

Impact Evaluation of the Courage Hope Care Institute's STEAM Program at DC Public Turner Elementary School for the 2025-2026 School Year

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Acknowledgment: I sincerely appreciate the Turner School staff's unwavering dedication to upholding student attendance and their significant contributions to comprehensive data collection.

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Executive Summary of the Impact Evaluation

This paper evaluates the effectiveness of the CHC Institute's after-school STEAM education program, conducted at Turner Elementary School in Washington, D.C., during the 2025-2026 school year. This study examines whether the program improves students' growth and core competencies in STEAM education. The program evaluation involved pre- and post-program surveys of 20 of the 22 enrolled students. In addition, end-of-program surveys were administered to the same 20 students and 16 faculty members to conduct a multi-layered analysis across educational motivation, knowledge, interest, and skill development in STEAM.

The pre-evaluation revealed that participating students had limited experience with STEAM but demonstrated high motivation to learn and a positive attitude toward new activities, suggesting the potential for expanding the educational program and providing ongoing support. The post-evaluation showed overall positive changes in STEAM knowledge, interest, confidence, and skill improvement. In particular, improvements in STEAM subject knowledge, project creation skills, and collaboration, as well as enhancements in attitude and self-confidence, were notable.

Student and faculty surveys conducted at the end of the program revealed high satisfaction and positive evaluations of the collaborative project experience and skill development; the consistency between student self-assessments and faculty evaluations confirmed the program's educational effectiveness and reliability. It was also notable that both groups trusted the program and wanted to rejoin it.

Overall, this study concludes that the CHC Institute's after-school STEAM program contributes to social equity via increasing accessibility and significantly impacts student motivation and the development of core competencies.

This program is evaluated as a best practice that maximizes each child's potential and lays the foundation for long-term educational growth through various hands-on learning experiences and a collaborative learning environment. These findings are a meaningful research outcome that provides a foundation for policy formulation and program development on equity and quality improvement in STEAM education.

Moving forward, to ensure its continued operation and expansion, the program emphasizes the need to systematically expand the operational staff, establish an effectiveness evaluation system, and strengthen collaboration with the local community and partner institutions.

1. Introduction

As society advances, STEAM (Science, Technology, Engineering, Arts, and Mathematics) education is vital for individual and community development in a high-tech economy. Despite its importance, access remains unequal. To address this inequality in STEAM education, the CHC Institute, a nonprofit, has provided a free after-school STEAM program at DC public schools. *(Refer to our programs at <https://www.chcsteam.org>.)*

This study evaluates the after-school STEAM program operated at Turner Elementary School in Washington, D.C., during the 2025-2026 school year. This study examines how the CHC Institute's STEAM program expands STEAM educational opportunities for underprivileged children, supports individual growth, and strengthens core competencies. The findings will inform strategies to close educational gaps and ensure the program's long-term sustainability. *(Refer to impact evaluation studies conducted at other sites at <https://www.chcsteam.org>.)*

2. Research Scope and Methodology

This impact evaluation study assesses the effectiveness of our STEAM after-school program in enhancing STEAM knowledge, fostering interest and engagement, and developing skills such as creativity, problem-solving, collaboration, and communication.

Research Questions:

- Did the STEAM after-school program improve students' STEAM knowledge, interest, confidence, and skills?
- How do school staff members evaluate the program's impact?
- To what extent do participants' learning outcomes and satisfaction align with school staff's objective evaluations?

Research Scope and Approach:

I evaluated the program's impact using pre- and post-surveys completed by 20 participating students. Using the results from both surveys, I analyzed changes for each question (item) across all respondents, and changes on the same 10 questions (items) for each respondent. Additionally, I conducted an end-of-program survey for both students and staff. The same group of 20 students completed an end-of-program student survey. Sixteen staff members completed a survey assessing their perceptions of the program at the end of the program. Results from both the end-of-program student survey and staff surveys were compared to evaluate student learning outcomes and satisfaction alongside staff evaluations. These two-layer analyses (pre- and post-survey comparisons and student-versus-staff comparisons) will provide a more in-depth look at our program's effectiveness and highlight areas for improvement.

Data:

- **Pre- and post-surveys:** The 20 students out of a total of 22 enrolled students completed both surveys. The pre-survey questionnaire has 10 questions across 4 areas: STEAM Experience and Knowledge; Interest and Engagement; Skills development; and Satisfaction with the Program. Each question is rated from 1 (very negative) to 5 (very positive). (see Annex 1) The post-survey includes the same 10 questions, with two more added: one to Interest and the other to Satisfaction of the Program. (see Annex 2)
- **End-of Program Student Survey:** At the end of the program, the same group of 20 students completed the survey used at our partner schools. The student survey questionnaire has 10

questions in 3 areas of Experience: Interest in Activity; Team Project Experience; and Skills Development. (see Annex 4)

- **End-of-Program School Staff Survey:** Sixteen staff members answered 10 questions regarding Program Design and Delivery; Student Engagement and Skill Development; Community Impact; and Satisfaction with the Program. (see Annex 5)

3. Analysis of Attendance Rates

Twenty-two students registered for the program are already enrolled in the school's aftercare program. Of them, 13 students achieved attendance rates of 70 percent or higher, demonstrating strong and consistent involvement. Only two students who dropped out of the school's aftercare program recorded attendance rates below 50 percent.

Students who attend more regularly tend to be more engaged and achieve greater learning gains, contributing to long-term success in STEAM education. However, lower attendance rates are directly tied to aftercare attendance and are often caused by factors outside the student's control, such as parents picking up their children early. Given these factors outside the student's control, attendance rates do not always accurately reflect a student's level of commitment. In other words, even though attendance is a valuable measure of participation and program effectiveness, it is not comprehensive.

Therefore, operational challenges and external circumstances must also be considered. Working together with partner schools, consistent monitoring, and active cooperation from parents are crucial for obtaining reliable attendance data. In particular, strengthening communication with parents—by emphasizing the value of the STEAM program—can encourage them to pick up their children after the program concludes.

4. Evaluation of Pre- and Post- Survey

In this chapter, I will first present and analyze the pre-survey and post-survey findings independently. By examining each dataset on its own, we can better understand participants' initial perspectives and experiences before the program, as well as the outcomes and shifts observed after program completion. Each survey provides valuable insights with distinct implications. Following these individual analyses, I will conduct a comparative assessment at two levels - at each question across all respondents and each respondent for all questions - to identify key changes, trends, and areas of growth or concern that emerged over the course of the program. This approach will help explain the program's impact and inform recommendations for future initiatives.

4.1. Analysis of Findings from Pre- and Post-Survey Results

In this section, I will present and analyze the findings from the pre- and post-surveys across four key domains: STEAM Experience and Knowledge; Interest and Engagement; Skills development; and Satisfaction with the Program. By examining the results in each area, I aim to highlight key findings, offer insights into the program's effectiveness, and identify areas for potential improvement.

4.1.1. Key Findings from the Pre-Survey Results

Although half of the students had little to no experience and a low level of awareness and understanding of potential career paths, 60 percent of respondents expressed positive attitudes toward STEAM activities. Limited experience may have led to lower favorability among some, highlighting the need to increase opportunities for STEAM activities. Students demonstrated a

strong willingness to learn, with most (80%) expressing interest in trying new activities and showing proactive attitudes. This motivation provides a solid foundation for expanding participation and can be sustained through challenging activities and ongoing support.

While students displayed varying levels of confidence in STEAM project creation and problem-solving, 75 percent of students viewed their collaboration skills positively. Sixty percent of children wanted to discuss STEAM topics with family or friends, though some showed little interest.

Student learning expectations were high (85%), with many hoping to gain significant knowledge, reflecting trust in the program. Ninety percent also hope to continue STEAM activities, suggesting positive long-term outcomes. Detailed survey results are provided below (see Annex 1):

Domain 1: Student knowledge and experience in STEAM (Q1-Q2): Half of the students had little or no experience with STEAM activities, while some appeared to have experience through participation in our program offered the previous year. Additionally, most students were unfamiliar with STEAM-related careers, and only a few felt somewhat familiar with them. These results suggest that access to and information about STEAM education are still insufficient, highlighting the importance of improving STEAM opportunities and career guidance in the future.

Q1. Experience with STEAM activities: Fifty percent had very little or no experience, indicating limited accessibility; 45 percent had no experience, and 5 percent had little experience. In contrast, 45 percent reported a lot of experience, mainly from our previous program participation (note: we delivered the program during the school year 2024-2025 at Turner ES).

Q2. Level of knowledge about STEAM-related careers: Most participants (80%) were uncertain about STEAM-related career options, with 40 percent “not at all,” 10 percent “very little,” and 30 percent “Neutral.” Only 15 percent were very familiar and 5 percent familiar with STEAM careers.

Domain 2: Student Interest and Engagement in STEAM (Q3-Q4): Although most students had limited experience and low awareness of career paths, respondents showed a positive attitude toward STEAM activities and a strong willingness to learn and embrace challenges. This suggests strong potential to expand program participation. We recommend a thorough analysis of the factors driving high satisfaction and greater willingness to participate, as well as a description of the program elements that motivated participants.

Q3. Favorability Toward STEAM Activities: Most respondents had positive attitudes, with 45 percent rating the activities as “a lot” and 15 percent as “quite a lot.” Twenty percent rated “not at all,” reflecting lower interest among those less exposed to STEAM activities. Previous participants generally viewed the activities more favorably.

Q4. Willingness to Learn and Try New Things in STEAM: All respondents expressed willingness to learn, with 45 percent saying, “a lot,” 35 percent “quite a lot,” and 20 percent indicating average interest. No one reported low willingness. Even those who show less favorability because they lack knowledge about STEAM activities still show willingness to learn. This demonstrates strong motivation and willingness to learn for STEAM activities, which is encouraging for future program participation.

Domain 3: Students' Core STEAM Competencies and Communication Skills (Q5-Q7): Although confidence also varied in problem-solving and creativity skills, students view their collaboration skills positively. Seventy-five percent of the students rated their collaboration skills positively, indicating that teamwork—a crucial element in STEAM activities—is functioning well. Some who lack core skills require additional support and attention. Overall, since students' core competencies are distributed in a balanced manner, it is important to implement diverse, tailored educational strategies and ensure continuous competency development.

Q5. STEAM Project Creation Skills: Responses were evenly distributed, with 25 percent rated their skills as “very good,” 15 percent as “good,” 20 percent as “not very good,” and 20 percent as “not at all good.” These results indicate that children view their project creation skills differently or could be less sure about their skills.

Q6. Problem-Solving Skills: Thirty-five percent rated their problem-solving skills as “very good,” 25 percent as “good,” 30 percent as “average,” and 10 percent as “below average.” This suggests some participants may lack confidence in their problem-solving abilities and have experienced challenges during STEAM activities.

Q7. Ability to Work with Friends: Fifty percent rated their collaboration skills as “very good,” and 25 percent as “good,” indicating that 75 percent view their teamwork abilities positively. Twenty percent of respondents rated 1 and 2: 10 percent as “not good at all” and 10 percent as “not good”. This strong sense of collaboration can support positive engagement in STEAM environments, where teamwork is essential.

Domain 4: Learning Outcomes and Satisfaction (Q8-Q10): Sixty percent of the respondents expressed a desire to discuss STEAM topics with family and friends, showing a willingness to communicate in ways that deepen understanding and strengthen relationships. However, since some students show less interest in this area, exploring diverse communication methods and ways to engage them could be helpful. Expectations for the program are also very high, with most students (85%) anticipating a rich and interesting learning experience. Their motivation to continue participating in STEAM activities is also very strong; nearly all students (90%) are ready to participate actively, which will be a major driver of the program’s long-term success and positive educational outcomes. These results are a highly encouraging sign for the program’s future design and operation.

Q8. Desire to Discuss STEAM with Friends or Family: Sixty percent of respondents wanted to discuss STEAM topics (45 percent rated it 5 and 15 percent rated it 4). Thirty percent of respondents were negative about this item, with 20 percent rating it “not at all” and 15 percent rating it “very little.” This suggests that many students are open to using conversation to deepen their understanding and strengthen relationships. For those less inclined, exploring alternative communication channels and participation methods may help address diverse preferences and needs.

Q9. Expectations of Learning: Eighty-five percent expect to learn “a lot” (50%) or quite a lot (35%) from the program. None selected rating 1. This reflects strong anticipation of a broad and engaging learning experience.

Q10. Willingness to Continue Participating in STEAM Activities: The vast majority (90%), with 85 percent of “very much” and 5 percent of “much,” expressed a strong desire to participate in future STEAM activities. Most respondents selected the highest rating, with only two giving lower scores. This high level of commitment is expected to support the program’s success and long-term educational outcomes.

4.1.2. Key Findings from the Post-Survey Results

The program provided students with practical, hands-on experiences, such as science and engineering experiments, math activities, robotics, drone operation, 3D printing, and virtual reality. These experiences significantly increased students’ interest in STEAM and strengthened their motivation to learn, which is expected to benefit their long-term academic and career growth.

Half of the students reported knowing STEAM-related careers, though lower-grade students showed less awareness. This highlights the need for grade-specific career exploration. All students (100%) demonstrated a strong willingness to learn and proactively tackled new challenges, underscoring the effectiveness of inquiry- and project-based instruction in fostering self-direction and curiosity.

While students varied in project creativity and problem-solving skills, most expressed (95%) high confidence in their collaborative abilities. Many students (90%) wanted to share their STEAM learning with family and friends, which will support deeper learning and stronger social relationships.

Student satisfaction with the program was high. All respondents (100%) reported enjoying the program, and 90 percent noted that they learned a lot. All participants (100%) also expressed enthusiasm for continuing with STEAM activities. These results highlight the program's effective content and delivery. Detailed survey results are provided below (see Annex 2):

Domain 1: Student knowledge and experience in STEAM (Q1-Q2): The findings indicate that all participants (100%) actively engaged in a variety of STEAM activities, suggesting that the program provided a wide range of experiential opportunities. Regarding STEAM-related career paths, about half of the students reported having knowledge. In contrast, some expressed a neutral attitude, and a few still lacked sufficient knowledge about these career paths. These results suggest that the program positively enhanced participants' experiences and awareness of career paths through various fun, hands-on activities.

Q1. Experience with various STEAM Activities: All participants (100%) engaged in a wide range of STEAM activities, with 95 percent rating it 5 and 5 percent rating it 4. These results demonstrate that the program offered extensive experiential learning opportunities.

Q2. Knowledge of STEAM-Related Careers: Fifty percent rated their knowledge as "a lot" (30%) and "quite a lot" (20%). Thirty-five percent answered "neutral," and 10 percent answered, "not at all." While overall awareness increased, some students—likely in lower grades—still lack understanding

Domain 2: Student Interest and Engagement in STEAM (Q3-Q5): All students (100%) rated the STEAM activities very positively, and various hands-on experiences—including science experiments, math activities, robotics, drones, LEGO, 3D printing, and virtual reality—significantly increased engagement and motivation. Their strong commitment to learning and taking on new challenges further demonstrated that project-based hands-on learning is an effective motivational tool. Satisfaction with the program was also very high; all students participated enthusiastically and built their self-confidence. These results clearly indicate the program's success.

Q.3 Favorability toward STEAM Activities: After the program, all students rated the activities as liked, with 85% of students rated "a lot" and 15% rated "quite a lot," with no negative responses. These results show that students developed a highly positive perception of STEAM activities. Positive experiences with activities such as science experiments, hands-on math activities, robotics, drones, LEGO, 3D printing, and VR contributed to increased engagement and motivation.

Q4. Willingness to Learn and Try New Things in STEAM: All respondents expressed willingness to learn, with 75% answering "a lot" and 25% "quite a lot," with no negative responses. This suggests the program significantly increased positive attitudes and curiosity, indicating that hands-on, project-based learning was an effective motivator.

Q5. Enjoyment of Program Participation: All respondents responded that they enjoyed the program "a lot" (rating 5), reflecting 100% satisfaction. This unanimous positive feedback indicates successful program implementation. The program's content and delivery maximized interest and participation, increasing engagement and self-confidence.

Domain 3: Students' Core STEAM Competencies (Q6-Q8): Most students (80%) rated their ability to create STEAM projects positively and expressed confidence in this area. Regarding problem-solving skills, 75 percent responded positively. Responses to collaboration skills were the most positive, with the majority (95%) expressing confidence in their ability. These results indicate that while students demonstrate a range of core STEAM competencies, they exhibit

particularly strong confidence in collaboration and communication. This provides valuable insights for the ongoing development of educational programs.

Q6. STEAM Project Creation Skills: Eighty percent rated their project creation skills positively, with “very good” (50%) and “good” (25%). Fifteen percent reported average (15%) or below (5%), and none gave the lowest rating.

Q7. Problem-Solving Skills: Half of respondents rated their problem-solving skills as “very good,” 25 percent as “good,” 20 percent as “average,” and 5 percent as “not good,” with none giving the lowest rating.

Q8. Ability to Work with Peers: Most students (95%) rated their collaboration skills as “very good” (60%) or “good” (35%), with only one reporting “average” and none giving lower ratings. This confidence in collaboration and communication is generally higher than other skills.

Domain 4. Learning Outcomes and Satisfaction (Q9-Q12): Most students (85%) are eager to discuss STEAM with their friends and family, a positive trend that fosters a deep understanding of the material and greatly contributes to improved social skills and motivation. The program proved highly effective in helping students learn new and interesting concepts that met their expectations. The program increased their engagement through diverse hands-on experiences and the use of technology. All students expressed a strong desire to continue participating in STEAM activities in the future, which will positively impact their long-term motivation and career development. Furthermore, many students (90%) hope their friends will also program, so we expect the learning community to expand and peer encouragement to strengthen further. These results are encouraging signs for the program's future operation and development.

Q9. Desire to Discuss STEAM with Friends or Family: Eighty-five percent expressed a strong desire to discuss STEAM, and 5 percent were neutral. This eagerness to share learning experiences supports deeper understanding, social development, and motivation. Conversations with friends and family help students internalize knowledge, expand their thinking, and foster a collaborative learning environment. This desire to communicate also strengthens social networks and self-confidence.

Q10. Extent of Learning New and Interesting Things: Ninety-five reported learning “a lot” (70%) or “quite a lot” (25%), with only one rating “average” and none giving lower scores. This indicates strong engagement and knowledge acquisition. The program's structure effectively met learning needs and provided practical, engaging experiences across STEAM fields. The inclusion of technologies such as experimental robots, drones, 3D printing, and VR stimulated curiosity and exploration.

Q11. Desire to Continue Participating in STEAM Activities: All respondents expressed a strong desire to continue with STEAM activities. This indicates the program has significantly increased interest and motivation, encouraging students to view STEAM education as a long-term journey. Such commitment supports self-directed learning and future career development, narrows STEAM educational gaps, and promotes social equality.

Q12. Desire for Friends to Participate in the Program: Ninety percent of respondents said they wanted their friends to join the program; 75 percent “very much” and 15 percent “much.” None gave low ratings. This strong desire suggests potential to expand the learning community, strengthen peer motivation, and foster positive interactions.

4.2. Comparative Analysis of Pre- and Post-Survey Results

In this section, I compare the pre- and post-survey results and analyze changes before and after the program in two ways to strengthen the analysis's reliability. First, I examine changes in each question across all participants. Second, I assess individual student growth on questions 1 to 10. These two layers of in-depth analysis will clarify the program's real effectiveness, highlight areas for improvement, and suggest implications for educational practice.

4.2.1. Item-Level Comparison of Pre- and Post-Survey Results

The CHC Institute's STEAM program has significantly enhanced students' STEAM knowledge and career awareness through increased experiences of a variety of hands-on activities. It has brought about positive changes in their motivation and attitudes toward learning and strengthened their self-directed learning skills. Skills in project creation, problem-solving, and collaboration also improved noticeably, and students' participation in discussions and communication skills improved. All participating students expressed a desire to continue participating after the program ended, indicating the program's high sustainability and social value. However, providing personalized counseling and support that accounts for grade-level differences and learner diversity remains a future challenge. Detailed survey results are provided below:

Domain 1: Student knowledge and experience in STEAM (Q1-Q2): In a pre-program survey, half of the participants had little to no prior STEAM experience. By the end of the program, all participants experienced various STEAM activities, including science and engineering experiments, logic hands-on activities, robotics, drones, and VR, helping them build practical skills and explore new fields. While only 20 percent of participants reported a high level of career awareness before the program, 50 percent reported understanding of STEAM-related careers. Overall, the program increased opportunities to experience STEAM activities and exposure to STEAM fields and careers. The survey also identified a need for tailored mentoring, particularly for younger students.

Q1. Experience with STEAM Activities: The pre-survey found that 50 percent of participants had little to no STEAM experience (rating 1 or 2). After the program, all participants engaged in diverse activities such as science experiments, robotics, drones, and VR (ratings 4 and 5). The program enabled participants to explore new fields and develop practical skills, confirming its effectiveness and the value of experiential, activity-based education.

Q2. Knowledge and Understanding of STEAM-Related Careers: The pre-survey indicated 20 percent awareness of STEAM-related careers (ratings 4 and 5). The post-survey showed that hands-on activities improved their understanding. Fifty percent of students now rate their career knowledge as "a lot" and "quite a lot". However, some students still have low career awareness, especially at lower grade levels, so tailored mentoring that addresses individual and grade-level differences remains important.

Analysis of findings in Domain 1:

First, the findings indicate that hands-on activities, such as robotics, drones, 3D projects, and virtual reality, proved highly effective in helping participants engage in a wide range of STEM activities and increase their interest.

Second, the findings suggest that hands-on experiences in various STEAM activities and practical learning played a key role in enhancing career-related understanding. Before the program, only 20 percent were well informed about STEAM-related careers, but after the program, 50 percent reported increased knowledge of STEAM-related jobs. However, the data also suggest that low career awareness among younger students underscores the importance of reflecting age-specific characteristics and individual differences in career education. Therefore, diversifying mentoring and counseling programs and developing grade-specific materials and experiences emerge as key areas for future improvement.

Third, in terms of the program's social value and sustainability, it is highly significant in that it increased access to STEAM education for children from underprivileged backgrounds. An education approach centered on hands-on activities is effective in bridging the educational gap, and expanding participants' career exploration can positively affect talent development in local communities and the nation in the long term. However, as the program expands,

operational management aspects—such as support staff, resource allocation, and a system for ongoing effectiveness evaluation—must also be systematically strengthened. Overall, the program substantially enhances learners’ STEAM knowledge and career awareness through engaging hands-on activities and practical training, while also contributing to social equity and improved access to education. Moving forward, strategic enhancements—such as strengthening tailored mentoring and age-appropriate career support- appear necessary.

Domain 2: Enhancing Student Interest and Engagement in STEAM (Q3-Q4): In a pre-survey, 60 percent of students expressed a positive attitude toward STEAM activities; however, after the program concluded, all students reported that they either “really liked” or “liked” the activities. Learning motivation also increased from 80 percent to 100 percent among those who answered positively. A variety of hands-on activities significantly increased students’ interest and motivation, thereby promoting participation and self-directed learning. These positive changes also led to improved collaboration skills, showing that the program was highly effective and well received.

Q3. Positive Perceptions of STEAM Activities: The pre-survey revealed 65 percent had positive attitudes toward STEAM activities (rating 5 and 4). After the program, all students reported they either “very liked” or “liked” the activities, with no negative responses. This improvement is attributed to the program’s diverse, hands-on activities, which increased student interest and motivation. These experiences enhanced engagement and encouraged self-directed learning. Continued observation and individualized support are important for less enthusiastic students.

Q4. Motivation to Learn and Attitude Toward Trying New Things: In the pre-survey, 80 percent of respondents expressed interest (rating 5 and 4). After the program, all respondents reported interest (rating 5 and 4). This demonstrates a clear increase in motivation and curiosity. The project-based, inquiry-driven approach fostered self-directed learning. Increased motivation and the absence of negative perceptions confirm the program’s effectiveness and high participant satisfaction.

Analysis of findings in Domain 2:

First, the significant improvement in students’ attitudes toward STEAM activities and their motivation to learn throughout the program is highly encouraging from an educational effectiveness perspective. Although a certain percentage of students already showed positive attitudes toward STEAM activities in the pre-survey, the fact that all students responded positively after the program strongly suggests that the diverse, hands-on activities significantly sparked students’ interest and increased their engagement. This served as a crucial educational stimulus for promoting participation in learning and fostering self-directed learning skills.

Second, learning motivation and attitudes toward new challenges improved across all participants, and project-based and inquiry-based teaching methods played a key role in fostering these self-directed learning attitudes. The complete absence of negative perceptions and the consistently high satisfaction levels attest to the high quality of the program’s design and implementation, and they also positively impacted collaboration and knowledge sharing among students. However, while all students responded positively, some showed relatively less enthusiasm, necessitating ongoing observation and individualized support. This underscores that a thoughtful educational approach that accounts for learner diversity is essential for achieving even greater results in the future.

Overall, the CHC Institute’s STEAM program improved both students’ attitudes and motivation through experiential and participatory learning, which is expected to positively contribute to strengthening self-directed learning skills and career development. Moving forward, it will be important to maintain the program’s strengths while expanding personalized

support for individual students and developing flexible strategies to address potential declines in motivation; doing so will ensure sustainable educational outcomes.

Domain 3: Improving Students' Core STEAM Competencies and Communication Skills

(Q5-Q7): The program improved self-rated students' project creation, problem-solving, and collaboration skills. Regarding project creation skills, positive responses improved significantly from 40 percent before the program to 80 percent afterward. The positive responses to problem-solving skills rose from 60 percent before the program to 75 percent afterward. The positive responses to collaborative skills also improved from 75 percent to 95 percent. The substantial growth in confidence for project-building highlights the impact of hands-on activities and underscores the ongoing importance of fostering various hands-on experiences.

Q5. Project Creation Skills: The pre-survey showed varied STEAM project creation skills, with differences in confidence and technical ability. Forty percent were positive about their project creation skills (rating 5 and 4). After the program, this increased to 75 percent, with 50 percent rated as "very good," and low ratings (rating 1 and 2) decreased significantly from 40 percent to 20 percent. This progress is attributed to hands-on experience, tool familiarity, quality mentoring, and a supportive environment. As STEAM projects require both technical knowledge and creativity, differences in competency are expected and often reflect prior experience.

Q6. Problem Solving Skills: Before the program, 60 percent of participants rated positively (35% rated 5 and 25% rated 4), but after the program, this increased to 75 percent (50% rated 5 and 25% rated 4). After the program, rating 5 (very good) alone increased by 15 percent. These results show the program significantly improved students' confidence in problem-solving. Maintaining a collaborative environment is essential for further development. Improved problem-solving was closely linked to better collaboration and more effective team communication.

Q7. Collaboration Skills: The pre-survey showed most students (75%) feel positive about working with friends (rating 5 and 4). After the program, 95 percent rated their collaboration skills as "very good" (rating 5) or "good" (rating 4), reflecting increased confidence in teamwork and communication. These results highlight the positive impact of the CHC Institute's collaboration-focused program.

Analysis of findings in Domain 3:

First, students' self-rated project creation skills improved significantly before and after participating in the program. The substantial growth in confidence in project building highlights the impact of hands-on activities, tool proficiency, and a supportive learning environment.

Second, since STEAM projects require both technical knowledge and creativity, variations in competency are inevitable; however, if practice-based education continues and personalized learning is instituted, students' technical confidence and creative problem-solving skills will be further strengthened.

Third, self-rated problem-solving skills improved; in particular, the "very good" rating increased by 15 percent, indicating a noticeable rise in students' confidence. Since improvements in problem-solving skills are closely linked to a collaborative learning environment, it is crucial to continue fostering an environment that supports team communication and cooperation.

Fourth, students' positive evaluations of collaboration skills indicate their strong confidence in teamwork and communication. Collaboration is essential for enhancing core competencies in STEAM education, and the program clearly improved overall learning outcomes via teamwork. Students also actively engaged in STEAM-related conversations with friends and

effectively solved challenges during the collaboration process, showing that improved collaboration skills also lead to enhanced social skills. Therefore, maintaining and strengthening this collaborative foundation is key to long-term success.

Overall, the CHC Institute's STEAM program is an excellent example of an initiative that simultaneously strengthens students' practical skills, deepens their collaborative abilities, and boosts their confidence, while also enhancing their motivation and engagement in learning. However, tailored educational strategies that provide balanced support for diverse learner abilities and differences, along with ongoing management of collaborative learning environments, will become even more important in the future. This is essential to ensure sustainable, scalable educational outcomes.

Domain 4: Increasing Learning Outcomes and Satisfaction (Q8-Q10): After participating in the program, students' willingness to discuss STEAM topics with friends and family increased: the percentage of students who responded positively increased from 60 percent to 85 percent. In comparison, negative responses decreased from 35 percent to 10 percent. In terms of learning outcomes, 85 percent expressed high expectations for the program before participation. After the program, 95 percent reported learning new and interesting content, demonstrating very high student satisfaction. The intention to continue participating in STEAM activities rose from 85% before the program to 100% afterward, and 90% of students recommended the program to their friends. These results further confirm students' high level of satisfaction with the program.

Q8. Desire to Discuss STEAM with Friends and Family: Before the program, 60 percent of students were interested in discussing STEAM topics with friends or family (45% rated 5 and 15% rated 4). In comparison, 35 percent showed little enthusiasm (ratings 1 and 2). After the program, the percentage rating 5 increased from 45 percent to 85 percent. Meanwhile, negative responses (ratings 1 and 2) decreased from 35 percent to 10 percent. This improvement shows the program encouraged students to share what they learned.

Q9. Extent of Learning in the Program: Before the program, 85 percent of respondents expected to learn (50% rated 5 and 35% rated 4). After the program, 95 percent reported they learned new and interesting things, with 70 percent indicating a very high degree of learning (rating 5) and 25 percent rating their learning as high (rating 4). Respondents who rated 5 increased from 50 percent to 75 percent. These results show the program met students' learning expectations.

Q10. Willingness to Continue Participation: Before the program, 85 percent were very willing to participate (rating 5), 5 percent were willing to (rating 4), and 10 percent said no (rating 1) in STEAM activities. After the program, all participants (100%) expressed a strong desire to continue (rating 5). This increase demonstrates the program's effectiveness in deepening learners' interest and motivation, positioning STEAM education as a path to ongoing growth. Such commitment supports self-directed learning and future career goals.

Analysis of findings in Domain 4:

First, students' willingness to engage in STEAM-related conversations increased noticeably before and after the program. This shows that the program encouraged students to share what they learned with others and significantly improved their social communication skills and motivation. Conversations with friends and family help students internalize knowledge, expand their thinking, and foster a collaborative learning environment. This desire to communicate also strengthens social networks and self-confidence. Therefore, for less proactive students, additional communication support and expanded family engagement programs are recommended.

Second, regarding learning expectations and outcomes, 85 percent expected to learn something before the program, and after its conclusion, 95 percent reported a new and interesting learning experience during participation, showing strong satisfaction with the

program. This suggests that the program's educational content and activities met expectations.

Third, regarding willingness to continue participating, 85 percent expressed a desire to participate before the program actively. After the program, all students (100%) said they wanted to continue participating, which indicates that the program significantly boosted students' interest and motivation and that STEAM education has established itself as a continuous learning pathway for growth and career development.

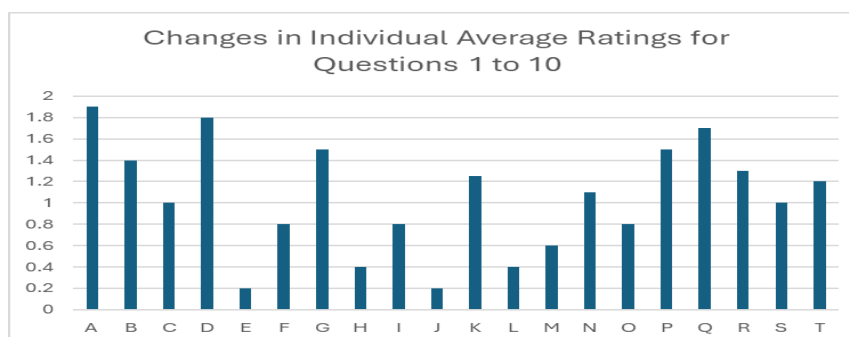
Fourth, 90 percent want to recommend the program to their friends, which is a strong point because expanding peer participation can strengthen social networks, support emotional stability, and sustain educational achievement. When friends participate together, students benefit from increased support and collaboration, which maximizes learning outcomes. Therefore, future programs should incorporate strategies and campaigns to encourage peer participation.

Overall, the program stands out as an exemplary educational model, having significantly enhanced students' motivation, technical skills, attitudes, and career awareness through hands-on experiences and a collaborative environment. To further strengthen the program, CHC Institute should emphasize individualized instruction and deeper family engagement.

4.2.2. Individual-Level Comparison of Pre- and Post-Survey Results

I analyzed changes in individual students' responses before and after the program to find the program's impact at the student level. In the bar chart (see Graph 1), the horizontal axis represents students (A to T), and the vertical axis shows score changes, illustrating each student's improvement. A value above 0 indicates improvement, 0 indicates no change, and a value below 0 suggests no improvement. The change in scores was calculated by averaging the difference in scores on 10 items before and after participating in the STEAM program; each student's average score change was calculated by summing the differences between pre- and post-survey scores for each question and dividing by ten (see Appendix 3).

Graph 1. Individual Average Rating Changes for Questions 1–10



The X-axis represents students, and the Y-axis displays the changes in their average ratings

An analysis of changes in survey scores before and after participating in the STEAM program showed that all 20 students demonstrated positive changes, and of those, 12 students improved by more than 1 point. More specifically, gains ranged from a minimum of 0.2 to a maximum of 1.9, and 6 students in the top 30 percent showed an average score improvement of 1.2 or higher, which indicates significant growth. Student A recorded a high score of 1.9, Student D 1.8, Student

Q 1.7, and Student P 1.5, demonstrating remarkable growth. The middle 40 percent of 8 students showed score changes ranging from approximately 0.6 to 1.1; while they exhibited meaningful growth, their average increase was somewhat lower than that of the top group. The bottom 30 percent of 6 students showed a relatively small improvement, with an average score increase ranging from approximately 0.1 to 0.5. This group includes students E, J, and H, among others, and they require additional personalized support based on their individual learning styles and environments.

The results indicate that the STEAM program had a positive overall impact on students' motivation and competency, and hands-on projects and collaborative learning significantly increased students' interest and confidence. However, improvements varied based on individual learning preferences, current levels of interest, and environmental factors.

Therefore, while these results support the appropriateness of the program's design and operational strategies, ongoing personalized support, long-term follow-up assessments, and motivation strategies are needed to account for individual differences.

For example, in addition to providing advanced learning opportunities focused on the top-performing group, it is necessary to maximize educational effectiveness by offering additional mentoring, remedial instruction, and emotional support to the group showing modest progress. As some students showed relatively small changes in their scores, this highlights the need for tailored support based on individual learning styles, interests, and environmental factors. This implies that long-term, individualized observation and support strategies are crucial for operating the program more effectively.

It is important to analyze each student's specific patterns of change to identify success factors and areas for improvement, and to establish a sustainable STEAM learning environment by strengthening social network building and individualized educational support.

4.3. Implications and Recommendations from Evaluation of Pre- and Post-Survey Results

After conducting independent analyses of the pre- and post-survey findings, as well as a comparative assessment at two levels—examining responses to each question across all participants and evaluating each respondent's answers across all questions—I draw several key implications for educational practice. These implications are outlined below.

- Strengthening Experiential Learning:** We have confirmed that hands-on experiences and the use of tools—such as various science and engineering experiments, logic and math hands-on activities, robotics, drones, 3D projects, and VR experiences—are key factors that significantly enhance students' learning outcomes. In addition, more exposure to STEAM activities increases STEAM knowledge and interest. Through these activities, students developed self-directed learning skills and creative problem-solving abilities, making this a highly effective teaching method that complements traditional lecture-based classes. Moving forward, program design should strengthen experiential, hands-on activities by adjusting difficulty levels to match each learner's abilities and interests and developing personalized assignments.
- Maximizing Learning Outcomes Through Collaborative Learning and Enhanced Communication:** The program improved students' collaborative and communication skills, and students notably increased their STEAM-related communication with friends and family. Because collaboration and communication strongly support creativity and improve problem-solving skills, we must continue expanding teamwork-centered activities and communication-enhancement training—student engagement and satisfaction increase when a collaborative environment is well established.

- **Meeting High Learning Expectations and Encouraging Continued Participation:** Satisfaction with learning expectations and outcomes increased significantly before and after the program, and a positive shift was observed, with 100 percent of participants expressing a desire to continue participating. This indicates that the educational content and activities effectively met the learners' needs and goals. To maintain this sense of achievement going forward, we must update program content and strengthen self-directed learning competencies.
- **The Need for Individualized Support and Differentiation by Grade Level:** Differences exist by grade level and among individuals in terms of early STEAM experiences, career awareness, and attitudes; some students exhibited low motivation and awareness. Significant variations also exist in individual student score changes, learning styles, and interest levels. Therefore, ongoing follow-up observations are crucial to strengthen tailored mentoring, counseling, and guidance programs suited to different ages and abilities. Tailored support that reflects individual characteristics will play an essential role in sustaining learning and improving outcomes.
- **Evolution of Motivation Strategies and Educational Content:** To sustain student interest, implement motivational techniques such as incorporating gamification elements, strengthening achievement motivation, and offering open-ended, inquiry-based learning. Furthermore, the curriculum should be reviewed regularly to reflect trends in science and technology and keep pace with changing times.
- **Enhancing Social Equity and Educational Accessibility:** We must expand opportunities for STEAM education for children from marginalized groups and help bridge the educational gap. We must continue to pursue these social values and expand the program by efficiently managing operational resources and ensuring long-term sustainability. To do so, we must establish a reliable, systematic management framework by expanding operational staff and implementing an effectiveness evaluation system.

Overall, the CHC Institute's STEAM program is an exemplary educational model that has significantly improved students' learning motivation, technical skills, attitudes, and career awareness through an experience-based approach and a collaborative learning environment. Moving forward, it is important to continue improving the program by emphasizing individualized and collaborative education while ensuring operational efficiency and sustainability. These efforts will lead to comprehensive educational outcomes and long-term growth.

5. Evaluation of End-of-Program Student and Staff Surveys

In this chapter, first, I analyze end-of-program surveys from students and staff independently to assess the program's impact and satisfaction. The student survey focused on 3 areas: Activity Interest; Team Project Experiences; and Skills Development. The results indicate that hands-on team-based STEAM activities increased their motivation, collaboration, and core skills. The staff survey covers 4 areas: Program Design and Delivery; Student Engagement and Skills Development; Community Impact; and Satisfaction with the Program. Staff responses show CHC contributed to improving student engagement and skills and had community impact by increasing access to STEAM education. Both students and staff showed high satisfaction with the program, indicating staff's strong support for reintroducing the program and students' willingness to rejoin.

Secondly, I compare students' self-reported STEAM skills growth with staff perspectives on students' STEAM skills growth to examine whether students' perspectives align with school staff's objective evaluation. Staff also observed notable improvements in students' attitudes, confidence, interest, and participation, highlighting the program's positive role in skills development.

5.1. Analysis of Students' End-of-Program Survey Results

In this section, I will present key findings and implications from the student survey results in 3 areas: Interest in Activities; Team Project Experience; and Skills Development and Learning Outcomes. Students' responses indicate that interest and knowledge in STEAM increased.

They were satisfied with the program and want to participate again. Responses to team project engagement were also positive. While confidence in learning STEAM subjects increased, responses on problem-solving skills varied. Some participants would benefit from more personalized support to improve problem-solving skills.

The program meets its educational objectives, but continued improvement in core STEAM competency skills is needed through targeted support and stronger teamwork. By building on these successes and addressing areas for growth, we can further strengthen the STEAM educational environment. Detailed survey results are provided below (see Annex 4):

Domain 1: Interest in Activities (Q1-Q4): Respondents reported high levels of interest and satisfaction, indicating the program is effectively increasing motivation. Willingness to participate and recommend the program was also strong. The interest in STEAM has grown significantly, and the program is seen as supporting educational goals. However, a few neutral responses highlight areas for improvement, so it will be important to reinforce the program's strengths and address the areas identified in those neutral responses.

Q1. Interest in activities: All found the activity interesting; 95 percent were "very interested," and 5 percent were "interested." This strong positive response indicates that the program's content, structure, and delivery effectively engaged participants, increasing their motivation and satisfaction. The high level of interest demonstrates that stimulating engagement through project-based, hands-on activities is essential for program success and sustained participation. These results highlight the importance of prioritizing participant interest in future program design.

Q2. Re-participation: Ninety percent indicated they are "very likely to participate again", while 10 percent were neutral. This high willingness to return reflects strong satisfaction with the program. Understanding the reasons behind the more reserved responses will help tailor improvements and further increase re-participation. These findings are key for assessing satisfaction and guiding long-term program strategies.

Q3. Suggest activity to a friend: Ninety percent would recommend the program to a friend, with "very likely" (75%) and "likely" (15%). Ten percent were neutral. While most participants are strong advocates, neutral responses indicate a need to communicate the program's benefits better.

Q4. Interest in STEAM increased: Ninety-five percent reported positively, with 75 percent reporting "increased greatly" and 20 percent reporting "increased" in interest in STEAM. Overall, 95 percent experienced greater interest, indicating the program effectively fostered engagement and met its educational objectives. Continued content development and participation strategies will be important to sustain and expand this positive trend.

Domain 2: Team Project Experience (Q5-Q7): Most respondents rated their team project work and team members' communication and cooperation positively. However, a few participants reported challenges with team projects. To improve the effectiveness and satisfaction of the teamwork projects, the program should develop collaboration training and provide targeted support for those who face challenges.

Q5. Team Project Engagement: All respondents said they worked well with their teammates; 60 percent rated "very well" and 40 percent rated "well." This indicates strong teamwork, trust, and communication among participants. The program effectively supports teamwork education, and future strategies should continue to emphasize team building and collaboration.

Q6. Team communication and cooperation: Eighty percent responded positively, saying team members communicated and worked together well, with 60 percent “very well” and 20 percent “well.” Fifteen percent indicated “neutral” and 5 percent “not well”. While most students were satisfied, some experienced communication challenges. Addressing these through targeted support, such as clearer role allocation, will further strengthen team cooperation and problem-solving.

Q7. Teamwork to solve problems: Eighty-five percent responded positively, saying the team works together to solve problems well, with 70 percent “very well” and 15 percent “well”. However, 15 percent rated it as average (10%) or below (5%), indicating some challenges. Future programs should provide targeted support, such as clearer role assignments and enhanced communication, to further improve teamwork in problem-solving.

Doman 3: Skills Development and Learning Outcomes (Q8-Q10): Most respondents reported increased self-confidence, STEAM knowledge, and problem-solving skills, reflecting the program’s effectiveness. However, a few showed minimal or moderate improvement, indicating a need for tailored support, such as individualized guidance, positive feedback, and stronger problem-solving strategies. Continued attention and support for each student will help all participants build confidence and develop their abilities.

Q8. Improved self-trust when working with a team: Eighty-five reported either “improved greatly” (65%) or “improved” (20%)—5% neutral and 10% little improved. While most benefited, some may need more individualized support and clearer role assignments. Future programs should focus on personalized guidance and fostering positive feedback within teams.

Q9. Increase in STEAM knowledge: Ninety-five percent reported improvement in STEAM knowledge, with 70% “increased greatly,” 25 percent “increased,” and 5 percent “average.” With 95% experiencing an increase, the program’s educational content and delivery were effective. Continued refinement will further enhance in-depth learning and educational value.

Q10. Self-trust in learning STEAM: Ninety percent reported improvement, with 55 percent “improved greatly” and 35 percent “improved”. 10 percent “average”. While most students gained confidence, some require additional support and feedback. Ongoing efforts to strengthen self-confidence should remain a priority.

Q11. Problem-solving skills: Seventy-five percent reported improvement in problem-solving skills, with 50 percent “increased greatly” and 25 percent “increased”. Twenty percent reported “average” improvement, and 5 percent reported little improvement. While most learners benefited, providing individualized support and systematic team-based strategies will help ensure all participants enhance their problem-solving abilities.

5.2. Analysis of Staff Members’ End-of-Program Survey Results

In this section, I will present key findings and implications from the staff survey results in 3 areas: Program Design and Delivery; Student Engagement and Development; and Program Community Impact and Re-joining. Results show that staff members responded very positively to the program, with high satisfaction and trust.

The program received very positive evaluations for supporting student learning and motivation and showed significant improvements in students’ skill development, demonstrating the program’s educational effectiveness and sustainability.

The results also show that the program provided high-quality educational opportunities to underprivileged children and helped narrow the educational gap. Furthermore, staff members recognized the importance of STEAM education within the local community and agreed that the program has positively impacted educational access and social equity.

Overall, respondents showed a high willingness to rejoin, and their high satisfaction levels support the program's long-term stability and growth potential. Detailed survey results are provided below (see Annex 5):

Domain 1: Program Design and Delivery (Q1-Q3): The program received positive evaluations from staff members for supporting student learning, program quality and effectiveness, and exposure to diverse STEAM activities. Staff members rated the program's overall quality and effectiveness highly, confirming its success in delivering high-quality STEAM education to children from underprivileged backgrounds. Staff members also agree that students developed creativity, experimental skills, and hands-on technical abilities through diverse STEAM activities. These outcomes demonstrate that the program's design and implementation align with its objectives and represent a meaningful achievement with potential for further development.

Q1. Level of Support for Student Learning: Ninety-four percent of respondents rated the program as supportive, with "very supportive" (63%) and "supportive" (31%). Only one respondent rated "neutral". These results confirm the program's strong effectiveness in supporting learning, enhancing student experiences, motivating participation, and fostering self-directed learning.

Q2. Overall Program Quality and Effectiveness: Ninety-four percent of respondents rated the program "excellent" (63%) and "good" (19%), with only one respondent rated "neutral". This reflects strong satisfaction with the program's design, content, support, and facilitation. The program has helped bridge the educational gap by delivering high-quality STEAM education to underprivileged children.

Q3. Exposure to Diverse STEAM Activities: All reported positively, with 81 percent reporting the students being "a lot" and 19 percent "quite a lot". This confirms students had ample opportunities to engage in a wide range of STEAM activities. The program effectively fostered experimentation, creativity, and hands-on technology experiences, increasing interest and strengthening STEAM skills.

Domain 2: Student Engagement and Development (Q4-Q7): Almost all staff members agreed that the program improved student learning engagement, core competencies, and confidence. In particular, staff members rated students' attitudes, confidence, and motivation to learn as having improved significantly, highlighting the program's educational effectiveness and sustainability. To ensure all students benefit equally, it will be important to expand resources and strengthen individual support.

Q4. Student Engagement and Interest Levels: Ninety-four respondents rated student engagement and interest as "very high" (50%) and "high" (44%), with only one respondent rated "neutral". This demonstrates the program's effectiveness in promoting engagement. These results strongly indicate that the CHC Institute's STEAM program has increased student engagement and interest, enhancing its impact. Frequent engagement develops core STEAM competencies, enhances motivation, and prepares students for future careers.

Q5. Teamwork and Communication Skills: Ninety-four percent of respondents rated students' collaboration and communication as "very good" (63%) and "good" (31%). One respondent answered "poor". This shows most students collaborated effectively, communicated actively, and demonstrated strong teamwork.

Q6. Frequency of Problem-Solving and Creative Thinking: Ninety-six respondents observed these activities with "very often" (56%) and "often" (38%). One answered neutral. This shows students regularly engage in problem-solving and creative thinking. The program consistently exposes students to real-world challenges and encourages independent, creative solutions. Continued expansion of resources and mentoring is essential to ensure all students benefit equally.

Q7. Improvements in Students' Attitudes, Confidence, Interest, and Learning: Eighty-seven percent rated improvement with "a lot" (56%) and "quite a lot" (31%). Most participants perceived positive changes. Thirteen percent rated "neutral". The program has enhanced students' attitudes,

confidence, interest, and motivation, leading to greater participation and self-directed learning. Enhanced attitudes and motivation also improve academic performance and encourage interest in STEAM careers.

Domain 3: Program's Community Impact and Re-joining (Q8-Q10): Staff members are highly aware of the importance of STEAM education as a core value for developing future talent and supporting the local economy. Almost all staff members agreed that the program expanded educational opportunities and accessibility to STEAM education in the community, and that CHC has positively impacted students' holistic growth and promoted social equity. High satisfaction and trust have led many staff members to express a strong desire to re-enroll, indicating a solid foundation for the CHC Institute's long-term stability and sustainability. Building on this positive feedback, it will be important to expand further and continuously improve the program to maximize its social value.

Q8. Recognition of the Importance of STEAM Education in the Local Community: Ninety-four percent rated STEAM education as Important in our community, with 88 percent rated it as "very important" and 6 percent as "important". Only one rated it "neutral," and no respondents gave low ratings. Respondents acknowledged its significance, indicating strong recognition of STEAM education's value in developing future talent and supporting economic growth in the community.

Q9. Expanded Access to Education and Opportunities: Ninety-four percent responded that this program improved access to STEAM education and expanded educational opportunities, especially for students in underprivileged communities. Eighty-eight percent rated "a lot" and 6 percent rated "quite a lot". Most staff members see The CHC Institute's program as increasing access to STEAM, supporting holistic student growth, and advancing social equality.

Q10. Intention to Re-enroll in the Program: All respondents are likely to support bringing this program back next year, with 88 percent "very likely" and 12 percent "likely". The results indicate strong ongoing interest. These results demonstrate high satisfaction and trust in the program's content and operations, confirming its effectiveness and social value for underprivileged children. This strong willingness to re-enroll provides a solid foundation for long-term stability and growth and motivates future expansion and improvement. Overall, satisfaction and trust are driving continued engagement, supporting the future development and sustainability of the CHC Institute's STEAM education.

5.3. Comparative Analysis of End-of-Program Student and Staff Survey Results

In this section, I compare the responses to common questions from both the pre- and post-surveys, focusing on five key items: willingness to participate in the program again; student participation and interest; assessment of collaboration and communication skills; development of problem-solving skills; and improvements in attitudes and confidence toward STEAM (see Annex 5). A comparative analysis of each item is presented below.

Item 1: Willingness to participate in the program again (Student survey Q2; Staff survey Q10): Both students and staff strongly agree that they want to rejoin the program next year. Ninety percent of students said they were eager to participate, and all staff (100%) said they support the program again next year. This positive response indicated that both students and staff members evaluated the program positively. Staff support for rejoining the program could stem from the program's design, delivery, and role in the community, while students' willingness to participate could stem from intrinsic motivation.

Item 2: Student participation and interest (Student survey Q1; Staff survey Q4): Ninety-five percent of students reported feeling "a very high" level of interest, and 5 percent "a high" level. Fifty percent of staff members rated the students' participation and interest as "very high" and 44 percent as "high". While students reported motivation and enjoyment slightly exceeded staff

observations, both groups demonstrated a high level of immersion in the activities. This indicates that the program design effectively reflected students' interests, thereby promoting participation.

Item 3: The assessment of collaboration and communication skills (Student survey Q5; Staff survey Q5): Sixty percent of students rated their performance as "very well" and 40 percent as "well," similar to staff evaluations, where 63 percent rated it as "very good" and 31 percent as "good." While staff rated it as a more objective and conservative evaluation approach and students rated it as a need to view themselves more positively, both groups agree that the students' collaborative abilities are quite excellent.

Item 4: The development of problem-solving skills (Student survey Q11; Staff survey Q6): Fifty-six percent of staff members reported observing these skills "very often," and 38 percent reported observing them "often." Among students, 50 percent reported "increased greatly," 25 percent reported "increased," and 20 percent reported "neutral," indicating that their direct perceptions were slightly more divided. This suggests that while staff observe students' behavior and attitudes in the moment, students' self-assessments may be influenced by the passage of time, their emotions, or their lower confidence in problem-solving skills than staff observations.

Item 5: Improvements in attitudes and confidence toward STEAM (Student survey Q8; Staff survey Q7): Fifty-six percent of staff rated the improvement as "a lot," and 31 percent as "quite a lot." Similarly, 55 percent of students reported "improved greatly" and 35 percent "improved," showing strong alignment. These results indicate that both groups acknowledge the program's effectiveness in fostering positive attitudes and boosting confidence toward STEAM.

In summary, a comprehensive analysis of student and staff survey results revealed strong agreement that the program was highly satisfying and effective. Staff members highlighted the program's well-designed structure, effective implementation, and community impact. This positive feedback from both groups also included support for rejoining the program. Students' strong intrinsic motivation likely contributed to their enthusiasm to rejoin the program.

Both groups observed high student participation and interest, highlighting the program's student-centered approach in fostering motivation and engagement. Student and staff evaluations were nearly identical regarding improvements in collaboration and communication skills, demonstrating significant growth in teamwork. Although students' self-assessments of problem-solving skills varied, they were consistent with staff observations. Both groups rated improvements in attitudes and confidence toward STEAM highly, confirming the program's educational effectiveness.

These evaluation results show that the program strengthens motivation, fosters engagement, enhances collaboration and problem-solving skills, and boosts confidence in STEAM. These findings can serve as a foundation for continuous improvement and expansion, particularly through more sophisticated, customized educational design that balances both student and staff perspectives.

5.4. Implications and Recommendations from Evaluation of End-of-Program Student and Staff Survey Results

After independently analyzing the student and staff survey results and then comparing them in 5 particular items, I identified several key implications for educational practice. These implications are detailed below.

First, students' strong willingness to participate again and strong staff support demonstrate that the program offers substantial motivation and satisfaction, supporting long-term sustainability. Since intrinsic motivation is crucial, enhancing the student participation experience should remain a priority in program design.

Second, high engagement and interest reported by both students and staff indicate that program activities effectively connect learning motivation with enjoyment. This highlights the importance of student-centered educational program design that fully reflects student interests.

Third, nearly identical positive evaluations from both groups regarding collaboration and communication skills suggest that team-based learning is effective. This implies the need for ongoing program management strategies to support collaborative skill development further.

Fourth, the slight discrepancy in problem-solving evaluations suggests that students' self-perceptions may differ from staff observations. This highlights the need to help students better recognize their growth by improving self-assessment skills and establishing an objective feedback system.

Fifth, consistent positive evaluations of improved attitudes toward STEAM and increased confidence are key indicators of achieving educational goals and confirm the program's effectiveness. This provides a strong foundation for developing expanded and advanced programs.

Sixth, to secure sustained resources and strengthen support systems to realize equal educational opportunities for children from marginalized groups, we must expand STEAM education opportunities for these children and help bridge the educational gap. We must continue to pursue these social values and expand the program by efficiently managing operational resources and ensuring long-term sustainability. To do so, we must establish a reliable, systematic management framework by expanding operational staff and implementing an effectiveness evaluation system.

Overall, these evaluation results demonstrate that the program strengthens motivation, fosters engagement, enhances collaboration and problem-solving skills, and boosts confidence in STEAM. These findings can serve as a foundation for continuous improvement and expansion, particularly through more sophisticated, customized educational design that balances both student and staff perspectives.

6. Conclusion

After evaluating the students' pre- and post-survey results, along with the end-of-program student and staff survey findings, I can answer 3 central research questions. The evaluation confirms that the STEAM after-school program led to measurable improvements in students' STEAM knowledge, interest, confidence, and skills. Staff members also reported that the program positively impacted not only students' skill development and engagement but also the broader local community. Regarding the alignment between participants' learning outcomes and satisfaction and the school staff's objective evaluations, both groups demonstrated similar perspectives in their survey responses. Overall, the findings indicate that the program implemented by the CHC Institute at Turner Elementary School is an effective educational model and makes a significant contribution to advancing students' STEAM education.

This program's success stems from a variety of hands-on experiential activities—including science experiments, hands-on math, robotics, 3D activities, drones, and virtual reality—that significantly boosted students' motivation and engagement in learning. The success of hands-on experiential activities is evident in the fact that all students expressed a desire to continue participating even after the program ended, indicating high satisfaction and the program's sustainability. As such, experiential learning plays a crucial role in strengthening students' creative problem-solving skills and self-directed learning abilities, while also fostering a proactive attitude toward learning and broadening their awareness of future career paths.

Although STEAM knowledge and core skills have improved, some areas still need strengthening. First, the program should provide personalized mentoring and counseling that accounts for differences in STEAM experience and career awareness across grade levels and among individual students. It also underscores the importance of establishing a systematic self-assessment and feedback system to enhance students' self-awareness regarding their problem-solving skills and creative thinking. Second, the program should expand the scope and proportion of hands-on activities to maximize students' interest and engagement, while tailoring difficulty levels and assignments to individual needs to strengthen self-directed learning capabilities. Furthermore, communication training and team projects aimed at improving collaboration skills should be implemented continuously, and a sustainable learning environment must be created through collaboration among teachers, families, and the local community to unlock every student's potential more effectively. Lastly, to make evaluations of the program's effectiveness even more reliable, statistical analysis techniques should be introduced, and qualitative case studies should be conducted in parallel to provide a rich interpretation of the context behind the numbers. This will serve as a basis for future educational policy proposals and assessments of scalability.

The CHC Institute's STEAM program serves as a model initiative that provides equal educational opportunities—particularly to children from underprivileged backgrounds—thereby reducing the education gap and positively impacting talent development across society. This program shows that hands-on education and individualized support are key to fostering inclusive, sustainable talent development. Moving forward, continuous innovation and attention—based on systematic development and operational efficiency—are required to ensure that all children can fully realize their potential.

Appendices

Appendix 1. Pre-survey questionnaire and results (20 respondents)

Ratings		5	4	3	2	1	
STEAM Experience and Knowledge	Q1. How many STEAM activities have you done before? (Examples: science experiments, robotics, Legos, drones, VR, computers) (1 = Not at all, 5 = A lot)	8	1	1	1	9	20
		45%	5%	5%	5%	45%	100%
	Q2. How much do you know about jobs like being a scientist, engineer, or computer programmer? (1 = Not at all, 5 = A lot)	3	1	6	2	8	20
		15%	5%	30%	10%	40%	100%
Interest and Engagement in STEAM	Q3. How much do you like STEAM activities? (1 = Not at all, 5 = A lot)	9	3	3	1	4	20
		45%	15%	15%	5%	20%	100%
	Q4. How much do you want to learn and try new things in STEAM? (1 = Not at all, 5 = A lot)	9	7	4	0	0	20
		45%	35%	20%	0%	0%	100%
Skills Development	Q5. How good are you at making STEAM projects (1 = Not good at all, 5 = Very good)	5	3	4	4	4	20
		25%	15%	20%	20%	20%	100%
	Q6. How good are you at solving problems? (1 = Not good at all, 5 = Very good)	7	5	6	2	0	20
		35%	25%	30%	10%	0%	100%
	Q7. How good are you at working with friends? (1 = Not good at all, 5 = Very good)	10	5	1	2	2	20
		50%	25%	5%	10%	10%	100%
Learning outcomes and Satisfaction	How much do you want to talk about STEAM with your friends or family? (1 = Not at all, 5 = A lot)	9	3	1	3	4	20
		45%	15%	5%	15%	20%	100%
	How much do you think you will learn new and interesting things in this program? (1 = Not at all, 5 = A lot)	10	7	1	2	0	20
		50%	35%	5%	10%	0%	100%
	Do you want to keep doing STEAM activities in the future? (1 = Not at all, 5 = Very much)	17	1	0	0	2	20
		85%	5%	0%	0%	10%	100%

Appendix 2. Post-survey questionnaire and results (20 respondents)

Ratings		5	4	3	2	1	
STEAM Experience and Knowledge	Q1. How many different STEAM activities did you try in this program? (Examples: science experiments, robotics, Legos, drones, VR, computers) (1 = Not at all, 5 = A lot)	19	1	0	0	0	20
		95%	5%	0	0	0	100%
	Q2. After this program, how much do you know about jobs like being a scientist, engineer, or computer programmer? (1 = Not at all, 5 = A lot)	6	4	7	1	2	20
		30%	20%	35%	5%	10%	100%
Interest and Engagement in STEAM	Q3. After this program, how much do you like STEAM activities (such as science experiments, robotics, drones, Legos, 3D, or VR)? (1 = Not at all, 5 = A lot)	17	3	0	0	0	20
		85%	15%	0	0	0	100%
	Q4. After this program, how much do you want to learn and try new things in STEAM? (1= Not at all, 5 = A lot)	15	5	0	0	0	20
		75%	25%	0	0	0	100%
	Q5. How much did you enjoy being part of this STEAM program? (1 = Not at all, 5 = A lot)	20	0	0	0	0	20
		100%	0	0	0	0	100%
Skills Development	Q6. After this program, how good are you at making STEAM projects? (1: Not good at all, 5: Very good)	10	5	3	1	0	20
		50%	25%	15%	5%	0	100%
	Q7. After this program, how good are you at solving problems? (1: Not good at all, 5: Very good)	10	5	4	1	0	20
		50%	25%	20%	5%	0	100%
	Q8. After this program, how good are you at working with friends? (1: Not good at all, 5: Very good)	12	7	1	0	0	20
		60%	35%	5%	0	0	100%
Learning Outcomes and Satisfaction	Q9. After this program, how much do you want to talk about STEAM with your friends or family? (1: Not at all, 5: A lot)	17	0	1	0	2	20
		85%	0	5%	0	10%	100%
	Q10. How much did you learn new and interesting things in this program? (1: Not at all, 5: A lot)	14	5	1	0	0	20
		70%	25%	5%	0	0	100%
	Q11. After this program, do you want to keep doing STEAM activities in the future? (1: Not at all, 5: Very much)	20	0	0	0	0	20
		100%	0	0	0	0	100%
	Q12. How much would you want your friends to join this STEAM program? (1: Not at all, 5: Very much)	15	3	2	0	0	20
		75%	15%	10%	0	0	100%

Appendix 3. Student-specific average rating changes for questions 1 through 10

Student	Q1 How many different STEAM activities did you try in this program?	Q2 How much do you know about STEAM jobs?	Q3 How much do you like STEAM activities?	Q4 How much do you want to learn and try new things in STEAM?	Q5 How good are you at making STEAM projects?	Q6 How good are you at solving problems?	Q7 How good are you at working with friends?	Q8 How much do you want to talk about STEAM with your friends or family?	Q9 How much do you think you will learn new and interesting things in this program?	Q10 Do you want to keep doing STEAM activities in the future?	Average Change
A	4	2	4	0	4	1	0	4	0	0	1.9
B	4	3	4	0	2	0	0	1	0	0	1.4
C	4	2	4	0	2	0	0	-2	0	0	1
D	4	2	4	0	4	0	0	4	0	0	1.8
E	-1	0	0	1	0	1	0	0	0	0	0.1
F	2	2	1	1	0	0	1	0	0	0	0.7
G	0	3	1	0	2	0	3	0	2	4	1.5
H	0	0	1	1	0	0	0	1	1	0	0.4
I	2	0	0	1	0	2	1	1	0	0	0.7
J	0	0	0	0	1	0	1	0	0	0	0.2
K	4	0	0	0	0	1	2	1	2	0	1
L	0	1	0	2	0	0	0	0	1	0	0.4
M	0	2	0	0	1	1	-1	2	0	1	0.6
N	0	1	1	1	2	0	0	0	2	4	1.1
O	4	4	0	0	0	0	0	0	0	0	0.8
P	4	3	0	1	3	0	5	0	-1	0	1.5
Q	4	4	0	1	0	2	5	0	1	0	1.7
R	1	4	1	0	0	1	4	1	0	0	1.2
S	0	2	2	0	3	-3	3	3	0	0	1
T	0	5	0	1	1	0	5	0	0	0	1.2

Appendix 4. End-program Student Survey Questionnaire and Results

Ratings		5	4	3	2	1	
Enjoyment and Satisfaction	How much interest and fun did you have while participating in the program ? 1 (not at all interested) to 5 (very interested)	19	1	0	0	0	20
		95%	5%	0	0	0	100%
	How much has your interest in STEAM increased? 1 (not at all increased) to 5 (increased greatly)	15	4	1	0	0	20
		75%	20%	5%	0	0	100%
	Would you like to participate in the program again ? 1 (not at all likely to participate) to 5 (very likely to participate)	18	0	2	0	0	20
		90%	0	10%	0	0	100%
	How likely would you suggest this activity to a friend ? 1 (not at all likely to suggest) to 5 (very likely to suggest)	15	3	2	0	0	20
		75%	15%	10%	0	0	100%
Team Project Engagement	How well did you work with your teammates ? 1 (not at all well) to 5 (very well)	12	8	0	0	0	20
		60%	40%	0	0	0	100%
	How much has your self-trust improved when working with a team? 1 (not at all improved) to 5 (improved greatly)	13	4	1	2	0	20
		65%	20%	5%	10%	0	100%
	How well did the team work together to solve the problem ? 1 (not at all well) to 5 (very well)	14	3	2	0	1	20
		70%	15%	10%	0	5%	100%
	How well did the team members communicate and work together? 1 (not at all well) to 5 (very well)	12	4	3	1	0	20
		60%	20%	15%	5%	0	100%
Learning Outcomes	How much do you think your self-trust in learning STEAM subjects has improved? 1 (not at all improved) to 5 (improved greatly)	11	7	2	0	0	20
		55%	35%	10%	0	0	100%
	How much do you think your skills in solving problems have increased? 1 (not at all increased) to 5 (increased greatly)	10	5	4	1	0	20
		50%	25%	20%	5%	0	100%
	How much do you think your STEAM-related knowledge increased during this program? 1 (not at all increased) to 5 (increased greatly)	14	5	1	0	0	20
		70%	25%	5%	0	0	100%

Appendix 5. End-program Staff Survey Questionnaire and Results (16 respondents)

Ratings		5	4	3	2	1	
Program Design & Delivery	How supportive was the program for student learning? (1 = not supportive at all, 5 = very supportive)	10	5	1	0	0	16
		63%	31%	6%	0	0	100%
	How would you rate the overall quality and effectiveness of the program? (1 = very poor, 5 = very good)	12	3	1	0	0	16
		75%	19%	6%	0	0	100%
	How much were students exposed to a variety of new STEAM activities? (1 = not at all, 5 = a lot)	13	3	0	0	0	16
		81%	19%	0	0	0	100%
Student Engagement & Skill Development	How actively did students participate and show interest in the program? (1 = very low, 5 = very high)	8	7	1	0	0	16
		50%	44%	6%	0	0	100%
	How would you rate students' teamwork and communication skills throughout the program? (1 = very poor, 5 = very good)	10	5	0	1	0	16
		63%	31%	0	6%	0	100%
	How often did you observe students demonstrating problem-solving or creative thinking? (1 = not at all, 5 = very often)	9	6	1	0	0	16
		56%	38%	6%	0	0	100%
	How much have students' attitudes, confidence, interest, and learning in STEAM fields increased as a result of this program? (1 = not at all, 5 = a lot)	9	5	2	0	0	16
		56%	31%	13%	0	0	100%
Program's Community Impact	How important is STEAM (Science, Technology, Engineering, Arts, and Mathematics) education for students in our community? (1 = not Important at All, 5 = very Important)	14	1	1	0	0	16
		88%	6%	6%	0	0	100%
	How much has this program improved access to STEAM education and expanded educational opportunities, especially for students in underprivileged communities? (1 = not at all, 5 = a lot)	14	1	1	0	0	16
		88%	6%	6%	0	0	100%
Satisfaction with the Program	How likely are you to support bringing this program back next year? (1 = not at all, 5 = very likely)	14	2	0	0	0	16
		88%	12%	0	0	0	100%

Appendix 6. Staff vs. Student End-of-Program Survey Comparison

Staff Survey						Student Survey						
Ratings	5	4	3	2	1		5	4	3	2	1	
How likely are you to support bringing this program back next year? (1 = Not at All, 5 = Very Likely)	14	2	0	0	0	Would you like to participate in the program again? 1 (not at all likely to participate) to 5 (very likely to participate)	18	0	2	0	0	20
	88%	12%	0	0	0		90%	0	10%	0	0	100%
How actively did students participate and show interest in the program? (1 = Very Low, 5 = Very High)	8	7	1	0	0	How much interest and fun did you have while participating in the program? 1 (not at all interested) to 5 (very interested)	19	1	0	0	0	20
	50%	44%	6%	0	0		95%	5%	0	0	0	100%
How would you rate students' teamwork and communication skills throughout the program? (1 = Very Poor, 5 = Very Good)	10	5	0	1	0	How well did you work with your teammates? 1 (not at all well) to 5 (very well)	12	8	0	0	0	20
	63%	31%	0	6%	0		60%	40%	0	0	0	100%
How often did you observe students demonstrating problem-solving or creative thinking? (1 = Not at All, 5 = Very Often)	9	6	1	0	0	How much do you think your skills in solving problems have increased? 1 (not at all increased) to 5 (increased greatly)	10	5	4	1	0	20
	56%	38%	6%	0	0		50%	25%	20%	5%	0	100%

How much have students' attitudes, confidence, interest, and learning in STEAM fields increased as a result of this program? (1 = Not at All, 5 = A Lot)	9	5	2	0	0	How much do you think your self-trust in learning STEAM subjects has improved? 1 (not at all improved) to 5 (improved greatly)	11	7	2	0	0	20
	56%	31%	13%	0	0		55%	35%	10%	0	0	100%