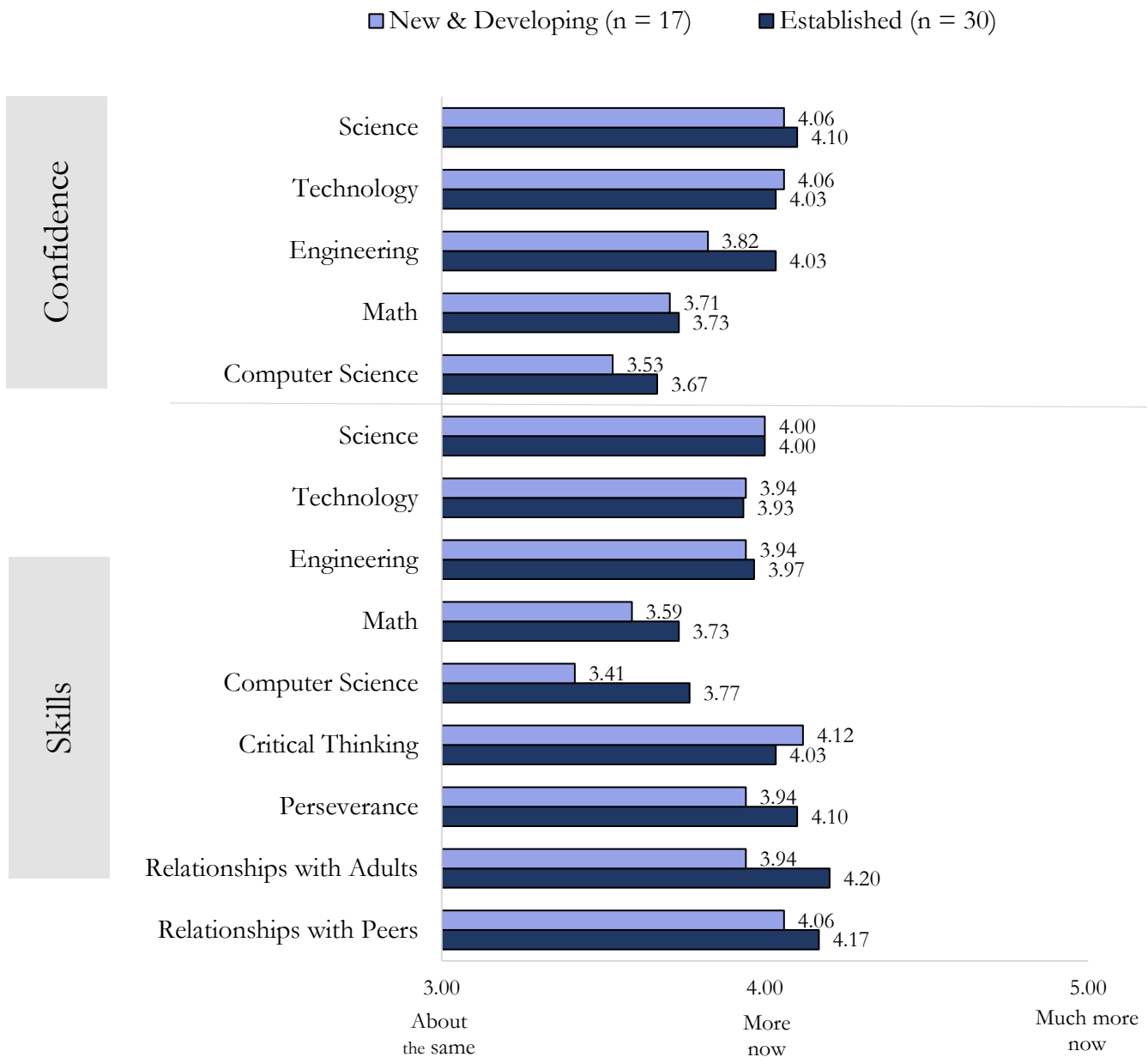
Figure 4. LETS GO Instructors' Attitudes Toward Leading STEM (n = 48), 2023



Lastly, instructors were asked to rate their perceptions of youths' change in confidence and skills on a 5-point Likert scale from "Much Less Now" to "Much More Now." Analyses revealed statistically significant positive change in instructor perception of youths' confidence and skills across all 5 STEM domains, as well as, all 4 21st-century skills (p 's < 0.05).

We also analyzed instructor perceptions of youths' change in confidence and skills by partnership type. To maximize statistical power, we combined instructor responses from new and developing partnership sites into a single group. Analyses revealed that there were no significant differences in instructor perceptions of youths' change in confidence or skills in STEM or 21st-century skills between instructors at new and developing sites and those at established sites (**Figure 5**).

Figure 5. LETS GO Average Change Scores in Instructors' Perceptions of Youths' Confidence Levels and Skills by Partnership Type (n = 47), 2023



Discussion

As a result of LETS GO's efforts to increase the capacity of program sites, we saw increases in youths' STEM-related attitudes and 21st-century skills, as well as instructors' attitudes toward leading STEM activities. Youth reported significant positive change on all 9 STEM and 21st-century outcomes, with the greatest positive change in critical thinking, perseverance, and relationships with peers. Consistent with student outcomes, instructors also reported they saw increases in youth confidence and skills in STEM, as well as 21st-century skills. Embedding 21st-century skills into STEM learning develops key career-readiness skills (Bybee, 2013). Specifically, research suggests that critical thinking is linked to enhanced problem-solving skills and an ability to analyze complex concepts, making it a sought after skill in both STEM and the larger labor market (Yaki, 2022). Additionally, perseverance has been linked to resilience and youth well-being, and long-term success in personal, academic, and career goals (Kannangara et al., 2018; Totosy de Zepetnek et al., 2021). Lastly, strong peer relationships are associated with adaptability, mental health, and general well-being (Shin et al., 2016).

When we looked at differences by demographics, we found differences by grade, but very few by gender. Across grades, there were significant differences on 5 of the 6 CIS-S scales assessed with 4th-5th graders reporting more growth on all STEM and 21st-century outcomes, than 6th-8th graders. This difference could be due to 4th-5th graders coming in with lower baseline scores or alternatively, this trend may mirror previous findings that STEM interest and identity decline as youths get older (Carlone et al., 2014; Sadler et al., 2012; Wieselmann et al., 2020). Across gender, only 1 of 9 CIS-S scales showed a statistically significant difference. These findings suggest that LETS GO is largely providing similar experiences for youths regardless of gender.

Across partnership types (defined by length of partnership), we saw that new partner sites had less impact on youth for two-thirds of the outcomes, than developing and established partner sites. Further, although not statistically significant, results from the instructor's report of youth outcomes mirrored this pattern. Instructors from established sites reported slightly greater increases in youth confidence and growth in STEM and 21st-century skills, than those at new/developing sites. These findings suggest that capacity-building efforts take time to reach their full impact. Interestingly, we see the greatest change on similar outcomes, regardless of partnership type. The greatest change reported by youth was in: critical thinking, perseverance, and relationships with peers. This pattern may indicate that regardless of how long a site has been partnered with LETS GO, the program model may be particularly effective at increasing certain 21st century skills.

An important aspect of LETS GO partnerships is their support of the professional development of instructors. Compared to a year ago, instructors reported positive growth in their comfort, interest, confidence, and capability leading STEM activities. Given that the vast majority of instructors received professional development from LETS GO, these findings may support previous research showing the positive impact of professional development on instructor self-efficacy (Zhou et al., 2023).

There were a few limitations to this year's data collection. Approximately 42% of our overall sample came from one program in Anne Arundel County that included a mix of youth traditionally underrepresented and overrepresented in STEM fields. Additionally, the Retrospective Self-Change (RSC) survey does not assess average youth outcomes prior to attending the program; therefore, it's difficult to determine if some youth are experiencing more growth, at least in part, because of lower baseline scores coming into the program. Instructor demographics, such as, years of experience as a traditional educator/leading STEM activities vary widely across regions making comparisons between instructors difficult and susceptible to potential confounds. Lastly, instructors reported increases in their attitudes toward leading STEM activities, but it's unclear how specific LETS GO professional development services (e.g., one-on-one coaching, individualized shadowing experiences, technical assistance with curricula) contributed to that increase. Future research should examine the impact of specific LETS GO professional development activities on instructor and youth outcomes.

In sum, LETS GO's capacity-building approach is having a promising impact on youths' STEM outcomes, as well as 21st-century skill development. Through partnering with schools and youth-serving organizations to ensure instructors have the resources, confidence, and skills needed, LETS GO is supporting the implementation of high-quality STEM learning opportunities. As this report shows, capacity-building and the development of strong partnerships take time, and through this investment and commitment to a long-term vision, LETS GO is successfully moving the needle on its mission to "create economic success for underserved and marginalized communities through STEM education and workforce development" (LETS GO Boys and Girls, 2023).

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- To learn more about **LETS GO Boys and Girls**, please visit their [website](#).
- To learn more about the data collection, interpretation, and reporting tools used in this report, please visit the **PEAR** [website](#).

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APPENDIX

Figure 1. Logic Model: LETS GO Capacity-Building of Partner Sites for Delivery of High Quality STEM

INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES
<p>People:</p> <ul style="list-style-type: none"> ● Staff: CEO, CPO, Regional Directors, Education & Program Managers (<i>DoS Certified</i>), Data and Evaluation Team ● Partner Site Leadership (<i>School Administrators, OST Administrators, Executive Directors, District Leadership, Site Directors</i>) ● Partner Instructors (<i>paid by partner</i>) ● Instructors (<i>paid by LETS GO</i>) ● Volunteers (<i>guest speakers, chaperones</i>) <p>STEM Resources:</p> <ul style="list-style-type: none"> ● Customized culturally relevant STEM Curricula ● Professional Development Resources ● Continuous Quality Improvement Process ● LETS GO Data Collection System ● Program Quality and Evaluation Tools <p>Strategic Partnerships:</p> <ul style="list-style-type: none"> ● School Systems (<i>including colleges</i>) ● Community Organizations ● Corporations ● Funders ● PEAR 	<p>Partnership:</p> <ul style="list-style-type: none"> ● Recruitment and retention of partner sites that serve under-represented students in STEM from economically disadvantaged backgrounds. <p>STEM Programming:</p> <ul style="list-style-type: none"> ● Collaborative, strategic program design ● Selection of culturally relevant, hands-on learning materials and STEM curricula aligned to partner site goals <p>Professional Development:</p> <ul style="list-style-type: none"> ● Delivery of Instructor workshops and training (<i>in-person, remote, shadow training</i>) ● On-going technical assistance and coaching of Program Administrators & Instructors <p>Quality Improvement:</p> <ul style="list-style-type: none"> ● Use of data and PEAR dashboard to facilitate program quality improvement and gain insights into program effectiveness and impact. <p>Data Collection:</p> <ul style="list-style-type: none"> ● Implementation of a variety of tools to collect student, instructor, STEM program, professional development, and partner site data (<i>youth outcome and knowledge surveys, educator outcome surveys, partner satisfaction surveys, and program observations</i>) 	<p>Partnership and Quality Improvement:</p> <ul style="list-style-type: none"> ● Partners: # ● Continued contracts: (#) ● Site support visits: (#) ● Observations (#) and coaching sessions (#) <p>STEM Programming:</p> <ul style="list-style-type: none"> ● Sites delivering STEM programs (#) ● Session # and length ● Types of learning experiences: # per site ● Students per site in STEM programs: # returning & # new participating in LETS GO learning experiences <p>Professional Development:</p> <ul style="list-style-type: none"> ● Workshops held: # <i>virtual</i> & # <i>in-person</i>, # participants ● Shadow trainings: # ● Instructors: (# <i>new/returning</i>, # <i>partner-paid</i>, and # <i>of LETS GO-paid instructors</i>) <p>Data Collection:</p> <ul style="list-style-type: none"> ● Instructor Workshop Evaluations (#), Partner Satisfaction Surveys (#), CIS-S (#), CIS-E (#), DoS (#), and Testimonials (#) <p>Reporting:</p> <ul style="list-style-type: none"> ● Metrics Reports and PEAR’s Dashboard 	<p>Partner Sites increase:</p> <ul style="list-style-type: none"> ● Confidence, Interest and Capability to implement High-Quality, culturally relevant, STEM Programs (<i>Partner Satisfaction Survey, Observations</i>) <p>Students develop:</p> <ul style="list-style-type: none"> ● STEM-related attitudes (<i>interest, identity, career interest</i>) and knowledge, 21st Century and Social-Emotional Learning Skills (<i>CIS-S, content assessment</i>) <p>Instructors develop:</p> <ul style="list-style-type: none"> ● Confidence, interest, and ability to lead high-quality, culturally relevant STEM activities, especially science and engineering practices (<i>CIS-E, testimonials, and workshop evaluations</i>)