Service-Learning Project Improves Health Literacy via STEM Curriculum in Bronx NY Elementary Students

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Background

Bronx County, New York has a population of 1.46 million people, with an average per capita income of $18,269 and 31.5% of residents living in poverty (years 2010-2014)\(^1\). In an annual New York State review for health indices and community health, the Bronx has ranked last out of 62 counties since 2010\(^2\). Bronx county has been deemed a “food desert,” an urban area where it is difficult to buy affordable or good-quality fresh food\(^3\). The poverty and community environment in the Bronx likely contributes to physical inactivity and unhealthy eating habits of residents. Decreased physical activity and poor diets are implicated in higher rates of type 2 diabetes, hypertension, cardiovascular disease, obesity, and cancer\(^4\). Furthermore, high school graduation rates in the Bronx in 2013 and 2014 were 53% and 55%, respectively, whereas the rest of New York State had 75% and 76%, respectively for those years\(^5\). Education level has been demonstrated to have a causal effect on health outcomes and behaviors\(^6\). It is clear that health awareness and literacy are inadequate in Bronx County, however, it is possible that early age interventions could make substantial strides in increasing academic success and healthy habits. To this end, we created Hoops 4 Health (H4H), a community-based service learning organization of volunteer medical and graduate students at Albert Einstein College of Medicine (AECOM). H4H engaged youth at the after-school program of the South Bronx Police Athletic League (PAL) to 1) develop a STEM curriculum for fourth and higher grade students at the PAL, which offers an academic, athletic, and cultural outreach program of the South Bronx Police Athletic League (PAL) to 1) develop a STEM curriculum for fourth and higher grade students at the PAL, which offers an academic, athletic, and cultural outreach program for assisting curricular development.

Materials & Methods

- **Hoops 4 Health at the Police Athletic League**
  - We designed an innovative monthly STEM education and physical fitness curriculum for fourth and higher grade students at the PAL, which consists of an after-school program Monday through Friday from 3pm-6pm. Over the past three academic years, we have held 1.5 hour sessions every month, where the students participated in a forty-five minute STEM module followed by forty-five minutes in the gymnasium for physical fitness and additional health-related counseling. To assess the impact of the intervention, we administered a 16-question survey at the initial visit in September, and then again at the final meeting in May. There was also a nine-question feedback survey to evaluate current interest in nutrition, science, health, as well as participants’ affinity for the program.

  **Year 1 (Pilot; n=13)**
  - One class of 4th and 5th graders. Only feedback survey administered. Taught the following STEM modules:
    - **Blood Types**
    - **Autonomy**
    - **DNA Extraction**

  **Year 2 (n=40)**
  - Taught 4th and 5th graders, one class of each. All three surveys administered. Taught the following STEM modules:
    - **Yeast/Sugar/CO₂, Balloon**
    - **DNA Extraction**
    - **Lava Lamp**
    - **Stimie**

  **Year 3 (Current; n=39)**
  - Teaching 5th and 7th graders, one class of each. Pre-survey administered. Taught the following STEM modules:
    - **Ballons and Baking Soda**
    - **Stimie/Physics of Flight**
    - **Brain Teasers and Acoustics**
    - **Bandy Bones – Calcium/Vitamin D**

- **Teaching 5th graders:**
  - Taught the following modules:
    - **Brain Teasers and Acoustics**
    - **Bandy Bones – Calcium/Vitamin D**

- **Teaching 7th graders:**
  - Taught the following modules:
    - **Brain Teasers and Acoustics**
    - **Bandy Bones – Calcium/Vitamin D**

- **Materials & Methods**

**Results**

- How likely are you to recommend this program to a friend?
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**Discussion**

Our mission is to increase appetite and awareness regarding healthy habits while simultaneously instilling in STEM education with a long-term goal of increasing the health status and graduation rates in Bronx youth. Over the course of three years conducting a monthly STEM and physical activity curriculum at the South Bronx Police Athletic League (PAL), we found that students gave positive reviews of the program (Figure 1) using feedback surveys; however, we wanted to assess our impact on specific health habits with an RIB-approved pre- and post-survey. Before quantifying our impact, we were able to potentially confounding covariates influencing our results. Specifically, we found underlying relationships between interest in Science/Math and physical activity, as well as familial STEM involvement and health habits (Figure 2).

- Students who reported math or science to be their favorite subject were physically active on more days than their peers (p<1).
- Students who reported having parents in a STEM career were 2.81x more likely to think about their health (p<1). 4.58x more likely to eat vegetables in a given day (p<0.01). 6.27x more likely to be physically active in a day (p<0.01). and 12.29x more likely to feel that physical activity was important (p<0.001) than their peers.

Although our sample size was too small to include the covariates in our assessment of the program’s impact, we were able to compare the 46 pre-survey responses to the 40 post-survey results, 46 of which attended at least half of the voluntary H4H sessions (Figure 3).

- Students showed unexpected decreases in interest in science, importance of physical activity, and knowledge of healthy eating, while showing an increase in the number of minutes spent when physically active.
- Possible explanations for these contradictory results include: the Fisher’s T-test being the best not ideal model for our mostly ordinal data; the dropping out of one 5th grade class and changing student population; and survey fatigue (Figure 3).

- More students in the initial survey reported math or science as their favorite subjects than in the final survey (p<1). We interpreted this to show that the subjects surveyed may be different between the two surveys. Despite this drop-off, we were able to determine the effect of prior participation on student responses in the pre-survey given at the beginning of year 3 (Figure 4).

- Students were 4.9x more likely to have spent more days thinking about their health (p<0.05).

This speaks to the enduring message and impact of Hoops 4 Health.

**Future Aims**

- Adjusting the survey used to attain better results in the following ways:
  - Reduce survey fatigue: more space and colorful, helpful pictures
  - Self-generated anonymous unique identifiers to track individual changes.
- Continue partnering with PAL, increasing sample size
- Develop a robust method to follow-up with prior participants and assess long-term impacts of H4H

**References**