Kindezi STE(A)M Truck Program Overview

September - December 2015

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OVERVIEW OF STEAM TRUCK & COMMUNITY GUILDS

Since 2014, Community Guilds has focused on delivering an innovative, gap-closing approach to education through its mobile makerspace, STE(A)M (Science, Technology, Engineering, (Arts), and Math) Truck, targeting elementary and middle school students. The STE(A)M Truck experience is anchored by a rigorous, experiential learning-based curriculum, which is brought to life in a mobile maker-space with the support and collective expertise of the local community. STE(A)M Truck creates a community of adult STE(A)M role models – "maker-mentors," STE(A)M designers, and local artists, along with "traditional" educators – and connects them closely with youth; together, they tackle real problems, design solutions, and build things.

Over the course of the program, students learn the design process and develop a sense of self-efficacy as they create their own solutions. Community Guilds also strikes a chord with educators, who become inspired themselves by the experience and the impact on students, and leave better-equipped to bring similar instructional concepts and methodologies into the classroom.

In its first full year of operation, over 300 students completed a STE(A)M Truck 20-day program. Community Guilds has partnered with several organizations, including district schools (e.g., Atlanta Public Schools), charter schools and networks (e.g., KIPP Metro Atlanta, The Kindezi Schools), and community organizations (e.g., Boys & Girls Clubs of Metro Atlanta).

Community Guilds' programming has also helped build students' non-cognitive skills and awareness of a breadth of life opportunities they need to be successful:

Non-cognitive Skills

- More than 97% of students improved their non-cognitive skills (e.g. grit, curiosity, problem solving)
- More than 90%of students performed at satisfactory competency levels on non-cognitive skills
- Increased student interest and willingness to take risks and try new things in learning
- Improved classroom behavior (e.g., significant decline in discipline referrals)

STEM skills and awareness

- More than 87% of students have improved applied STEM skills
- 2/3 (and as high as 90%) of students perform at satisfactory competency levels on STEM skills
- More than 73% of students have increased interest and confidence in pursuing a STEM career

The overall value proposition is powerful. Community Guilds enables students in even the least-resourced schools to access making-focused learning experiences, and gives districts and schools the opportunity to explore the benefits of an innovation lab without building one, while beginning to deepen their own capacity around experiential learning.

Over the next five years, Community Guilds is committed to strengthening and deepening its impact, while driving to greater scale and sustainability, in two main ways. First, Community Guilds will continue to refine its STE(A)M Truck and student engagement model, both by codifying and standardizing certain elements and by piloting variations to others. Second, Community Guilds will work to deepen its supports to educators over time, extending design thinking techniques into the classroom and creating longer-term sustainable impact.

Community Guilds has also set ambitious yet achievable plans to grow its reach while preserving its high bar for quality and maintaining a low cost for the programming (today, an average program cost per student of $200-300). Community Guilds aims to more than double its reach in 2015-2016, with plans to serve between 900-1,000 students per platform per year at full utilization, and to expand to four platforms serving over 4,000 students in Atlanta and surrounding districts by 2020.

PROJECT: BRIDGE BUILD

Description: In teams of 3-4, students build a cardboard bridge strong enough to support their weight when placed above a kiddie pool filled with water.

Length: 2 days

Day 1: Sketch & Prototyping of Bridges

Students learn about various types of bridges, sketch possible bridges on paper and then build a prototype (or scale model) out of K'nex. Then, students test model bridges with toy cars to see how well the bridges can withstand weight.

Day 2: Building of Cardboard Bridge

Students apply their insights from Day 1 to build a larger bridge out of cardboard and then test their bridges by walking across them!

PROJECT: JOURNALING & NAME TAGS

PROJECT: JOURNALING & NAME TAGS

Description: Each student receives their laser cut name tags and then assembles their STE(A)M Truck journal that they use to take notes, brainstorm project ideas, and reflect on project progress.

Length: 1 day

Day 1: Receive Laser Cut Name Tags

Student name tags are laser cut to show each student's name. Once cut personalize their nametags by adding color.

Assemble Journal and Laser Cut Journal Cover

Student's journals are made of a chip board cover –similar to cardboard but made from a stiffer material – and paper. Each cover is laser cut to display the STE(A)M Truck logo. Three clasps bind the cover and paper together.

PROJECT: STAMPS

Description: Students make Halloween/fall-themed stamps.

Length: 2 days

Day 1: Sketching

Students walk around school to look for inspiration from nature (e.g. trees, leaves, pine cones, etc.). Students collect materials, brainstorm ideas for stamps, and then sketch their final stamp designs.

Day 2: Making Stamps

Stamps are laser cut onto rubber. Students use Sculpey clay to make stamp handles, which are then hardened in the oven and attached to the stamp. Finally, students use their stamps to make Autumnal art.

PROJECT: PRINTER DECONSTRUCTION

Description: Students deconstruct a printer and then create art from the parts.

Length: 2 days

Day 1: Deconstruct Printer

Students learn safety procedures, such as using eye protection and gloves and how to safely use a drill. Then, students take apart printer –learning the parts and how they work as they go.

Day 2: Create Printer Art

Students create art from the deconstructed parts.


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PROJECT: SUPERHERO MASK MAKING

Description: Students consider what impact they would want to have on the world if they had superhero powers. Using these ideas, students create their superhero identity and make their own original superhero mask.

Length: 2 days

Day 1: Brainstorming Superpowers & Making Masks

Students brain dump all of their favorite superheroes and their characteristics. What superpowers do they have? What positive impact do they have on their cities (e.g. fighting crimes, protecting environment? What is their Achilles heel (e.g. kryptonite). Students design their own superheroes and begin making their masks.

Day 2: Creating a Superhero Identity through Writing

After completing their masks, students create and write fictional stories.

PROJECT: SCRATCH ANIMATION & CODING

Description: Students are introduced to computer programming as they create a simple computer animation or game.

Length: 2 days

Day 1: Introduction to Coding and Scratch: Students are introduced to Scratch, a MIT-created programming environment for beginning students. They create user accounts and practice basic skills – making characters walk, move, jump, speak, and change costumes.

Day 2: Make Scratch Animation or Game

Students create their animation or game using what they learned on Day 1.

PROJECT: ZOMBIE WINDOW GUARDS

Description: In pairs guided by a STE(A)M truck mentor, design and develop window guards for the side windows of the STEAM truck.

Length: 2 days

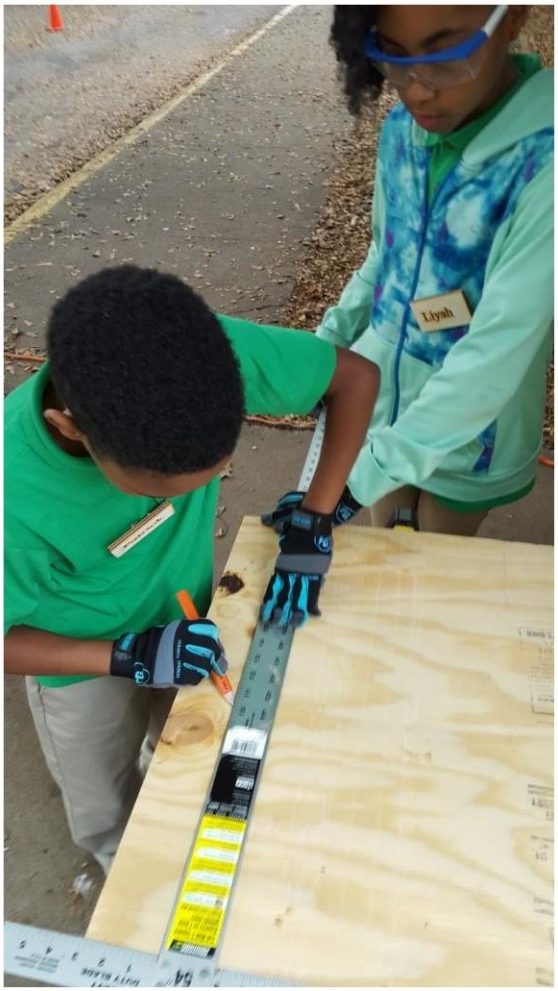
Day 1: Prep Window Guards

In pairs, students work together using measuring tools and cutting tools to appropriately size 1/2 inch plywood for use as side window guards. Using an electric drill, students attach metal reinforcement straps.

Day 2: Paint Window Guards

The pairs worked together to decorate one side of the window guards (one per class) using tempura paint.


Nina
PLANO
11" ORGANIZER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STEAMTRUCK

PROJECT: DESIGN THINKING – ORGANIZATION AT KINDEZI

Description: A team of students and their teacher worked together to solve the problem: "How might we be better organized at Kindezi?" using the design thinking process.

Length: 6 days

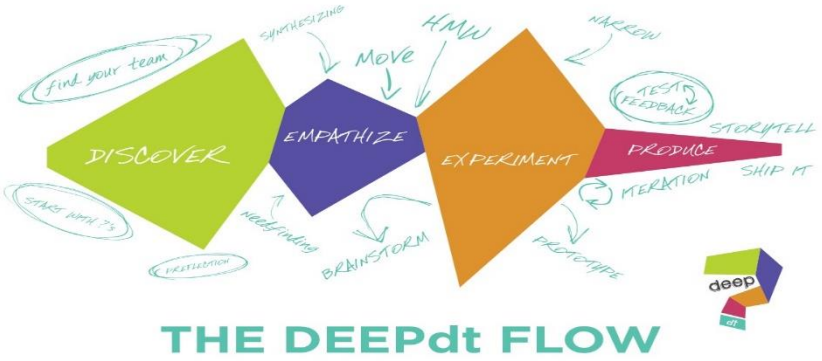
Curriculum Standards:

NGSS-3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

M.5.MD.5: Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

Day 1: What is design thinking?

Students and their teacher are introduced to design thinking through a one-day design challenge of designing something fun for a partner. In pairs, students learn what their partner does for fun, designs something new out of low-tech prototyping materials, and then presents their design to get feedback on their creation.



Day 2: Discover & Empathize

Students and their teacher return to the main question *how to improve organization at Kindezi*. The teams brain-dump things that are organized and disorganized at Kindezi. Then, each team narrows down the list of disorganized areas and chooses an area to focus on. Students then observe how the area they chose to focus on – cubbies and binders – is disorganized.

PROJECT: DESIGN THINKING – ORGANIZATION AT KINDEZI

Day 3: Experiment

The teams brainstorm how they might solve the disorganization challenge. Students test out a variety of solutions –ranging from shelf dividers to better delineate cubby space on shelves, mini lockers to ensure safety of student property, and locked, enclosed binder boxes to keep papers safe and neat.

Day 4: Review Experiment

The teams discuss how each solution worked. Did it actually solve their problem? Is it worth building out the solution out of sturdier materials or should we revisit the design? Based on this conversation, teams either redesign their prototype or moved forward with their design.

Day 5: Produce

Teams measure and build out their solution.

Day 6: Produce

Teams continue building their solution and plan out how to share their work with classmates who will be using their new organization solution

PROJECT: ARCADE

Description: Students were challenged to create carnival/arcade games using some new and some recycled materials. They were encouraged to include some sort of mechanical/electronic aspect.

Length: 6 days

Curriculum Standard: S.5.P.3: Students will investigate electricity, magnetism, and their relationship. (b) Determine the necessary components for completing an electric circuit. (c) Investigate common materials to determine if they are insulators or conductors of electricity.

Day 1: Brainstorming

Students worked individually and as a group to come up with a variety of ideas for the project. As a group, they settled on one design.

Day 2: Planning

Using a planning template, students drew up more detailed plans for the project, wrote up a materials/tools list, and laid out the steps involved in completing the project. They broke those steps up into the remaining four days.

Day 3: Build Day 3

Students followed their project plans. Each group made a unique game. Most groups focused on the more complex tasks to ensure that they were completed on time. This was, for the most part, solving the moving parts and electronics of their build.

Day 4: Build Day 2

Students again followed their project plans (after taking some time to make modifications based on the previous day's accomplishments). Most groups worked on building some sort of base for their project.

Day 5: Build Day 3

Students used their project plans to determine the steps that they had to complete on that day. Generally, the groups assembled the parts they had built – ensuring that all of the moving parts worked the way they should.

Day 6: Build Day 4

Students used this day to touch up, finalize, and try out their games!

PROJECT: CELL SCIENCE BOARD GAME

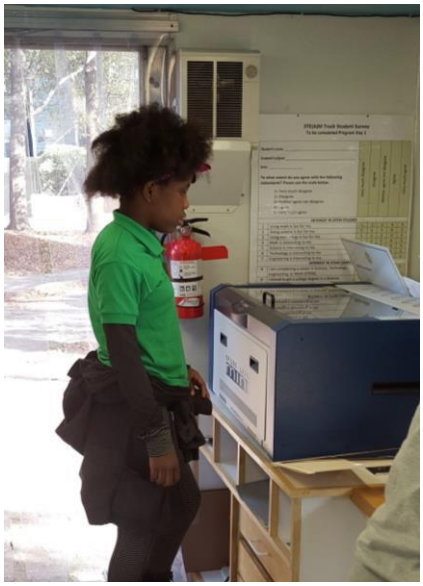
Description: Students cultivate an understanding of board game design and rapid prototyping by designing and producing their own board came.

Length: 6 days

Curriculum Standard: S.5.L.3: Students will diagram and label parts of various cells (plant, animal, single-celled, multi-celled).

Day 1: Rapid Concept Iteration Exercise

Students recall as many board games and cell-related terms as possible and record their thoughts on sticky notes. Students then pair the board game and cell term sticky notes to design their own board games on paper (e.g, Hungry Hungry Hippos + Endoplasmic Reticulum = Hungry Hungry ER).



Day 2: Board Game Review

Play a well-known board game (e.g. Trouble) from start to finish, and have students note what makes the game fun, playable, re- playable, and what would improve it.

Day 3: Design Game

Students design their game and begin the digital design of the board and pieces.

Day 4: Laser Cut Game Board

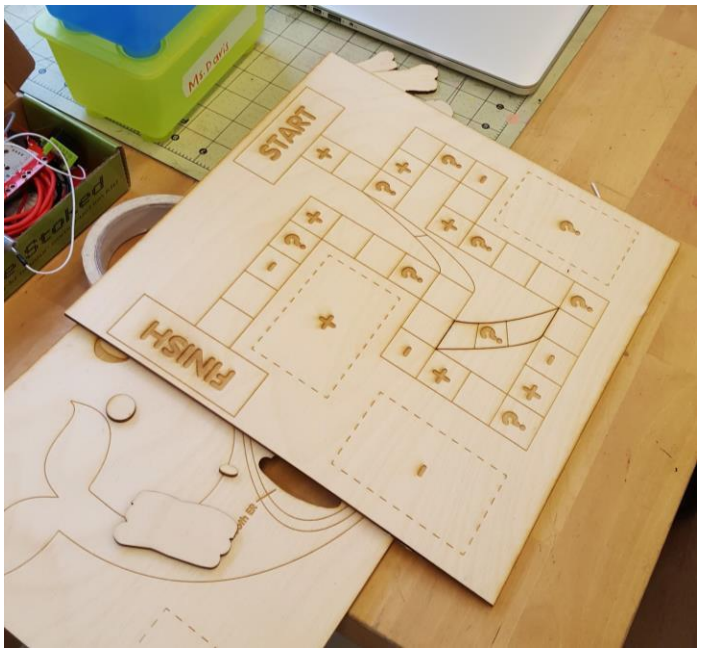
Students complete laser cut files and begin laser cutting. While laser is running, students their refine board game pieces or cards.

Day 5: Play Testing

Students play one another's games and give constructive feedback on how they could improve their board games.

Day 6: Complete Game

Taking into consideration the feedback from the previous day, students complete all laser cutting and board game piece production.



PROJECT: RUBE GOLDBERG MACHINE

Description: In teams of 3-4, students build a machine that completes a simple task in a complex manner by primarily using simple machines.

Length: 6 days

Curriculum Standards:

M.5.MD.3: Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

M.5.MD.4: Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

M.5.MD.5: Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

Day 1: Tinkering

Introduce the idea of the Rube Goldberg machines through examples, like the OK Go – This Too Shall Pass Video. Then, allow, students to tinker with materials that they could potentially use in their machine. Students should also decide what simple task their machine will complete (e.g. turn on light, crunch chip).

Day 2: Simple Machines

Students learn about simple machines and work together to identify them in the OK Go – This Too Shall Pass Video. Students continue tinkering with materials looking for ways to incorporate some of the simple machines in their sketch creations.

Day 3: Inclined Plane

Students make the first part of their Rube Goldberg Machine using an inclined plane.

Day 4: Lever and Pulley

Students complete the next two steps in their Rube Goldberg machine using a lever and a pulley, and consider how they will this simple machine with the inclined plane.

Day 5: Screw, Wedge, Wheel/Axle

Students complete the next three steps in their Rube Goldberg machine using a screw, wedge, and wheel & axle, and consider how these machines with the inclined plane and level and pulley.

Day 6: Final touches

Students put all of the parts together into a complete Rube Goldberg machine – testing and making modifications as needed.