ABC123

Yeseul Heo, Maya Holikatti, Dominic Kynkor, Elise Morton

Problem Statement

Problem

How might we increase pre school student opportunities for learning outside of the school at after school programs to bridge the gap between what is taught at school and what the students retain?

Significance

This problem persists throughout the United States where under resourced after school programs aren't sufficient enough to bridge the gaps in learning. These gaps in education need to be filled early on in order to ensure that it doesn't impact learning later on. When these gaps remain unfilled students end up failing classes and subsequently dropping out of high school. These students are unable to make better lives for themselves and move up the social ladder. (Posner & Vandell) Without fixing this issue, our society has more high school dropouts and/or more students without a college education--something that is necessary it today's society. (Afterschool Alliance)

Possible causes of the problem are lack of funding and resources. (Zarret, Abraczinskas, Cook, Wilson, & Ragaban). Wealthy families have the resources and money to pay for private after school programs where each student has sufficient one on one attention. However, low income after school programs lack funding for tangible resources to enhance learning and extra tutors/staff members. The staff to student is generally higher so students don't get the help they need. (Afterschool Alliance)

Society as a whole would benefit great if the problem was solved. We would have a more educated society with individuals who are actively engaged in their learning. This will lead to better outcomes in jobs and a higher standard of living. In the long run it would increase the wealth of the nation. (Education and Wealth). Scandinavian countries are rated as nations with the happiest individuals--data shows that these countries have more college graduates because so many resources are dedicated to early education. Their after school programs--even under resourced ones--maximize the resources available. (Rechnegal).

Stakeholders

Stakeholders include:

- Low income families--students and parents. Affects the students directly because it's their education and parents can be involved less with adequate after school programs.

- Public Schools: Standardized test scores of public schools would increase thus potentially increasing the school's funding and the name. This has the potential to change school's environment and provide better programs/resources for students.
- United States Government: More citizens with a high school diploma and potentially college education. Increase the society's "well-being" leading to content society and wealthier nation.
- Teachers: Public school teachers are generally don't have enough time to provide individual help. Bad standardized test scores could negatively impact the teacher but with proper after school programs test scores would increase and alleviate stress for teachers.

Context and Existing Solutions

In under-resourced communities and after school programs, parents may want to be involved in students' education but not have the financial means to invest in quality education, or not have the time to spend with their children to teach them things at home. We found that the Salvation Army Bellwood Boys and Girls Club was overcrowded and had a waiting list for children trying to attend the after-school program there. The Boys and Girls Club has tutors and does homework with the children during the week, but has free time and fun activities on Friday afternoons. It is clear that STEM exposure at a young age is crucial for children's development, yet this issue is not being properly addressed in these environments (Dejarnette).

There have been solutions that went into under-resourced after school programs and implemented simple instruction for an afternoon. These solutions lack the infrastructure to continuously feed students' imaginations, answer their questions, and develop their STEM backgrounds. When we visited the Salvation Army Bellwood Boys and Girls Club, we met Mrs. Patrice Holt, a director of all the Atlanta Boys and Girls clubs, who told us these groups had come into the Boys and Girls club but after they left, the kids wanted to learn more but did not have the resources to.

There are also solutions like week-long summer camps for students to attend. These camps are only truly ideal for students who have obvious interest in these fields, and not necessarily the typical student. Our solution would target every child in an under-resourced after school program, not just those who have already expressed interest in STEM. Our goal would be to expose more students to STEM who may not have otherwise had the same opportunities as children who have a lot of interest in it, or who have many more resources.

We need to get involved because no current solution addresses the children in the under-resourced after school programs' need for STEM exposure early on (Nugent et al.).

Why is it still a problem?

There have been attempts to address the issues of lacking STEM education, but frankly many of the professionals in these under-resourced areas have a higher priority of making sure the children are in safe spaces, have enough to eat, etc. and are less worried about the long-term effects of STEM education. We plan to help address the STEM need by giving kids exposure to STEM education early on, with hands-on experiments and interactive activities. We are not increasing the resources per se, but addressing the need for STEM within the bounds of their lack of resources.

It is hard to find the manpower of volunteers to work with children regularly when there is no pay or incentive for them. The children also may not have the initiative to work on STEM projects on their own at home, especially considering we can not assume parents will be home with them. To have students work by themselves, a solution must be extremely engaging and fun, which is very difficult to come up with.

Volunteers working in the boys and girls club also frequently don't have the time or experience to come up with science experiments they can do with kids. In order to have relevant, affordable, and sustainable projects, there needs to be a lot of thought put into designing activities, which is our goal for this project.

Proposed Work

Goal

By the end of this project, our goal is to have given kids in a low income environment the interest and confidence to pursue STEM-related activities or a STEM career. We are focusing on providing low-cost, reusable, and engaging materials and expertise to implement a STEM curriculum in a Georgia afterschool program. If successful, we hope that children will be more receptive and interested in STEM activities and opportunities both in the present and the future.

Objectives

Objective 1: Create an engaging, fun, safe, reusable, and low cost STEM activities.

Background

One of the primary goals of implementing a STEM curriculum in a low-income environment is creating activities that are as entertaining and educational as possible while also allowing them to be reusable and affordable for the program they are implemented into to maintain. In order to maximize affordability, we need to create activities that are low-cost to create and replace, while also making them durable in order to minimize long term maintenance costs or materials costs.

We also want to create STEM activities that are as fun and engaging as possible. Revision of activities and creativity are necessary in order to make sure the lesson comes across clearly and that the children are interested in the activity.

Above affordability and engagement, we must always place safety of components to activities above all other goals. Making activities "child-proof" and functional is our primary concern.

Methods

First we must brainstorm activities and come up with a large set of possible activities we can implement in the afterschool program. Then we will narrow down the number activities to a certain set

and define the learning objectives and procedures for that activity. We will then revise the activities to ensure they are safe, fun, and reusable, create lists of required materials, and create lists of instructions. Finally we will assemble the materials and organize them for ease of use.

Outcomes

The outcome of this objective is creating STEM activities that minimize long term costs, engage students with interesting principles from STEM, and ensure that the activities are safe and easy to follow for both instructors and kids.

Anticipated Problems

One of the biggest problems we may encounter is determining how engaging an activity is from a child's perspective. It might be difficult for us to see how fun an activity might be from a child's experience.

Objective 2: Compile and perfect easy to read instructions in order to complete STEM activities.

Background

Children in low resource environments have a harder time coming across expertise needed to teach STEM education in afterschool programs and thus have a harder time coming across exposure and mentorship relating to STEM.

Methods

First we will assemble and test activities for students and mentors to complete, and then record the steps needed to complete the activity. We will then attempt to convert that record into a visual/text based instruction sheet that will aim to be accurate, clear to read, and concise. Most likely our visuals will be created in a image manipulation software like Photoshop.

Outcomes

We hope these activity guides will both help explain STEM principles to children and their mentors and enable children and their mentors to perform experiments together and individually.

Anticipated Problems

A problem we may encounter is that students might not be willing or able to perform activities outside the afterschool program or without the guidance of a parent or mentor. In order to prevent this from occurring we want to have children engage in a mentor-led activity, and then provide children with activity kits that they can complete for entertainment whenever they want.

Objective 3: Implement activities in a way that both provides mentorship to kids completing activities as well as rules for how activities should be used.

Background

Lack of organization and/or order is frequently observed in under-resourced communities, especially in afterschool settings where a structured agenda is often absent. Allowing children freedom to explore different methods to approach STEM education as well as providing them with opportunities to follow instructions is essential. Appropriate understanding of rules and expectations particularly in a community sharing allows children to fully experience the gift of sharing and collaborating with one another.

Methods

Clear communication between instructors and children is the key to implement both mentorship and rules in educational experiences. Activities will be completed in small groups in order to provide each student with personalized attention. The overall outline of the activities will be described to the children verbally or visually prior to the start of the activities. Clear instructions will be given to children throughout the activities until the cleanup of the materials used for the activities. Reward system will be implemented in order to promote positive behavior in children after completion of the activities.

Outcomes

Having a clear understanding of the purpose and the process of the activities designated to them, children will be able to follow the instructions as outlined by the agenda and the instructors. The reward system will guide children to demonstrate the expected positive behavior for future activities.

Anticipated Problems

Some afterschool programs deal with children of different ages at once. The varying age and educational levels in children may bring difficulties in accommodating a group of students in the process of completing educational activities. As well, the number of children in a small group significantly affects the effectiveness in communication between students and instructors. Personalized attention may be difficult to be allocated to all students, making it difficult for the instructors to provide them with clear instructions in completing various activities.

Objective 4: Create a activity-feedback-reward loop in order to foster interest in the activities.

Background

Positive reinforcement revolves around providing a specific rewarding stimulus following a positive behavior in order to make it more likely that the same behavior will occur again in the future. The favorable outcomes after an action strengthens that particular response or behavior. Children are

extremely driven by the reward system. Rewards typically include smiling faces of adult figures or peers, compliments, and gold star stickers.

Methods

After completion of activities, simple yet significant items can be rewarded to children who have successfully achieved the purpose of the activities. Physical evidence that symbolizes positive behavior becomes a means of positive reinforcement. These items may be displayed in a shared community setting or handed out to children to keep.

Outcomes

After making a correlation between a positive behavior and a rewarding item, children will modify their actions in future activities in a more positive direction. The satisfaction that the children are able to receive upon following given instructions throughout the completion of assigned activities will drive students' engagement and motivation.

Anticipated Problems

As previously stated in objective 3, it is difficult for the instructors to handle children of different age and educational levels at once. Different age groups will show different reactions to the reward system. Some children may not have any reaction or response to the rewards and may fail to change their negative behaviors. Some may display aggression when reward is not granted when anticipated. There is a possibility that negative behaviors can be induced by the implementation of the reward system.

Objective 5: Spread and expand curriculum model to other low-resource programs.

Background

Rather than implementing a curriculum in multiple locations at once, it is more effective and practical to have a starting point at one location or program and expand the curriculum to other existing programs. Trial-and-error process guides successful implementation of a curriculum by displaying distinctions between expectations and reality. Changes can be made throughout the expansion of the curriculum in order to better suit children in various locations.

Methods

The first afterschool program that the curriculum will be implemented will serve as the model for other programs in the future. The successes and failures of the curriculum will be carefully observed and measured; changes will be made to the original system until its stable settlement before it is expanded to different locations.

Outcomes

When the curriculum is fully settled in an afterschool program, its expansion will be able to serve children in multiple areas at once. New locations will be able to observe the successful results of the curriculum and incorporate it to their targeted students. These programs with newly adopted curriculum will also be able to adjust and personalize the system to better suit children in their locations.

Anticipated Problems

The process may be time-consuming. It may take a long time to fully settle a curriculum at one afterschool program, especially if multiple major changes need to be made to the design of the curriculum. As well, although different afterschool programs may target children in similar age groups and backgrounds, it may not always be the case where students in one program respond in similar ways that students in another program do. Integration of multiple locations may make the implementation of the curriculum less personalizable to children.

Project Team

We currently have four people on our Grand Challenges Team: Maya Holikatti, Yeseul Heo, Ellie Morton, and Dominic Kynkor. There are 6 staff members at the Boys and Girls Club at a time, with up to 120 kids. There are tutors and volunteers present at the Boys and Girls Club at all times; this is who we are counting on to lead the science experiments and problems. We have a connection with Cooper Link, a brother of the Chi Phi Fraternity, whose fraternity goes to the Boys and Girls Club regularly. We could train the brothers there and other volunteers to do the science experiments with the children at the Boys and Girls Club.

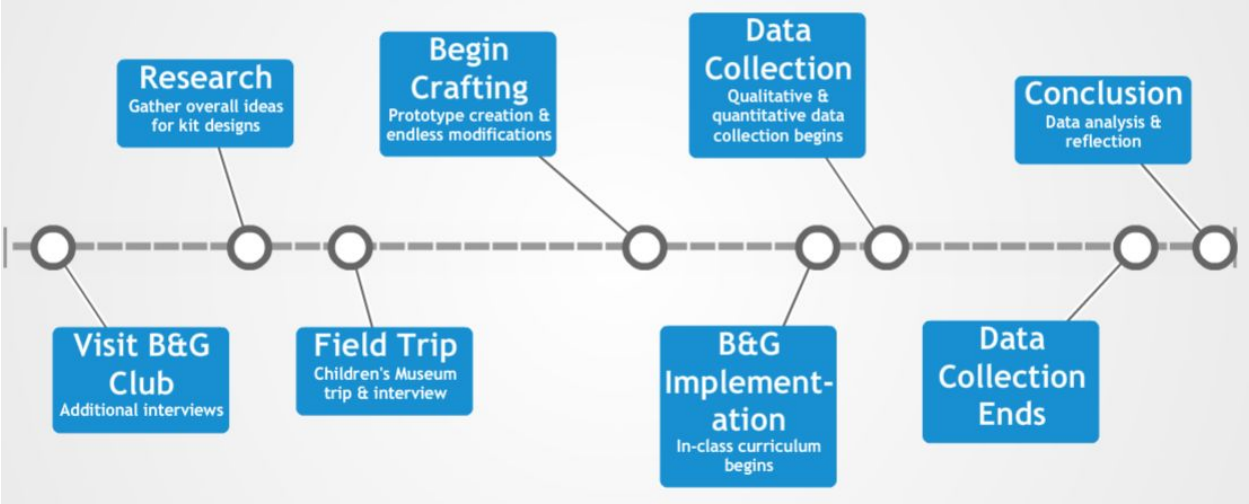
Everyone on our development team will contribute to the design and implementation of the kits. We need people with these skills (one person may fulfill multiple of these tasks):

- Someone competent at 3D modeling in order to 3D print materials
- Someone who excels at finding good deals online for materials in bulk
- People willing to test the science experiments and choose experiments that are easily sustainable
- Someone competent in training volunteers
- Someone competent in writing clear instructions
- Someone who excels at making clear video demonstrations of experiments

Possible mentors include:

- Patrice Holt, director of Atlanta Boys and Girls Clubs
- Kevin Omolo, graduate student and previous facilitator
- Alice Francis, previous Grand Challenges education project

Timeline



* Fall 2017 will cover Visiting the Boys and Girls Club through the beginning of crafting the activities
* Spring 2017 will cover Implementing programs and collecting data

Budget

Materials and Supplies

Reusable

3D printing material	3 spools at $25 each
Plastic boxes for activity kits	4 12-packs of plastic bins at $30 each
Construction materials (piping, dowels, wire, popsicle sticks)	$5 per experiment * 10 experiments at a time (decreases as we find materials to reuse)
Shelf for Boxes	$30

Non-Reusable

Office supplies (paper, adhesives, labels)	$100

Maintenance

3D printing material	*See above*

We don’t expect any expenses for equipment, travel, or service.

Expected Outcomes and Future Directions

Our first step is to revise fun and engaging stem related activities by using a mixture of online resources and fun experiments we can learn from teachers who have done demos before. We then want to compile both instructions and materials for activity kits intended for students and instructors about STEM and that teach fun and interesting concepts. Then we want to implement activities in a way that both provides mentorship to kids completing activities as well as rules for how activities should be used. We will also attempt to create a activity-feedback-reward loop in order to foster interest in the activities. Finally we will attempt to spread and expand our curriculum model to other low-resource programs.

Sources

APA Style

After School Alliance. (2016). Afterschool: Positive Outcomes and Promising Practices.

Dejarnette, N.K. (2016). America’s Children: Providing Early Exposure to STEM (Science, Technology, Engineering and Math) Initiatives.

Holt, Patrice. (2017, January 27). Personal interview.

Nugent, G., Barker, B., Grandgenett, N., & Adamchuk, V. I. (2010). Impact of Robotics and Geospatial Technology Interventions on Youth STEM Learning and Attitudes. *Journal of Research on Technology in Education,42*(4), 391-408. doi:10.1080/15391523.2010.10782557

Posner, J. K., & Vandell, D. (1994). Low-Income Children's After-School Care: Are There Beneficial Effects of After-School Programs? *Society for Research in Child Development*. Retrieved April 24, 2017.

Recknagel, C. (2011, July 18). What Makes Scandinavia Such A Happy Place? Retrieved March 16, 2017.

Reading Improvement, 53(4), 181-187.

Wiborg, S. (2004). Education and social integration: A comparative study of the comprehensive school system in Scandinavia. *London Review of Education*, *2*(2), 83-93.

Zarrett, N., Raczinskas, M., Wilson, D., & Ragaban, F. (2016). Promoting physical activity under-resourced afterschool programs: A qualitative investigation of staff experience and motivational strategies for engaging youth. *Applied Developmental Science*. Retrieved April 24, 17.