December 2018

STEAM Machine as a Vehicle for Educational and Community Engagement in Rural Shkodra

Adam P. Collins  
Worcester Polytechnic Institute

Jason Liang McGrath  
Worcester Polytechnic Institute

Joseph Niski  
Worcester Polytechnic Institute

Summer L. Thurlow  
Worcester Polytechnic Institute

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Machine as a Vehicle for Educational and Community Engagement in Rural Shkodra

Adam Collins
Jason McGrath
Joseph Niski
Summer Thurlow
The STEAM Machine as a Vehicle for Community and Educational Engagement

Authors:
Adam Collins, Jason McGrath, Joseph Niski, Summer Thurlow

Advisors:
Professor Robert Hersh, Professor Leslie Dodson

Sponsor:
Director of ARKA Youth Center, Arta Nikoll
Project Lead, Jermaine Harts

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Our team worked with ARKA, a youth center, to develop a STEAM based mobile library for rural and peri-urban communities within the Shkodër Region of Northern Albania. We developed a series of hands-on STEAM activities and piloted them with students between 4th and 12th grade. Our goal was to observe how well the activities conveyed educational content and fostered social and interpersonal skills. In pilot tests with 93 students, we found that students were receptive to STEAM principles by applying hands-on learning techniques while using interpersonal skills. We hope this project contributes to the development of a mobile library that provides books and STEAM activities in the context of a broader community engagement initiative.
We would like to extend our gratitude to those who helped us complete this project:

We would like to thank Arta Nikolli and Jermaine Hartsfield from ARKA, for providing us with invaluable information and resources for this project as well as a place to stay during our time researching.

We would like to also thank the Peace Corps volunteers: Erik Carlson, Victoria De La Vega, Ryan Damon, Damien Burge, Minju Kim, and Derik Oki for providing us with an understanding of northern Albania.

And lastly, we would like to thank Robert Hersh and Leslie Dodson, for guiding us through this process of understanding, challenging us to create our best work, and executing our project.
This report includes many sections, each of which were approached differently by the group. Each section was assigned an original author, but through various drafts of the report, many sections have multiple authors and editors. The group did do major final editing together, however, to ensure a comprehensive sound, Adam was the main editor of the report.

The abstract was written and edited by the group as a whole. The acknowledgement section was written and edited by Joseph. The authorship section was outlined by Adam and Summer, and was edited by the entire group. This section was then reformatted and written by Summer. The executive summary was written as a group, and was edited by Adam. The introduction of the report was authored collaboratively between Joseph and Adam.

The report design was done mainly by Jason, but many group members did help in this process. Jason was, however, the final editor in this to ensure a cohesive look throughout the report.

The background was collaborative between Adam, Jason, and Summer, with each group member authoring a section of their own. Adam was the main editor of the background.

The Approach was split into three objectives, which each originally had one team member focused on them, but through development of the project and iterations of the report, these became much more collaborative. Adam was the main editor of this section.

The writing first objective was split between Jason and Adam, and was edited by Adam. In the second objective, Adam, Joseph, and Summer were authors, and the section was edited by Adam, Joseph and Jason. Adam and Summer collaborated on the third objective, with both taking authorship roles, and Adam took charge of the editing.

The Findings of our report was the section that underwent the most changes, with many sections having multiple authors, as well as going through multiple iterations of restructuring. Joseph and Summer had collaborated on a major restructuring and re-write of this section, which was then edited as a group, and restructured in various sections.

The first part of the findings chapter was authored by Summer, Adam, and Jason, who all also acted as editors.

The Pilot tests 1: Pukë, Vau Dejës, and Koplik section was originally authored by Summer, then was edited by the group as a whole, then was restructured and further edited by Adam in-depth. After which it was edited yet again by Summer. Revised Set of Pilot Tests: Lezhë and Bushat was originally authored by Joseph, then was similarly edited by the whole group, followed by another restructuring and in-depth edit by Joseph. This was followed by another round of edits done by Jason.

Joseph, Summer, and Jason authored the final sections of the chapter, with Adam acting as the editor.

The Ethics and Limitations were outlined and structured by Joseph and Jason, then written by Summer. Summer authored the Ethics and Limitations, and she also outlined and authored the Conclusions, these sections were finally edited by Jason.
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Executive Summary

Introduction

A substantial depopulation of villages has affected rural communities in northern Albania, specifically in the Shkodër prefecture. Mass internal and external migration between 1990 and 2011 followed the fall of communism (King, 2012). Emigration was spurred by the search for jobs or better economic situations, while internal migration was characterized by a population shift from rural areas in the north (particularly the north-east), south-central, and south-east regions to the economic centers of Albania, including the cities of Shkodër, Durrës, and Tirana (FILIPI, 2014).

The rural exodus resulted in a lack of resources and services in rural and peri-urban areas, especially in the education sector. According to Albania Education Policy Review: Issues and Recommendations, rural schools lack quality education and resources, compared to their urban counterparts (United, 2017). Rural Albanian schools in the Shkodër prefecture in particular, often lack equipment and capacity for engaged Science, Technology, Engineering, Art and Math (STEAM) learning. Just as importantly, schools lack interactive learning techniques such as hands-on learning activities. Science labs and technology studios in these schools are very basic (if they exist at all) and may continue to decrease in quality with a continuing decrease in funding to local and regional schools (Bashkia, 2017).

There are currently limited opportunities for youth development, especially in villages around the Shkodër prefecture. ARKA, a youth center in Shkodër, offers youth empowerment programs ranging from business classes for students to training sessions for makeup artists. They are currently pursuing a new initiative called the Biblioteka Lëvizëse or Moving Library that will bring books and hands-on activities to villages around the Shkodër prefecture.

The idea of a mobile library has existed for more than a century: the first was created by Warrington Mechanics Institute in Cheshire, England in 1858 (Warrington, 2016). There are currently approximately 650 mobile libraries in the United States (Stateline, 2018) and many more worldwide. While bringing books to people are their focus, many mobile libraries provide places for community engagement.

Community engagement often comes in the form of new experiences. Some of these are workshops, plays and concerts. These new experiences are essential to developing interpersonal skills with different genders and ages.

The goal of this project is to create opportunities for creative, community, and educational engagement within rural villages in the Shkodër prefecture, through the creation of a mobile library program focused on hands-on STEAM activities. To achieve this goal, we identified the following objectives:

Objective 1: Determine the existence and interest of hands-on STEAM-based learning activities

Objective 2: Develop and pilot test STEAM-focused educational activities and programs that could be offered through a mobile library initiative

Objective 3: Understand the potential for sustainability of a STEAM-focused Driving Library
Approach

Over the course of four weeks, we visited four different schools within northern Albania and conversed with a variety of students to gauge their interest in an after-school Science, Technology, Engineering, Arts, and Mathematics (STEAM) program. The A in STEAM—arts—offer skills that are the basis for divergent thinking and the pursuit of multiple solutions to a single problem (Hunter-Doniger & Sydow, 2016). The addition of arts offers open-endedness to projects which encourages students to be more self-directed and explorational (Park, 2016). Our project lead, a Peace Corps volunteer, provided us with relatively easy access to schools through his connections with co-workers. The team traveled to four locations within the Shkodër prefecture and one in nearby Lezhë County to perform pilot tests of STEAM-focused activities that also had strong elements of social and interpersonal skill-building. We conducted assessments and pilot tests in:

1. Shkolla 9 Vjeçare, “Gjon Ndoci”, Bushat
5. Qendra Komunitare Pukë

After collecting data on the feasibility of introducing a hands-on STEAM program, we developed a preliminary portfolio of 27 potential STEAM activities that the STEAM Machine might bring to students. To create this portfolio of activities, we combined past experience with online research, as well as a google form sent to friends and family asking for STEAM-based ideas. We ultimately pursued 13 hands-on STEAM activities, which we refined for pilot testing in four after-school school and club environments as well as a community center in Pukë.

Findings

**STEAM-based Education in Rural and Peri-urban Schools of the Shkodër Prefecture**

We found that many students in Vau Dejës, Bushat, and Koplik prefer the more hands-on subjects in school like math and science. When asked what their favorite school subject was, 34 students at different grade levels responded that math was their favorite, of which 25 were girls.

Although questions were focused on favorite school subject, interest in STEAM-based education was still sufficient for demonstrating the feasibility of a STEAM-based program. It seemed that those who were opposed to STEAM-based activities based their interest on preconceived idea that these activities require highly advanced laboratory equipment and multiple types of computer software for analysis. Indeed, this may also explain why all five of the schools we visited used few to no interactive teaching techniques.

In each of the locations we visited, there was an absence of hands-on learning, laboratory space, or equipment in schools. Library materials come “from parents who donate books on an inconsistent basis,” the school director in Bushat said. In Lezhë, the library is restricted to two 45-minute access periods a day. The school librarian emphasized that “students are encouraged to check out books and read them on their own time,” but the limited hours she can spend “during [her] breaks” can only provide so much access. As literature has noted, funding to these schools is not only low, but is also decreasing (Bashkia, 2017).

**School clubs could serve as a model for STEAM Machine visits**

In Bushat, a Peace Corps volunteer runs an in-school club during the last period of the day. Students who don’t have class during this time may participate in a club. One such club run by a Peace Corps volunteer is about Health and the Environment which was meant to meet once a week; the frequency of meetings, however declined as the school year went on. Her goal was originally that of two different clubs; one on female empowerment and one to teach sexual health to both males and
females. The director, however, set the club up as a combination of the two. As time went on, it was offered to boys as well, but male attendance was still rare.

Lezhë is the only location we visited that keeps its school building open for any amount of time after the school day ends. While the building we visited closes a half hour after the school day ends, the other school remain open to host clubs in. The Peace Corps volunteer, Minju took us to a girls’ basketball club that students could participate in if they paid the trainer.

Existing school clubs show the potential for after-school student involvement as long as there is consistency and structure within the program. The importance of this structure is emphasized in Vau Dejës. Within a few months period between Peace Corps volunteers, a girl’s club was disbanded due to inconsistency. Once a new volunteer arrived, the club was immediately reinstated although at a varied attendance rate. Nevertheless, regular meetings allowed for the stabilization of attendance. The importance of this structure is emphasized in Vau Dejës.

STEAM Machine activities can provide outlets for interpersonal engagement

Both Koplik and Vau Dejës have football fields, but these must be rented out, and children need to pay to use them, which makes them inaccessible to many. This severe lack of free, accessible after-school activities space supports the potential for the STEAM Machine to provide opportunities for young people in the Shokodër region.

### STEAM Activities and Pilot Testing

#### Effectiveness in fostering STEAM understanding and interpersonal engagement

Two effective methods of understanding the retention that hands-on learning material gives are reflection and metacognition (Concordia, 2018).

We facilitated a reflection session in Lezhë by asking questions about what students learned from the activity. There were two successes from one of our activities. First, there were multiple students who wanted to speak about what they learned. Second, the students provided a comprehensive explanation of something they learned. This takes into account the fact that students had some sort of previous knowledge about building and were able to apply it here. That requires critical thinking and proved the activities were fostering learning.

Another way to analyze whether learning is effective is by observing or eliciting metacognition (Concordia, 2018). This is when a student is able to understand that they learned by reiterating what the learning objectives are while describing why everything works. This helps them articulate how they are learning (Concordia, 2018).
with another student what they learned, it reflects how they learn. In Bushat, a student was able to explain how the Baking Soda Rockets worked without the assistance of one of the WPI students. By being able explain the problem and solution to someone else, the student exemplifies metacognition by showing she was aware of her thought and problem-solving process. Another example of this was seen in Koplik. During the Friendship Bracelet activity, students began to help each other when they were struggling. By helping a peer who is struggling with something that was challenging in the past, the student reinforces her understanding of the material.

A STEAM Machine can assist in bridging the gender gap

The gender divide was a recurring theme across every village we visited. In Bushat, we witnessed men in public spaces, such as in cafes drinking and chatting, playing billiards or chess, and working in jobs such as construction. Conversely, we witnessed few women on the streets, apart from the occasional grandparents taking care of a young child or picking up groceries from the store. One male Peace Corps Volunteer mentioned, “[Girls’] parents would not let them go on a field trip to the beach with just me. Once Arta (a past teacher who now works at the Bashkia in Vau Dejës) said she was coming with [them], mothers were much less wary about letting their daughters go.” Veronica, a 9th grader from Vau Dejës, spoke to us about how it is impossible for her to participate in after-school activities without first getting permission from her father. She mentioned that “her parents will only approve of school related activities” and are more likely to “get permission to go to an after-school event if [her] parents know [her] friends will also be in attendance.”

Girls are more engaged in hands-on STEAM activities than boys are

Throughout our pilot tests, girls tended to be more engaged and needed less encouragement with activities than did boys. We found this surprising given the general lack of opportunities available to girls outside of school.

In engineering design activities, girls tended to lead the design process. In cases where girls and boys were in gender-segregated groups, groups of boys tended to copy the designs of female groups. In pairs where there was one boy and one girl, the girl was almost always leading the boy throughout the process, telling him what to do, and generally leading the design work. In three-person groups, whichever gender had two members tended to take control, and would lead the design of the project. In larger groups, when the ratio of boys to girls was closer to 1:1, boys and girls participated in activities evenly. They made equal contributions to the design of a structure or helped lead team discussions. In general, mixed groups tended to perform better than segregated ones.

From our observations, we surmise that although girls receive fewer opportunities than boys, when they receive opportunities they are much more receptive of them. We do not know, but wonder whether this might be because girls and young women have few chances to pursue their interests, so whenever they do get an opportunity, they make the most of it, not knowing the next time they will have another.

Understanding the potential for sustainability and obstacles of this project

This project faces sustainability challenges due to a pessimistic outlook. This idea was reinforced in other interviews with Peace Corps volunteers. One volunteer said that efforts to start new clubs was halted by this attitude. Another volunteer confirmed it as a reason for the lack of clubs and extracurricular activities. In an interview with a former teacher now at the municipal government (the Bashkia) in Vau Dejës, we asked her thoughts on whether the Bashkia would be interested in working on a creating a vehicle for hands-on activities. She laughed and shook her head no; not only does the Bashkia have other priorities, but she suggested that it wasn’t worth it. In the past, funding for projects were dropped randomly, although funding was promised.

Our group became puzzled by the lack of discipline and rules within schools. We saw students who would hop the schoolyard fence in the middle of school as well as teachers and directors who would leave in the middle of the session. The comparison of teacher engagement to the interest of students to STEAM and hands-on learning allowed us to gain interesting revelations to the limited role that schools should play within this STEAM Machine.
**Conclusions**

**Ethics**

We encountered numerous ethical considerations throughout our field work, particularly in our role as American engineering students. We understand that our presence in schools and after school programs may have been perceived as a sign of immediate change or change in the near future. We have no control over the true start date of this project and had to state that our project mostly involved gathering preliminary data that would serve as a basis for the future project for our sponsor.

Additionally, we were aware that it is unreasonable to visit a country for a short time and attempt to change a culture that we know very little about.

**Limitations**

Our project is limited in that our role as foreign visitors likely influenced how participants and key informants responded. This study is also limited by a lack of range of schools. Albanian Independence day and Thanksgiving restricted the availability of Peace Corps Volunteers and students, thus limiting the time to do fieldwork. Furthermore, our field work and pilot tests were hampered by frequent cancellations and postponements. School visits were frequently canceled and our pilot tests in Lezhë and Bushat were rescheduled three times, making a consistent schedule difficult to maintain.

This study was also limited by the availability and quality of translators. The translator varied depending on the group we were working with. Sometimes, an English-speaking teacher would explain the activity to students, while other times it would be an older or proficient student. These more experienced students didn’t always know how to assist us, sometimes only translating for a couple of groups instead of addressing all the participants.

**Concluding Remarks**

**Develop Community Engagement**

Hands-on STEAM activities provide much more than purely educational benefits and we believe that such activities can be used in situations that are non-educational. Having spent seven weeks working on developing hands-on activities and analyzing how and why they work on both STEAM content and social skills, we believe there is some potential for these to be used in social settings because of the joy and curiosity they facilitate. Hands-on STEAM activities like those provided by the STEAM Machine could act as a creative outlet.

Interactive opportunities, such as those we have studied throughout this project, hold the potential to serve as ice breakers in community meetings or other public events. Many of these activities, particularly those involving teamwork, encourage communication between participants, regardless of age, gender, or education level.

**Bridging Generational Divides**

While it is easy to solely focus on children within a mobile library initiative, it is just as important to discuss the effect a project like this may also have on adults. From the study of literature, it is clear that the involvement of parents in school years varies. As the child progresses through more classes, parental involvement decreases in school life and in their child's education. The interest from the parents, however, only progresses. When children participate in higher level classes, parents feel difficulty in understanding and are often found near their children and perhaps seek the support of the school and especially the teachers who have the necessary expertise.

ARKA may want to take note of this and even incorporate activities into the STEAM Machine that are geared towards adults spending time with their children. This inclusion of adults in the program would not only create new ways for parents and children to spend time together, but it may also teach adults STEAM concepts.

**Bridging the Gender Divide**

In order to ensure equitable female involvement, the STEAM Machine will need to stay attentive to creating mixed-gender teams and opportunities. Moreover, it is imperative that the STEAM Machine be staffed by both male and female facilitators to the extent possible.
Further Recommendations

We believe that in time, a sport aspect could be added to the STEAM Machine in order to combat the lack of physical education in many schools, as well as gain more interest from potential participants. Physical activity is an important aspect to living a healthy life and adding an aspect to the STEAM Machine that focuses on Physical education may be particularly important in locations that have almost no ways for children to participate in physical activities.

Our other recommendations and ideas have less to do with the educational aspect of the STEAM Machine, but more on the execution and operation of the vehicle itself. We believe that having a question/suggestion box, as well as a digital form for questions and suggestions would be an important aspect to a project as involved in the community as this. This will allow the STEAM Machine to better tailor its activities to the needs and wants of the locations it is visiting in order to create the best experience for all participants.
Figure 1: Koplik school and fence
Introduction

Figure 2: Run down school courtyard in Vau Dejës
Rural Albanian schools in the north, particularly in the Shkodër prefecture, often lack the facilities, materials and capacity for engaged Science, Technology, Engineering, Art, and Math (STEAM) learning. Over the past few decades, there has been a major exodus from rural areas to cities, in part to pursue job opportunities, but also due to family choices and the pursuit of better quality education (Vullnetari, 2016). However, the school systems in the Shkodër prefecture are expected to face a decrease in funding (Bashkia, 2017). Science labs and technology studios are very basic, if they exist at all, and may continue to decrease in quality (Sahlberg, 2010). The current STEAM curriculum is lecture and textbook based, which can result in disinterested students (Sahlberg, 2010).

Mobile libraries have existed for more than 150 years, although they are a more recent phenomena in Albania. The first documented mobile library was created by Warrington Mechanics Institute in Cheshire, England, 1858 and sought to bring education to people who couldn’t otherwise obtain it (Warrington, 2016). There are now approximately 650 mobile libraries in the United States (Stateline, 2018) and many more worldwide. While the core belief behind mobile libraries is the provision of books, they are now focused on so much more by adapting to the needs of their
communities through providing books, workshops, training, human interaction, and community engagement for people living in remote areas (Mitchell, 2018).

Although there are national plans that have been created to support youth development, regional plans are still lacking in relation to the Shkodër prefecture (Ministria e Mireqenies Sociale dhe Rinse, 2015); it wasn’t until 2017 a program came to fruition within Shkodra. YES Future has so far created not only Atelje’s Public Youth Center for programming (Rrjeti i OJF-ve Rinore, 2018) --opening in January of 2019--but has also organized a support network for youth interest groups and NGOs to collaborate with the Directorates of the Shkodra Municipality (Rrjeti i OJF-ve Rinore, 2018). One of the collaborators to this project, ARKA, a youth center in Shkodër, has since pursued another project called You Power. A questionnaire filled out by forty students in respective areas found that bookshops, libraries, and recreational activities are missing within the district (Nikolli, 2018). In these circumstances, students are left to spend their afternoons alone at home after school, often using smartphones as a replacement (Nikolli, 2018). ARKA has argued, however, that reading books would offer a better opportunity to spend their free time (Nikolli, 2018). For this reason, the organization has proposed the creation of an itinerant library.

Figure 4: A field at the Vau Dejës school
Our project pursued three main objectives related to the Biblioteka Lëvizëse: we observed the existence of, and interest, in STEAM-based activities in rural and peri-urban schools in the Shkodër prefecture; we developed and piloted various hands-on STEAM-based activities that had both technical and social and interpersonal skill-building qualities; and we investigated the potential to sustain a STEAM-based Moving Library. By helping provide hands-on STEAM-based outlets in rural villages, we hope to support formal educational efforts as well as community engagement needs. Moreover, we hope to stimulate interest in STEAM-related topics, which is underdeveloped in the Shkodër prefecture.
Background

Figure 7: Rubble behind a school construction site in Koplik.
Background

The year 1992 marked the end of the communist regime in Albania, but the transition to democracy after decades of isolation has not been smooth.
Migration in Albania

A drastic depopulation of villages has affected rural communities in northern Albania, particularly in the Shkodër prefecture, leaving them with a lack of resources and services, specifically in the education sector. Between 2001 and 2011, Albania experienced a major population shift through both internal and external migration (King, 2012). Much of the external migration to Italy and Greece was driven by the desire to pursue more favorable economic circumstances (King, 2012). Internal migration was characterized by a shift away from rural areas in the north (particularly the north-east), south-central, and south-east towards economic and political centers of Albania: Durres, Shkodër, and Tirana (FILIPI, 2014). According to the 2011 Albanian Census, for the first time in recorded history, more citizens lived in urban centers than rural communities, with 54% of the population living in cities compared to 47% back in 2001 (Republic, 2012, pg. 10). The main causes of internal migration included family decisions (marriage), working opportunities, and education (Zhllima, 2016).

The influx of rural residents into urban centers caused a regional disparity between rural and urban communities which manifested in unequal economic and development (Republic, 2013).

Figure 8: This demonstrates the rural exodus between 1990 and 2007. The width of the arrows represents the importance, by size, of each flow; the direction of the arrows represents the sign of migration balance, and the color index indicates if the flow is balanced or countered. (Lerch, 2016).
Shkodër Prefecture Demographics

The prefecture of Shkodër is located in the northwest region of Albania, bordering Montenegro and Kosovo. The prefecture is made up of 33 municipalities and communes, with an estimated population of 215,347 (Republic, 2013). This makes Shkodër prefecture the fifth most populated region in Albania, with 55.6% of its population living in rural communities (Republic, 2012). Forty-six percent (46%) of the Shkodër population is under the age of 30 (similar to the national average) (Republic, 2013). The poverty rate of the region is 15.4%, slightly above the national poverty rate (National, 2015). Forty-four percent (44%) of the populace attends, or has attended, basic education (grades 1-9), but only 8% of residents are currently in, or have finished, university (Republic, 2012).

Rural Education

According to the Albania Education Policy Review, rural schools, such as those in Shkodër prefecture, lack quality education and resources, compared to their urban counterparts (United, 2017). The central government spends 2.9% of its Gross Domestic Product (GDP) on public education compared to the European Union (EU) average of 4.5% (Psacharopoulos, 2017), and per-student subsidies in rural areas are lower than in urban schools (United, 2017). Many village schools have poor infrastructure, which contributes to low attendance rates (United, 2017). A 2013 nationwide study by the Ministry of Education found that approximately 2,000 teachers, primarily in villages and small cities, did not have a teaching degree or were not qualified to teach (United, 2017). Furthermore, an additional 2,000 teachers were teaching a subject they were not competent in teaching and had to be reassigned (United, 2017). Depopulation of rural regions, moreover, account for the creation of more than 1,000 micro schools in rural Albania (Martino, 2018). These low populated, mix-gendered, single classroom institutions, have “low-quality teaching and [a] lack of teachers with adequate education” (United, 2017).
Social Implications of Migration

The “brain drain” has negatively affected rural areas in Albania (Gedeshi & Jorgoni, 2012). During the post-communist transition, a substantial number of doctors, economic specialist, teachers, artists, and researchers immigrated to other countries (Gedeshi & Jorgoni, 2012). Between 1991-2008, more than 40% of academic and scientific workers migrated abroad, contributing to the deterioration of education and health services especially in remote and rural areas (Gedeshi & Jorgoni, 2012). The transmission of experience and knowledge from one generation to another is hampered by the continuing desire among the youth to migrate (Gedeshi & Jorgoni, 2012).

According to a study done by Albania’s Demographic and Health Survey, 11% of internal migrants and 12% of international migrants have left children back at home (Gedeshi & Jorgoni, 2012). This is more common in rural communities, particularly those with international migrants; 15% of rural households look after children of international migrants, compared to 7% of urban households (Gedeshi & Jorgoni, 2012). Most migrant parents are male (98.5%), with the majority of them originating from rural areas (Gedeshi & Jorgoni, 2012). Even though the government has attempted to improve rural living conditions, these regions continue to suffer the negative consequences of family separation, including psychological and emotional stress on children (Gedeshi & Jorgoni, 2012). Many unskilled, low-income migrants leave their children with grandparents (Gedeshi & Jorgoni, 2012). However, studies show that many grandparents cannot fulfill their grandchildren's economic, health, social, and educational needs due to economic strain (Gedeshi & Jorgoni, 2012).

According to the World Bank 2007 Poverty Assessment, there is evidence that migration has a negative impact on school enrollment rates, particularly for females and high school-aged children in rural areas (Gedeshi & Jorgoni, 2012). Opportunities to work abroad in low skilled jobs lowers the incentive to attend school (Gedeshi & Jorgoni, 2012). Children who are members of families who have migrated are more likely to choose working elsewhere rather than going to school (Gedeshi & Jorgoni, 2012).
Gender Roles in Rural Communities

Gender inequality in rural areas is more prevalent in countries, such as Albania, that are transitioning from a communist past (Zhllima, 2016). In the transition from communism, state institutions that once might have supported economic and social equality were destroyed, allowing the re-emergence of traditional customs and patriarchal norms, especially that of women’s submission in the household (Zhllima, 2016). A study by UN Women, claimed that the harsher the economic conditions are, the more unequal division there was between men and women (Zhllima, 2016). High unemployment, high poverty levels, and more traditional social roles have led to higher acts of domestic violence in rural areas compared to urban centers (Zhllima, 2016).

In terms of pursuing education, more rural women have completed basic education than men, but when it comes to higher education, such as university, the enrollment rate for rural women drops (Zhllima, 2016). Compared to their urban counterparts, only 23% of rural women have finished secondary school (grades 10-12) versus 53% of urban women (Zhllima, 2016). Evidence suggests that early-age marriage, dropout due to poor school location, and migration to urban cities has been the cause for the gap between rural and urban women’s enrollment in secondary education (Zhllima, 2016). Additionally, poor school infrastructure, weak road networks, lack of transportation, as well as the increasing opportunity costs are some major barriers to young women attempting to complete high school (Zhllima, 2016).
Hands-on & Experiential Learning

Although hands-on learning is a relatively contemporary practice, the concept of learning by experience is ancient. Modern day hands-on learning is a form of experiential learning that focuses on a multisensory approach to actively engage learners (Hawtrey, 2007). According to educational theorist David Kolb, experiential learning is a continuous process that is attached to experience; to him, all learning is relearning and should therefore be paired with the repetition of the Lewinian Experiential Learning Model: formatting ideas, testing concepts, having concrete experiences, reflecting, and repeating (Kolb, 2014).

The application of hands-on activities in Science, Engineering, Mathematics, and Technology (STEM) fields is on the rise (Kyere, 2017, Hunter-Doniger & Sydow, 2016). When learners participate in hands-on activities, both the short-term and long-term memory interact for a longer period, and that extended length of time allows the mind to associate abstract meaning and concepts with physical images, making future retrieval easier (Gage & Berliner, 1984). A recent study by cognitive psychologist Carly Kontra, provides evidence that both the sensory and motor-related parts of the brain activate when practicing a subject after having a concurrent physical experience with it (Kontra, 2015). A number of other studies on the power of associative memory conclude that hands-on learning is more effective in providing increased academic vigor and excellence than its traditional counterpart (Ates, 2011). One such study, focusing on math and science topics, found positive effects of hands-on activities with 55 eighth grade students’ science processing skills and attitudes in urban Bolu, Turkey (Bilgin, 2006). Another physics-based study on a 140 sixth grade student sample observed parallel results years later (Sadi & Cakiroglu, 2011). Both studies support the findings of Stohr Hunt (1996); the more often a student experiences hands-on activity, the higher their grade will be (Stohr-Hunt, 1996).

Figure 14: The benefits of hands-on learning.
(Gerstein, n.d.)
The Benefits of Hands-On/Experiential Learning

- Increases motivation and engagement.
- Builds social-emotional skills.
- Engages emotions.
- Preparation for real life.
- Increases learning retention.
- Expands critical thinking skills.
- Multisensory
- Lots of brain activation.

Figure 15: The Lewinian Experiential Learning Model. (Kolb, 2014)
Although a STEM curriculum provides a foundation for technical competence, it does not necessarily foster scientific creativity across disciplines (Madden, 2013). In an effort to highlight and incorporate what Sousa and Pilecki deem essential human skills – those of creativity, problem solving, critical thinking, and community development skills – STEM studies are often shifting to STEAM initiatives (Sousa, 2013). The A in STEAM—arts—offer skills that are the basis for divergent thinking and the pursuit of multiple solutions to a single problem (Hunter-Doniger & Sydow, 2016). The addition of arts offers open-endedness to projects which encourages students to be more self-directed and explorational (Park, 2016). Another strong rationale for STEAM initiatives is to support critical thinking by mingling with materials. In other words, investigative learning through the modification of toys, dioramas or any sort of physical object can be an important aspect to increasing individual expression (Ryan, 2017).
National and Local Youth Development

In 2015, the governing body of Albania approved a National Youth Action Plan, a continuation of the National Youth Strategy developed in 2007, which supports the inclusion of youth in the political decision making process (Ministria e Mireqenies Sociale dhe Rinse, 2015). A 2011 study on Albanian youth concluded, however, that the problem was much bigger than political inclusion; youth unemployment between the ages of 15-29 was an astounding 30.2% (2014), while only 16% of youth were involved in volunteer activities and 19.7% had been a part of an internship (Ministria e Mireqenies Sociale dhe Rinse, 2015). The 2015-2020 National Youth Action Plan was created to combat these issues. Six main objectives have been developed with the insight of more than 12,000 youth, students and representatives from society (Ministria e Mireqenies Sociale dhe Rinse, 2015):

1. Youth Promotion and Participation in the Democratic Process/Decision Making
2. Youth Employment Promotion through Effective Labor Market Policy
3. Health, Sport, and Environment
4. Youth Education
5. Social Protection
6. And Culture and Voluntarism

With regard to Youth Education, the state has budgeted 6,166,247 ALL ($52,000 USD) for the improvement of school curriculum, teaching methodology, and school infrastructure (Ministria e Mireqenies Sociale dhe Rinse, 2015).

Although these national plans have been developed, regional plans are still lacking; in fact, it wasn’t until 2017 that specifically within Shkodra, a program came to fruition. YES Future, funded by the Italian-Albanian Debt Development Conversion Program (IADSA), seeks to focus on social inclusion of youth by providing access to formal education, informal education, and entrepreneurship culture, regardless of social status or demographic orientation (Code Partners, 2018). The Italian Consulting and Development (CODE) Partners organization of Albania has so far created not only Atelie’s Public Youth Center for the programming (Rrjeti i OJF-ve Rinore, 2018), scheduled to open in January of 2019, but has also organized a support network for youth interest groups and NGOs to collaborate with the Directorates of the Shkodra Municipality (Rrjeti i OJF-ve Rinore, 2018). These programs act in combination with other community engagement initiatives.
ARKA Youth Center

ARKA is a youth center in the city of Shkodër, Albania. It was established in 2015 by the collaboration of two non-profit, non-governmental organizations, the Italian Acli Ipsia in Albania and the European Union based Consulting and Development (CODE) Partners organization of Albania (ARKA, 2018). ARKA’s mission is “to inspire young people to be innovative and help them discover new possibilities” (ARKA, 2018). The organization offers entertainment, education, and training specifically targeted at promoting art, culture, and creativity (ARKA, 2018). Past initiatives range from business and entrepreneurship courses, to the Project You Power; the Future Community, which focuses on the inclusion of Shkodran orphans into the labor market; the ARKA Social Coffee, which hosts periodic meetings with young people; the Youth Book Club, a joint effort with the Ministry of Culture National Reading Movement to host periodic book review meetings; and training courses for waiters and makeup artists (ARKA, 2018). The organization is funded through grants, donations, and international agencies.

The You Power project promoted civic engagement by generating an ARKA Youth Council from students in Shkodër, Vau Dejës and Malësia e Madhe municipalities in the Shkodër prefecture (ARKA, 2018). By creating an environment conducive to the exchange of ideas on social and political awareness, involved youth have been encouraged to contribute to the development of their local municipal structures and overall society (ARKA, 2018). A questionnaire filled out by forty students found that bookshops, libraries, and recreational activities are missing within the district (Nikolli, 2018). Instead, students spend their afternoons alone at home after school, often using digital devices as a replacement to the limited range of activities available (Nikolli, 2018). ARKA, however, suggests that reading is a better use of free time, so the organization has proposed the creation of an itinerant library,

“... a tool for the personal and cultural development of the children”
- Arta Nikolli

ARKA aims to create their own “driving library” for the Shkodër prefecture. Their objective for this vehicle is to bring books and cultural activities to the any age of youth in rural villages, stimulating community engagement through new and different experiences.
US Peace Corps & Community Engagement

The United States Peace Corps sends volunteers to more than 60 countries, with projects in six different sectors including agriculture, community economic development, health, environment, education, and youth in development (Peace Corps, n.d.).

Peace Corps volunteers in Albania participate in projects that fall under the health, education, and community economic development categories. Volunteers in the health and education sectors volunteer in schools from elementary through high school. Health education volunteers are typically placed in rural locations in both high schools and the combined elementary-middle schools, and focus on training teachers on youth sexual and reproductive health (Peace Corps, n.d.). These volunteers may also work with community health centers and other community organizations to provide staff training, teach proper sexual health practices, and even start other educational clubs in their schools to give avenues to local youth (Peace Corps, n.d.). English education volunteers are usually stationed at high schools in both rural and urban locations, and have even been placed at the university level. Similar to health education volunteers, English education volunteers work with community organizations to provide more opportunities for local youth.
Mobile Libraries

There are numerous mobile libraries operating around the world today, many of which tackle issues similar to those found in the Shkodër prefecture. In the case studies described below, all of the programs are referred to as mobile libraries, but none of them solely focus on providing books. Instead, each has a larger social and community engagement goal.

The Camelback Library in Mongolia was established after the fall of communism in the 1990s, and the rise of capitalism that converted most children’s libraries into banks (Jacques, 2014). In order to combat the absence of libraries, the Camelback Library has traveled more than 50,000 miles across the Gobi desert and through every province of the country (Jacques, 2014). The founder, along with his wife and son, have written and translated literature into Mongolian (Jacques, 2014). Many of the founders original books have earned the Best Book of Mongolia Award, and the Camelback Library has also won the IBBY-Asahi Reading Promotion Award—an award given to programs that provide long lasting contributions to reading (Jacques, 2014). Much like in Albania, Mongolian schools still lack resources, such as books and laboratory equipment, and adequate development of professional educators (Rosario, 2005). The Camelback Library is funded by profits from the founder’s novels (Jacques, 2014).

Figure 22: The Camelback Library
Figure 23: Camelback Mobile library in transit
There are two mobile libraries currently active in Albania. The Lezhë Mobile Library (Figure 24) is run by the regional public library. It provides services to 28 village schools throughout the Lezhë prefecture (Saracini, 2017). Original funding came from a $10,000 national competition where the Lezhë Bashkia, or Municipality of Lezha, was awarded first prize for the best practice (Bala, 2018). With this funding, the library visits villages two to three times a week to provide students with both fiction and educational stories (Bala, 2018). Every trip takes two librarians: the library’s director and an available worker. One staff member checks books out while the other answers questions and interacts with students (Bala, 2018). Although the Lezhë Mobile Library strives to make village visits more frequently and offer activities to improve communal engagement, the current staff and funding have restricted them to only focus only on providing books (Bala, 2018).
Figure 25: Rear of Lezhë mobile library
“…not only did we get children, but we also got, and get women… Women out there are pretty isolated, you know, not allowed to mix with men sitting in a café, you know? So the library became that meeting point.” – Ingrid Jones
Figure 27: Tirana mobile library distributing books
The iRead Mobile Library in Nigeria is another example of a traveling library that brings activities and books to remote, rural villages throughout Nigeria. The iRead Mobile library originated in 2013 with two crates of books on public transit, but has evolved into a fleet of four vans. The first van was purchased with a grant from The Federal Government of Nigeria’s YOUWiN program. This Mobile Library has visited more than 3,000 children who live too far from public libraries to access them (Mitchell, 2018). This is similar to needs in Albania, where there are many small, distant villages that don’t have public libraries.

The iRead Mobile Library not only provides books, it also hosts workshops which use songs, drama, and art to educate children on topics such as sustainable development (Mitchell, 2018). A 12-person team visits each location each week, with anywhere between 1,500-2,500 books on each van at a time (Mitchell, 2018). Currently, the iRead Mobile Library visits 21 schools, 19 neighborhoods, and one special needs facility (IRead, n.d.). During each visit, the volunteers and other staff lead a 35-minute discussion about how the participants felt about the book they read previously. These discussions are usually based on themes such as financial intelligence, poise and etiquette, leadership, or climate change (IRead, n.d.). The iRead Mobile library strives to become “Africa’s largest accessible library, bridging literacy gaps for children, one book at a time” (IRead, n.d.).
Figure 29: One of the iRead mobile library vehicles
The SparkTruck began as a Stanford University project in 2012. It is a STEM-focused “educational build-mobile” that provides a makerspace to various locations across the United States (SparkTruck, n.d.). The program’s mission is to focus on and promote hands-on learning in schools in the United States. The SparkTruck is outfitted with high tech equipment such as laser cutters and 3D printers. They attempt to visit a mix of public and private schools, in urban and rural environments, high- and low-performing districts (SparkTruck, n.d.). The locations they visited were chosen based off of a form that schools would fill out. The truck visited as many locations as they could with the funding they had (SparkTruck, n.d.). In its first year in operation, the SparkTruck traveled nearly 16,000 miles, visiting more than 2,700 students in 70 locations in 33 states (SparkTruck, n.d.). Staffed by four unpaid Stanford students, the group raised $31,000 from a kick starter campaign, $48,000 from corporate sponsorships, and around $24,000 from small donations during the road trip to fund operating expenses (SparkTruck, n.d.).

Figure 30: A Group of children in front of The SparkTruck (SparkTruck, 2018)
Figure 31: Sparktruck doing an activity with students
Our project: The STEAM Machine as a Vehicle for Educational and Community Engagement

Our project aims to lay the foundation for ARKA’s “driving library” by combining information from other mobile libraries, including the SparkTruck and the Tirana mobile library. The travelling STEAM Machine will be designed to provide villages with resources for hands-on learning activities to enhance children’s learning and to provide more opportunities for students to understand technical concepts as well as to engage in activities that support their social development, such as teamwork, leadership, confidence-building and communication skills. The STEAM Machine is designed to utilize supplies and equipment that can easily be found in Albania that will allow children to take activities they do at this mobile library and bring them home. Using easily-accessible materials will also allow the mobile library to restock easily between village visits.

Figure 32: ARKA’s poster for the Driving Library. Retrieved from https://www.facebook.com/pg/qendrarinovarka/photos/?ref=page_internal
Figure 33: WPI students in the Lezhë public library with David
Approach

The overall goal of this project is to provide opportunities for creative, community, and educational engagement within rural villages in the Shkodër prefecture through the creation of a mobile library program focused on science, technology, engineering, art, and mathematics (STEAM) activities. To achieve this goal, we identified the following objectives:

Objective 1: Determine the existence and interest of hands-on STEAM based learning activities

Objective 2: Develop and pilot test STEAM-focused educational activities and programs that could be offered through a mobile library initiative

Objective 3: Understand the potential for sustainability of a STEAM-focused Driving Library

Figure 34: Students and teachers in the Lezhë school library
**Objective 1:** Determine the existence and interest of hands-on STEAM based learning activities

We pursued this objective through mixed methods, including a needs-based assessment of the curriculum in rural public schools; a brief investigation of available space; in-school and extracurricular activities; interest in STEAM-centered, hands-on education.

We sought to answer the following research questions:

- What social conditions within these communities support or detract from an interest in STEAM?
- What after-school activities do children participate in currently?
- What are the existing formal or informal after-school programs or educational opportunities outside of schools?
- What public, educational or recreational spaces are available for hands-on learning activities?

**Semi-structured, Guideline-based Individual and Group Interviews**

We designed a brief guideline-based interview plan to answer the research questions for Objective 1. According to James Beebe’s Rapid Assessment Process, a short guideline-based interview is comprised of predetermined questions focused on a selection of main issues. Depending on the respondent’s answer, questions emerge that allow the interviewer to delve deeper into different dimensions of these topics.

With this interviewing technique, our team interviewed a total of 13 key informants, including Peace Corps volunteers, pre-university teachers, a school director, and members of two Non-Governmental Organizations (NGOs): the ARKA Youth Center and Qendra Kulturore e Fëmijëve Malësi e Madhe. The remaining informants were students in grades 4th-12th who were interviewed on an individual and group basis. An audio recorder was used to record and transcribe only the responses of key informants. All other responses were recorded into field notes. The list of the guiding questions and interview protocol for these interviews is detailed in Appendix A and D respectively.
Figure 35: Locations visited by WPI students
Key Informants: American Peace Corps Volunteers

Upon initial arrival in Shkodra, our team took the opportunity to first interview our project lead, Jermaine Harts, a Peace Corps volunteer who has worked in the Shkodra region for approximately two years. Jermaine Harts is a Community Economic Development volunteer and our project lead that has been working with the ARKA Youth Center for almost two years. He provided initial cultural insights as well as aided in organization of school visits. With his help, we used convenience sampling to interview a total of four other Peace Corps volunteers in the Shkodër prefecture and Lezhë district. We interviewed each volunteer at one of the local cafes.

Each of the volunteers provided us with a basic understanding of the schools, any social structures, existing educational and extracurricular activities, and village-specific information such as demographics or gathering spaces.

Figure 37: Damien Burge is an English Education volunteer who has been located in the city of Vau Dejës, Shkodër for approximately two years. As an English Educator, he assists teachers and lectures his own classes.

Figure 38: Victoria De La Vega is a Health Education (HE) volunteer located in the rural village of Bushat in the Shkodër prefecture and is our second key informant. Although her main function is to help train teachers on Youth Sexual and Reproductive Health, she is often found helping teachers in teaching life skills. Her location has most engulfed her within the Albanian culture and its language which made her essential for understanding the basics of small village life.
Figure 39: Derek Oki is a Health Education volunteer who lives in the peri-urban city of Koplik within the Shkodër prefecture. He instructs middle school students on general health education and has been in Albania for approximately two years.

Figure 40: Minju Kim is a Health Education volunteer who has lived in Lezhë for approximately two years. Her main job was to teach Youth Sexual and Reproductive Health but instead instructs good hygiene.
Key Informant Walkthroughs: Teachers and Directors

To better understand the different school systems, their facilities, and any identify opportunities or obstacles we might face with students, we conducted multiple interviews and walkthroughs with teachers and directors in each school. Interviews were conducted in formal and informal settings, including schoolyards, classrooms and libraries. We consulted with the directors of Bushat, Shkolla 9 Vjeçare “Gjon Ndoci”, and Lezhë, Shkolla 9 Vjeçare “Gjergj Kastrioti”, in order to contact teachers and access classrooms while also securing approval for any photographic or audio recordings. Information from walkthroughs were written directly into a log. All photography was taken with consent.

With permission of the School Directors, we directed formal and informal interviews with a total of five teachers to learn about the current curriculum and how STEAM-focused hands-on activities might support it. Of the five teachers, two function in Bushat—one English and one Chemistry—and three function in Lezhë—an English teacher, a Biology teacher, and a Computer teacher.
Group Interviews: Students in 4th-12th grade

Student experiences were a valuable source of information. Individual respondents were selected through opportunity sampling based on factors such as: English speaking capability, age, gender, and student-teacher relationship. Students who could speak English not only acted as informative respondents, but they also as interpreters for group interviews.

Students were interviewed in multiple sessions from a total of five schools:

1. Shkolla 9 Vjeçare, “Gjon Ndoci”, Bushat

Interviews took place within school classrooms, a schoolyard, and a youth community center. These conversations were facilitated by the project team or by a Peace Corps volunteer and a translator if the students did not speak English. Interviews were transcribed by journal entry. The information gathered from these group interviews helped generate ideas for initial pilot activities.
Interview Analysis

We transcribed the audio from interviews with key informants and field notes from student respondents. Following this transcription, the team was broken up into two teams, one focused on key informants while the other focused on student respondents. Rather than generating themes, we coded so that the perceptions and experiences of observers weren’t restricted by the preconceptions of Albania (Thomas, 2003).

Figure 45: Section of a transcript of an interview with Ingrid from Tirana mobile library

Figure 46: Notes from WPI student notebook

Figure 47: Example of raw coding
Objective 2: Develop and pilot test STEAM-focused educational activities and programs that could be offered through a mobile library initiative.

The purpose of this objective was to create a set of STEAM-based, hands-on activities that also had social/interpersonal skill-building elements. These activities could be brought to different sites for testing. In addition to devising activities, we developed extensive debrief and review questions for each activity to ensure the understanding of learning objectives. The following research questions were taken into consideration:

- How do extracurricular STEAM activities and programs need to be developed to take into consideration gender, age and educational abilities?
- What age ranges will respond to what activities the best?

Use of Pilot Test Studies

This objective was fulfilled through the use of pilot testing. Known by different names--small sample size study, feasibility study, pilot randomised controlled trial--pilot tests are helpful for gauging real demand for a product (Shade, 2015). They often validate activity structure and help understand the time necessary for each session (Shade, 2015). In testing these activities, we considered gender issues in regards to team structure, age, and educational ability for each activity.

Figure 48: Examples of activity kits for pilot tests
Development of a preliminary portfolio of STEAM-focused activities

The team used a combination of past experience, group brainstorming, and online research to create a portfolio of hands-on STEAM-focused educational activities for a range of students. One of our group members is an executive member of a club on WPI’s campus that does similar activities to what we are planning. This provided us with an initial list of activities that are simple and easy to do with a young audience. We also compiled ideas using multiple internet sources and responses from key informant and respondent interviews.

Additionally, we created a Google questionnaire for other IQP teams and friends back in America to fill out with any hands-on activities they remember participating in.

We kept in mind the education and English comprehension level of students and instructors. We also took into consideration the feasibility of gathering the materials we need for the activities.

We collected 27 activities from our different sources but only tested 13 of them due to limited access to schools and time constrains when we were doing the pilot test.

Pilot Demonstrations of STEAM-focused Activities with Students in 4th-12th grade

We formulated 13 activities, which include instructions and a list of materials for each pilot demonstration. Pilot sites were chosen based on the availability of a Peace Corps Volunteers to help gather participants and facilitate the workshops. Student participants in grades 4th-12th were selected on an opportunity sampling basis. The pilot demonstrations contained an introduction, activity, and debrief. We used a combination of participatory and direct observation, reflection, and photography to analyze these pilot demonstrations.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
<th>STEAM</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass Through Paper</td>
<td>Participants use scissors and a piece of paper to create a ring large enough to fit their body through. This is done using a series of alternating cuts on a folded piece of paper.</td>
<td>By utilizing geometry, a piece of paper can be expanded into a large ring.</td>
<td>This is a primarily an individual activity, however, the challenge can be conducted in a group so more people can contribute ideas for the final shape.</td>
</tr>
<tr>
<td>Non-Newtonian Fluid</td>
<td>Create a Non-Newtonian fluid by mixing cornstarch and water.</td>
<td>There are three states of matter. The Non-Newtonian fluid behaves like two of them due to two different conditions. Students learn what a Non-Newtonian fluid is, and how it behaves like both a liquid and a solid depending on the conditions it is put in.</td>
<td>This is a primarily an individual activity. The only opportunity to develop social skills are when playing with the “obleck” and figuring out how it works.</td>
</tr>
<tr>
<td>Origami Cranes</td>
<td>Use a square piece of paper to create a traditional paper crane.</td>
<td>Students may gain a deeper understanding of different cultures and customs. They may learn about Japanese folklore and the symbol of 1000 paper cranes, which represent hope, granting the creator a wish. By utilizing geometry, a piece of paper can be transformed using symmetry into a paper crane.</td>
<td>This is primarily an individual activity, however, participants can work on communication and build their leadership skills by helping other students who are struggling with complex directions.</td>
</tr>
<tr>
<td>Paper Airplanes</td>
<td>Use a piece of paper to make a glider that can fly the farthest.</td>
<td>By understanding the principles of symmetry and geometry, students create an object that flies. This spurs an understanding of basic aerodynamics. More advanced participants may learn about forces such as drag, lift, and gravity.</td>
<td>When working in pairs, participants would need to work on communication skills to ensure they agree on a design and trial and error to find the best plane design. This activity promotes healthy competition and low-stress achievement.</td>
</tr>
<tr>
<td>Coke and Mentos</td>
<td>By dropping candy into a bottle of soda, it creates a reaction that sends soda shooting into the air.</td>
<td>The outside of a Mentos candy has small pores. When it interacts with Diet Coke, it speeds up the oxidation process (releasing bubbles) from the soda, which causes more fizz.</td>
<td>Participants learn problem-solving when determining what amount of Mentos can produce the highest stream of soda.</td>
</tr>
<tr>
<td>Spaghetti Tower</td>
<td>Using spaghetti, marshmallows and tape, students work together to create the tallest tower.</td>
<td>Through a basic design process, students can understand the basics of construction and architecture.</td>
<td>This activity focuses on teamwork and communication. Participants are encouraged to work effectively with their group partners.</td>
</tr>
<tr>
<td>Activity</td>
<td>Description</td>
<td>Educational Benefits</td>
<td>Activity Focuses</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>Elephant Toothpaste</td>
<td>By using a few simple chemicals, participants can create an exothermic reaction that expands and produces something much larger than the initial ingredients.</td>
<td>This is an effective activity to convey the principles of exothermic reactions. Exothermic reactions give off heat, which is made obvious in this reaction as students can touch the warm bottle after the reaction completes.</td>
<td>This activity encourages critical thinking as they try to explain the chemistry behind the reaction.</td>
</tr>
<tr>
<td>Toothpick Bridges</td>
<td>Participants work together to create a self-supporting bridge out of a specific number of only toothpicks and marshmallows</td>
<td>By utilizing triangles and basic construction methods, students make a weight-supporting bridge with basic materials.</td>
<td>This activity focuses on teamwork and communication as participants are encouraged to work effectively with their group partners.</td>
</tr>
<tr>
<td>Tin Foil Boats</td>
<td>Participants work together to use tin foil to create a boat that can hold the most weight without sinking</td>
<td>Understand buoyancy, water displacement, and surface area in the design of boats.</td>
<td>This activity focuses on teamwork and communication. Participants are encouraged to work effectively with group partners.</td>
</tr>
<tr>
<td>Egg in a Bottle</td>
<td>By lighting fire in a bottle and placing an egg over the top of the bottle, the egg is forced into the bottle when the fire goes out.</td>
<td>This demonstration helps students understand pressure by watching it force an egg into a hole much smaller than the egg.</td>
<td>This exercise builds curiosity.</td>
</tr>
<tr>
<td>Friendship Bracelets</td>
<td>Participants use string to weave a pretty pattern on a bracelet they can wear.</td>
<td>Students are not only creating a bracelet with patterns, but they also are learning about the American culture of giving friendship bracelets to friends to show appreciation. Students may also gain a deeper understanding of the world by learning about different cultures and customs via jewelry design.</td>
<td>This is primarily an individual activity, however, participants can work on communication and leadership skills by helping others who are struggling with weaving. This activity also challenges gender stereotypes by encouraging boys to be involved in an art activity that might normally be considered to be for girls.</td>
</tr>
<tr>
<td>Cardboard Racers</td>
<td>By using simple materials, participants create a small car powered only by a rubber band.</td>
<td>Energy and its conservation are taught through the utilization of rubber bands as the “power source” of the cars. Kinetic and potential energy are taught as different terms and types of energy.</td>
<td>This activity focuses on teamwork and communication. Participants are encouraged to work effectively with group partners.</td>
</tr>
<tr>
<td>Baking Soda Rockets</td>
<td>By mixing baking soda and vinegar in a bottle, participants witness the speed of reactions.</td>
<td>Students get a basic understanding of how chemical reactions produce more gas, and how pressure build-up can cause quick physical changes.</td>
<td>This is primarily an individual activity, however, it can be conducted as a group challenge, allowing for more people to give ideas. This encourages collaboration and development of communication skills.</td>
</tr>
</tbody>
</table>

Table 2: Activities with STEAM and Social concepts
Choosing Pilot Sites

Rural and peri-urban disparities exist in our study area, so select multiple test sites for pilot demonstrations of STEAM activities. Ideally, these sites would represent a range of demographics and social conditions from traditional and peri-urban villages.

Managing pilot demonstrations

All activities were introduced through a spoken introduction that included the learning objective and real-world applications of the activity. A group leader demonstrated how to do the activity. For group activities, the lead facilitator split the room into smaller teams based on sample size, aiming to achieve a gender mix on each team.

After completion of the activity, participants gathered for a debrief session. The facilitator led a discussion asking questions such as:

What worked and what didn’t?

What STEAM principles did students learn from the activity?

Did participants understand the instructions and learning objective of the activity?

How or why did students enjoy, or not enjoy the activity?

Sample debrief questions are in Appendix B.
**Table 3: Pilot Test information**

<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>Age Group</th>
<th>Group Size</th>
<th>Activity List</th>
</tr>
</thead>
</table>
| Pukë     | 11/8/18  | 8th-12th graders (13-18 years old) | 6 participants | 1. Pass Through Paper  
2. Non-Newtonian Fluid  
3. Coke and Mentos  
4. Origami  
5. Spaghetti Towers  
6. Paper Airplanes |
| Vai Dejes| 11/9/19  | 4th graders (9-10 years old)       | 15 participants | 1. Pass Through Paper  
2. Spaghetti Towers  
3. Paper Airplanes  
4. Coke and Mentos |
| Koplik   | 11/13/18 | 9th & 10th graders (14-16 years old) | 27 participants | 1. Elephant Toothpaste  
2. Bridges  
3. Tin Foil Boats  
4. Egg In a Bottle  
5. Friendship Bracelets |
| Lezjë    | 12/5/18  | 5th graders (10-11 years old)      | 32 participants | 1. Cardboard Racers  
2. Spaghetti towers |
| Bushat   | 12/6/18  | 9th graders (14-15 years old)      | 13 participants | 1. Baking Soda Rockets |
Participant and Direct Observation

Ellen Taylor-Powell and Sara Steele in, Collecting Evaluation Data: Direct Observation, emphasize that direct observation is an essential element in good teaching and program development. It is also effective for monitoring activity appeal (Taylor-Powell, 1996). For these pilot demonstrations, we took field notes in our roles as participant observers and direct observers. The following roles were taken:

1. Activity Facilitators (WPI Students)
2. Activity Observer (WPI Student and/or Peace Corps volunteer)
3. Media Specialist (WPI Student or Peace Corps volunteer)
4. Translator

Activity facilitators focused on capturing specific details by observing what happens in the pilot demonstrations. These observers looked for physical and emotional responses to an activity, levels of participation, and other salient features that indicate engagement or disengagement with the activity. They also watched for how students reacted to each other. Lastly, the observers looked for whether or not the activity was understood or if any unexpected responses occur.

Activity observers were trained ahead of time to understand the activities that were facilitated. Observations were standardized by creating a list of observations and determining meaning for these observations or mannerisms (Taylor-Powell, 1996). The observer either participated in the activity or sat outside of it directly observing and taking notes within a journal.

Media specialist acted as a direct observer through the use of photography. Consent was obtained from any participants before the demonstration began.

A translator was recruited from Peace Corps volunteer, a faculty member, NGO members, or older students to help facilitate the activity. Field notes recorded by observers were collected and coded. Coding generated themes to note for the iterative process of improving these activities (Beebe, 2001).
Facilitator and Team Reflection

According to Neville Hatton and David Smith at the University of Sydney, a conversation-based reflection can help demonstrate a ‘stepping back’ from the events and actions (Hatton, 1994). A group dialogue with facilitators and the pilot team was conducted following the pilot demonstration to note specific observations with regard to success, challenges, and any future adjustments to the activities.

Figure 55: Facilitators introducing cardboard racers
Objective 3: Understand the potential for sustainability of a STEAM-focused Driving Library

The goal of this objective was to get a basic understanding of the individuals and organizations that could help sustain this project past the completion of this IQP project. Some research questions focused on were:

- Who could sustain the mobile library initiative and why?
- How would interested stakeholders be trained?
- How could potential stakeholders assist the mobile library program financially, physically and academically?
- What potential obstacles does the project face?

Semi-Structured, Guideline-based Individual Interviews

We identified and interviewed candidates who could provide information on the obstacles a continuous community engagement program would face. We asked potential stakeholders about any similar projects focused on youth development, interest, and funding. We recorded important points in handwritten notes or, if the stakeholders consented to us audio recording their interviews, we used a Zoom microphone to record our conversations. The recordings were used as record keeping and as reference for direct quotes. The guidelines for interviewing potential stakeholders are in Appendix C.
Key Informant: Mirjeta Domi, Qendra Inovative Kualifikuese Edu ACT Albania

Mirjeta Domi is the executive director of EduAct NGO and the Tirana, Albania Worldwide Microsoft Trainer and Expert. Qualified Innovative Edu Atc is a part of a larger organization called Science on Stage and supplies training to teachers, conferences, and even after school activities. We interviewed Ms. Domi while her daughter translated for us. We asked questions related to children’s interest in afterschool STEM education. She was particularly helpful for understanding how to elicit responses from students to see their comprehension of basic science concepts.

Key Informant: Toni Linadi, Qendra Kulturore e Fëmijëve Koplik

Mr. Linadi is one of the executives of Qendra Kulturore e Femijeve (QKF) office in Koplik. QK Koplik, or the Koplik Children’s Cultural Center organizes activities for students in the Koplik district, funded by the local Bashkia. The main emphasis of these centers are to host local and national academic, art, and sport competitions. While Mr. Linadi is the executive for the sports section, he offered us invaluable information on the creation of these events and the interest.
Findings

Figure 57: Participants and facilitators watch a bottle rocket take off.
Findings

Our findings are a combination of seven weeks of research, interviews, and pilot tests in peri-urban towns and one rural village in the Shkodër region. We interacted with 80 students, between the ages of 9 and 18, through group interviews and were able to get an understanding of how our project might contribute to education and community engagement. Through our pilot tests, where we worked with 93 participants, between the ages of 9 and 30, we investigated the potential for hands-on education and community engagement for primary and secondary school students in the Shkodër Region.

Coding Interviews

In order to generate themes from our initial insights, the team took both the field notes and transcriptions from interviews and coded them in groups of two people. We had each group highlight important topics/categories from each interview and then combined those similar topics to create themes. Of the multiple topics identified between the two informants, five total themes were identified. As seen in figure 57, these themes respectively are: social conditions, access to resources, sustainability, STEAM and schools, and after school activities.

<table>
<thead>
<tr>
<th>Key:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainability</td>
</tr>
<tr>
<td>Social Issues</td>
</tr>
<tr>
<td>Access to resources</td>
</tr>
<tr>
<td>Apathy</td>
</tr>
<tr>
<td>NGOs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bushtat</th>
<th>Vau Dejes</th>
<th>Lezhe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers won’t accept help</td>
<td>No interactive learning</td>
<td>Took a while for community to warm up</td>
</tr>
<tr>
<td>Restricted Access</td>
<td>No student involvement</td>
<td>Traditional learning</td>
</tr>
<tr>
<td>It’s not the young woman</td>
<td>Students get lost</td>
<td>Needs permission for projects</td>
</tr>
<tr>
<td>Clubs exist at school</td>
<td>School locks/restricted access</td>
<td>Poor communication</td>
</tr>
<tr>
<td>Disorganization</td>
<td>School open 30 mins after close</td>
<td>Taboo topics</td>
</tr>
<tr>
<td>Lack of space</td>
<td>Gatekeeper near</td>
<td>Sexual education</td>
</tr>
</tbody>
</table>
STEAM-based Education in Rural and Peri-urban Schools of the Shkodër County

We found that many students in Vau Dejës, Bushat, and Koplik prefer the more hands-on subjects in school like math and science. When asked what their favorite school subject was, 34 students at different grade levels responded that math was their favorite, of which 25 were girls. Second to math was biology, followed by English.

Although questions were focused on favorite school subject, interest in STEAM-based education was still sufficient for demonstrating the feasibility of a STEAM-based program. It seemed that those who were opposed to STEAM-based activities based their interest on preconceptions of both their previous education and what STEAM is. One teacher commented to a key informant that,

“They have a lack of resources to do activities like this.”

It shows the possible preconceived idea that these activities require highly advanced laboratory equipment and multiple types of computer software for analysis. Indeed, this may also explain why all five of the schools we visited used few to no interactive teaching techniques.

When we asked Bushat’s school director what would make students more successful, she commented that “[they] need different types of practice.” In this same location, there is no public or school library. Instead, a small room holds two bookcases, one with outdated teaching material while the other holds a handful of novels which can only be read in the library (Figure 58). Materials come “from parents who donate books on an inconsistent basis,” the director said.

The same is true in Lezhë, where library access is restricted to three 45-minute periods a week (Figure 60). The school librarian emphasized that “students are encouraged to check out books and read them on their own time,” but the limited hours she can spend “during [her] breaks” can only provide so much access. In the last year, the number of available books has increased dramatically, but they still require more for the 360 students at the facility.

In each of the locations we visited, there was an absence of hands-on learning, laboratory space, or equipment in schools. In Bushat, the science teacher showed us the limited chemistry equipment they had; in a single cabinet, various beakers and a few hot plates that were seldom used, only for teacher demonstration purposes (Figure 61). As literature has noted, funding to these schools is not only low, but is also decreasing.
Figure 60: A chemistry classroom in Bushat

Figure 61: Example English posters in Lezhë

Figure 62: Library schedule in Lezhë
How schoolchildren in grades 4-12 spend their time after school

*Schools Lack Spaces for Afterschool Programs*

The Bushat School has a large field as well as a courtyard surrounding the school. We observed that students, all male, played soccer outside on the courtyard instead of on the field (Figure 63). We later learned that the school only allowed the use of the field when there was physical education class. There was also a rickety basketball hoop next to a small restaurant where students and teachers eat during school hours. After school ends, the gates are locked, closing off access to these spaces for students to use.

Vau Dejës has a park directly in front of the school (Figure 2) that can be used for outdoor activities. The park includes an open grassy area with rusty, damaged, playground equipment and trash scattered around the ground. A Peace Corps volunteer mentioned that there are frequently students in the park from when school starts until school gets out of session, after which the gates are closed. He explained that there are some students who do not go to class; rules about being in class are apparently not reinforced by teachers or directors. When we arrived at the school, we noticed that there was a group of male students socializing and playing with a ball in the park in front of the school building.
The school we visited in Lezhë shared a courtyard with another school next door, which had a run-down court, basketball posts missing their backboards and rims (Figure 62). Unlike other schools we visited, the Lezhë school stays open for half an hour after the school day ends, which provides a meeting place for students. The courtyard stays open for much longer because the other school offers extracurricular activities in their building. Some of these include basketball programs and band rehearsals.

The Koplik schoolyard housed a brand-new basketball and volleyball court as well as a sizable courtyard in front of the school (Figure 65). The gates of the school were always closed when we visited, and we even had to be let in by a guard. This, however, didn’t seem to prevent some older male students from climbing over the wall to leave school.
School Clubs Could Serve as a Model for STEAM Machine Visits

In Bushat, a Peace Corps volunteer runs an in-school club during the last period of the day. Students who don’t have class during this time may participate in a club. One such club run by a Peace Corps volunteer is about Health and the Environment which was meant to meet once a week; the frequency of meetings, however declined as the school year went on. Her goal was originally that of two different clubs; one on female empowerment and one to teach sexual health to both males and females. The director, however, set the club up as a combination of the two. As time went on, it was offered to boys as well, but male attendance was still rare.

The Vau Dejës school offers after-school clubs that are almost exclusively run by the Peace Corps volunteer. Damien hosts his clubs in one of two locations he found from making connections throughout the village with a local NGO member and his host family. One of his clubs focuses on furthering English skills, while the other provides a safe space for girls to explore Albania’s gender issues.

Lezhë is the only location we visited that keeps its school building open for any amount of time after the school day ends. While the building we visited closes a half hour after the school day ends, the other school remain open to host clubs in. The Peace Corps volunteer, Minju took us to a girls’ basketball club that students could participate in if they paid the trainer. While we entered the indoor basketball gym, we witnessed a student band in another building.

Existing school clubs show the potential for after-school student involvement as long there is consistency and structure within the program. The importance of this structure is emphasized in Vau Dejës. In the short time that a Peace Corps volunteer was not there, the girl’s club was disbanded due to inconsistency. Once a new volunteer arrived, the club was immediately reinstated although at a varied attendance rate. Nevertheless, regular meetings allowed for the stabilization of attendance. The importance of this structure is emphasized in Vau Dejës. Within a few months period between Peace Corps volunteers, a girl’s club was disbanded due to inconsistency.
Assessment of STEAM-focused educational activities and programs that could be offered through a mobile library initiative.

For each pilot test, we analyzed the activities on two scales: 1) reception and understanding of STEAM concepts, and 2) the social and interpersonal skills that were embedded in the activities. In the charts below (Table 4 & 5), we “graded” the activities with either a positive or negative sign in both categories and then provided a brief explanation as to why it was graded this way. This is a quick visual representation of how well the activity went in either of these two categories. Following the chart is an in-depth discussion of the observations of these experiences.

Pilot tests were done in two iterations are separate from the other due to the fact that we have different conclusions from each iteration. Although we did repeat some activities, this was due to multiple factors; first, we knew the activity was successful and students would enjoy participating; second, since we knew the activity well enough to present it at that point, we knew what behaviors to look for to get a better understanding of the interpersonal skills and reception of STEAM content utilized by students.

*Figure 68: Participants finish Pass Through Paper activity*
Pukë: November 8th, 2018
Our first pilot test was in Pukë, a small, rural village that was only accessible through a windy, mountainous road. This pilot test was with a group of six participants between eighth and twelfth grade (13-18 years old). There were three male participants and three female participants. As it was our first pilot test, we had a brief debrief session that did not focus too much on understanding STEAM objectives.

Vau Dejës: November 9th, 2018
Our second pilot test was with a group of 15 fourth graders, consisting of 7 girls and 8 boys. Two 9th grade girls acted as translators for the activities. Albanians begin learning English in third grade, so the fourth-grade students were not proficient enough to lead lessons in English. The debrief technique we did, since this was directly after Pukë, was similar. Due to the fact that we had 15, young students and not enough writing materials, we found it easier to verbal debriefs after each activity.

Koplik: November 13th, 2018
Our third pilot test was in Koplik, with a group of 28 eighth and ninth grade students. This group had about the same number of male and female participants. This pilot test became the first model for our revised debrief that were more focused on the retention of STEAM content.
<table>
<thead>
<tr>
<th>Activity</th>
<th>STEAM Content</th>
<th>Social Skills</th>
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<tbody>
<tr>
<td>Positive or Negative</td>
<td>+</td>
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<tr>
<td>Pass Through Paper</td>
<td>• Lacked understanding of geometric principles.</td>
<td>• Some participants left out of team collaboration.</td>
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<td></td>
<td>• Multisensory learning.</td>
<td>• Expresses emotions of frustration and confusion.</td>
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<td></td>
<td>• Expands critical thinking.</td>
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<td></td>
<td>• Making mistakes to learn.</td>
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<td></td>
<td>• Team building.</td>
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<tr>
<td>Non-Newtonian Fluid</td>
<td>• Difficulty connecting characteristics of fluid with real world examples.</td>
<td>• Little to no engagement.</td>
</tr>
<tr>
<td></td>
<td>• Multisensory learning.</td>
<td>• Expresses emotions of disappointment.</td>
</tr>
<tr>
<td></td>
<td>• Expresses emotions of disgust yet curiosity.</td>
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<tr>
<td></td>
<td>• Increases engagement.</td>
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<tr>
<td>Coke and Mentos</td>
<td>• Difficulty understanding the reaction behind the process.</td>
<td>• Little to no critical thinking.</td>
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<tr>
<td>Origami</td>
<td>• Learned about symmetry</td>
<td>• Little to no interpersonal engagement.</td>
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<td></td>
<td>• Learned about folklore</td>
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<td></td>
<td>• Creative design.</td>
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<td></td>
<td>• Learned about structural integrity.</td>
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<tr>
<td></td>
<td>• Learned about managing resources.</td>
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<tr>
<td>Spaghetti Towers</td>
<td>• Difficulty understanding aerodynamics.</td>
<td>• Little to no critical thinking.</td>
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<td></td>
<td>• No use of trial and error.</td>
<td>• Little to no interpersonal engagement.</td>
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<tr>
<td></td>
<td>• Lacked creative design.</td>
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<tr>
<td>Paper Airplanes</td>
<td>• Multisensory Learning.</td>
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<td>• Increases engagement.</td>
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<td>• Critical thinking.</td>
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<td>• Expresses emotions via competition.</td>
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<td>• Builds social-emotional skills.</td>
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<td></td>
<td>• Team building.</td>
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<tr>
<td>Elephant Toothpaste</td>
<td>• Difficulty understanding exothermic reaction.</td>
<td>• Little to no interpersonal engagement.</td>
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<td></td>
<td>• Creative design.</td>
<td>• No retention of learning objective.</td>
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<tr>
<td></td>
<td>• Learned about structural integrity.</td>
<td>• Expresses emotions of excitement.</td>
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<td></td>
<td>• Learned about managing resources.</td>
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<tr>
<td>Toothpick Bridges</td>
<td>• Multisensory learning.</td>
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<td>• Increases engagement.</td>
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<td>• Team building.</td>
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<tr>
<td>Tin Foil Boats</td>
<td>• Creative design.</td>
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<tr>
<td></td>
<td>• Learned about surface area and buoyancy.</td>
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<td></td>
<td>• Learned about managing materials.</td>
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<tr>
<td>Friendship Bracelets</td>
<td>• Multisensory learning.</td>
<td>• Little to no interpersonal engagement.</td>
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<tr>
<td></td>
<td>• Increases engagement.</td>
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<tr>
<td></td>
<td>• Undertones of emotional engagement in friendship.</td>
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<tr>
<td></td>
<td>• Difficulty understanding pressure differences and thermodynamics.</td>
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<td></td>
<td>• Expresses emotions of curiosity.</td>
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Pass Through Paper:

Pass Through Paper was the first activity in two locations, Pukë and Vau Dejës, and was tested by a total of 20 students, six 8th graders and 15 4th graders on two different days. The activities’ main goal sought to teach the understanding of geometric principles by cutting a piece of paper in a way that a person can pass through it. Of the two different age groups, similar responses were elicited from both. Although there were important social skills incorporated into the activity like multisensory learning, critical thinking, and team building, the STEAM content wasn’t well received.

All participants were generally confused and many needed extra help understanding how to cut the paper properly—suggesting no understanding of geometric principles it focused on. They struggled with the fact that this was a complex problem that had no easy answer. It often caused some frustration, eliciting disappointment. Although the process to cut the paper was confusing and somewhat tedious, participants were eventually excited about the final product, and many wore it as a necklace afterward (Figure 68).

During our debrief in Pukë, we heard comments like “amazing” and “inspiring”, connoting feelings of excitement and interest despite confusion. Their confusion, as a result, inspired teamwork and collaboration to think critically and understand the geometry behind the activity. This demonstrates that the use of a math-focused individual activity also fosters social interactions. We did observe, moreover, that in all-female and mixed gender groups, there tended to be more ideas flowing around, whereas all-male groups were less proactive and waited for instruction when they were confused. As for the younger group, we found that younger students require much simpler activities than anticipated, particularly when there is a translation barrier.

Figure 69: Students in Pukë enjoy their final result of Pass Through Paper
**Non-Newtonian Fluid:**

The second activity only in Pukë was creating a Non-Newtonian Fluid using cornstarch and water. Students learned what a Non-Newtonian fluid is, and how it behaves like both a liquid and a solid depending on the conditions it is subjected to. On a STEAM aspect, this activity, also failed. Students struggled applying the concept to the real world. While it was paired with a multisensory learning approach, without having had the previous experience, it was hard to compare.

Some participants were enthusiastic and enjoyed playing with the “oobleck,” but others thought it was too messy, and did not want to partake in the activity. The ones who did not want to engage were only girls, although some still enjoyed the activity. In the debrief session, we received mixed comments like “messy but awesome” and “I don’t like.” (Figure 71) From this, however, we decided to eliminate messier activities that would discourage some participants. This activity showed little understanding of the STEAM content and lacked much interaction or social skills between participants. Although sensory learning was a huge part of this activity, it doesn’t appeal to both audiences.

**Coke and Mentos:**

For the third activity, our team facilitated a demonstration of the reaction between Coke and Mentos in both Pukë and Vau Dejës. Participants were asked what they thought would happen when different numbers of Mentos were added to bottles of Coca Cola. The reactions between Coke and Mentos were generally underwhelming to the facilitators, and some participants had already seen videos of the reaction. Despite this, the participants still appreciated and enjoyed the activity. These reactions were expressed through the debrief comments as well as visual reactions while explaining the STEAM related concepts. As this was our first demonstration, we found that students were not as engaged as they were during previous activities involving more sensory stimulation. It can be shown by the fact that some students disregarded the activity, talking to one another instead, and lacking animated facial expressions.
Figure 71: Facilitator executed coke and mentos experiment

Figure 72: Participant responses from activities in Pukë

1. Amazing, inspiring
2. Funny, weird
3. Cool, (kinda boring)
4. Great
5. Exciting, good
6. Great, amazing (bc we won)

- Pretty surprising in the end!
- Messy but ookooöma!
- Cool, even though it didn’t go as planned.
- Tiresome, I’m not made for all that brain work.
- Marvellous!
- Fun!
- Is this unlongleftrightarrow
- Funny
- I don’t like it
- Boring, im-fun-write
Origami:  
The fourth activity was creating an Origami Paper Crane which brought the art component of STEAM. This functioned as an art activity similar to the Pass through Paper activity, where it was confusing for the participants.

Many participants needed to be shown each step multiple times, and some were still confused, despite receiving one-on-one hands-on instruction. We observed that certain participants would assist others, and although we could not conclude this, it shows evidence that participants understood the activity to a small extent. All of the participants eventually created the final product, and many were pleased that they actually completed the activity which they struggled so much with. The downside to this facilitation, however, is the limitation of critical thinking and interpersonal engagement. We determined that activities requiring less instruction from facilitators, and more problem-solving from participants encouraged higher levels of engagement.

Figure 73: A decorated paper crane
Spaghetti Towers:

The fifth activity appeared to be the most successful activity between the two visits. In the Spaghetti Tower activity, participants were grouped into teams of two or three and tasked to build the tallest spaghetti tower they could in 10 minutes. Not only did they propel STEAM understanding of structural integrity, and managing resources, they also demonstrated the capacity an activity has for incorporating all the social benefits of hands-on learning. Within the older group, creative design was demonstrated through the participants creating successful structures despite not having any example of what the spaghetti towers could be. The collaborative nature of this activity, moreover, propelled communication from both genders while also practicing the reiterative nature of the scientific process. Mixed gender teams often had the most success in not only building the higher tower, but a successful tower at that.

We observed high social engagement, where, this activity had the participants in the most excited and creative state. Children were all excitedly talking to their partner as they created their towers, building social-emotional skills. Many of the 4th grade group tended to copy designs that seemed to be working for other groups—making a lot of the towers extremely similar. The copycat nature may indicate that some students did not understand the STEAM content behind the activity, however, we observed that students also finalized those structures in their own creative ways. This insight suggests the use of critical thinking in a quickly changing environment. Rather than following the crowd, students pressured instead to be the most creative. Overall, the experiences between these two pilot tests suggests that this activity is successful in promoting educational and social engagement.

Figure 74: An all-boys team making a spaghetti tower in Van Doijes
Paper Airplane:

The last activity in Pukë was the Paper Airplane competition. The participants were split into three pairs and were asked to create a paper airplane to fly as far as possible. The pairs were each given two sheets of paper, one for a practice plane, and one for the final competition. These pairs worked well, and we observed ample communication between partners, as well as excitement from participants during the competition. The teams were given some example designs of paper airplanes, limiting the creativity that had been observed in the spaghetti tower activity. From this we determined that offering examples discouraged individuality. On a STEAM basis, there was less of an understanding and more of regurgitation of instruction.

Within the social skills aspect, activities encourage interpersonal interaction between participants through discussing potential design ideas as well as communicating to each other while waiting to test their creations. The participants were excited about this activity and were jumping around while waiting to watch their creations fly. However, there once again was not much difference in the designs of the airplanes, similar to Pukë.

Elephant Toothpaste:

We began our third pilot test in Koplik with a demonstration of the Elephant Toothpaste activity. This activity was not very successful. Not only were the reactants not properly measured out, resulting in an underwhelming reaction, but the participants did not understand the concepts behind the reaction. When asked why the foam was warm or why it kept bubbling, they either responded by saying “It is warm because the water was warm,” or by repeating the directions back to us. The participants seemed to understand what was happening in front of them, but they were not understanding the explanation of how or why the reactions happened. This activity can be best seen on the first page of the pilot tests. Since this activity was a demonstration, there was not a social aspect that could be measured.
Figure 76: Students feel the temperature of elephant toothpaste.
Toothpick Bridges:
The Toothpick Bridge in Koplik was much more successful than the first. The group was split into groups of four and tasked to build a bridge out of toothpicks and marshmallows to cross a gap between two tables. All of the girls tried to form one large group, but when this was discouraged, they split and formed mixed groups. This emphasizes teamwork between genders which they wouldn’t normally choose out of free will. There was more space to spread out the groups for this activity, because we were using an outdoor space, so each group utilized sensory learning techniques had a unique design.

Additionally, the participants all enjoyed watching their creations being tested, and there was almost an issue of too much excitement during this activity. When trying to discuss the engineering behind what type of structure would work best, we gave them an example of why the triangle was the strongest shape. They were able to communicate this back to us, but struggles with coming up with examples in the real world. Like the Spaghetti Towers, this activity emphasized collaboration and leadership as each group had to find a balance using each other ideas while succinctly building a bridge in the allotted time.

Figure 77: A completed marshmallow bridge in Koplik.
**Tin Foil Boats:**

Following the Toothpick Bridge activity was the Tin Foil Boat activity. This activity used the same teams as the previous, so they all worked quite well together. Teams were given supplies to make two different tin foil boats and were told that they could choose to test whichever they decided the better of the two. Teams did not exactly follow these directions, and many made two of the exact same boats and expected to be able to test both, despite being told otherwise from the beginning. Despite this confusion, participants all enjoyed this activity, particularly watching their creation be put to the test. When we tested the boats, we explained why certain boats worked better than others. It was difficult to see how they received this information due to the fact that some of them were still rowdy from the testing of boats.

**Friendship Bracelets:**

The next activity was teaching the participants how to make Friendship Bracelets. This activity was specifically chosen to push the gender role issue, which we believe was successful. The male participants were a bit weary of the idea of making a bracelet when the lead facilitator was female, but once the male facilitators started walking around and helping out, they became much more involved in the activity. This was received well and understood by the students as they kept working after we stopped giving instructions. They were helping each other, asking about different designs, and playing around with different colors. Although this activity did not have a technical aspect to it, having male facilitators assist instruction with the bracelets certainly helped break down gender expectations.

*Figure 78: A tin foil boat is tested*
Figure 79: Facilitator helps participants make their friendship bracelets.
Egg in a Bottle:

The Koplik visit concluded with the Egg in a Bottle activity. This activity was poorly executed and was not exactly well received. Not only was the demonstration not carried out properly, but there were also other factors that went wrong. The bell to let out younger children from class went off 18 minutes sooner than expected, so a large crowd formed around the activity, with children pushing up against the facilitators, and even throwing things at them. The egg was not completely sucked into the bottle, which is what the students were told would happen. We explained the scientific concept of why it should have been sucked into the bottle, the students had a hard time comprehending it. They all agreed that it made sense, but most of them still had confused looks. We should have kept explaining, but a massive crowd swarmed the schoolyard, becoming very loud, interrupting the activity.

Figure 80: Facilitator demonstrated the effects of the failed egg in a bottle demonstration

Figure 81: Close up view of Figure 79
Lezhë: December 5, 2018

Our fourth pilot text was with a class of 5th grade students in Lezhë. There were 17 boys and 15 girls. In addition to the two WPI students, there was one Peace Corps volunteer and one teacher. Both were able to translate our instructions as well as what questions the students were asking.

Bushat: December 6, 2018

The fifth pilot test was seven male and six female 9th grade students.
Revised Set of Pilot Tests

When conducting our pilot tests, we noticed that participants would answer our debrief questions by either repeating what we said earlier or describing the exact process we demonstrated. It often seemed that they couldn’t understand our explanation because of the language barrier or the description of the process was too complicated. To address this, we adjusted our pilot demonstrations by reducing the number of activities and focusing on the collaborative process. In the following pilot tests we took more time to focus on the debrief session, since we had a general understanding that participants would enjoy the activities from our previous excursions. These tests were to understand the effectiveness of the potential hands-on STEAM activities offered by the program in the future.

<table>
<thead>
<tr>
<th>Activity</th>
<th>STEAM Reception</th>
<th>Social Skills</th>
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<tbody>
<tr>
<td>Positive or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>+</td>
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<tr>
<td>Cardboard Racers</td>
<td>• Learned about potential and kinetic energy.</td>
<td>• Multisensory Learning.</td>
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<td></td>
<td></td>
<td>• Increases engagement.</td>
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<td></td>
<td></td>
<td>• Critical thinking.</td>
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<td></td>
<td></td>
<td>• Expresses emotions of personal achievement.</td>
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<td>• Builds social-emotional skills.</td>
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<td>• Team building.</td>
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<td>• Educational retention</td>
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<tr>
<td>Spaghetti Towers</td>
<td>• Creative design.</td>
<td>• Multisensory Learning.</td>
</tr>
<tr>
<td></td>
<td>• Learned about structural integrity.</td>
<td>• Increases engagement.</td>
</tr>
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<td></td>
<td>• Learned about managing materials.</td>
<td>• Critical thinking.</td>
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<td>• Expresses emotions via competition.</td>
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<td>• Builds social-emotional skills.</td>
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<td>• Team building.</td>
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<td>• Educational retention</td>
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<tr>
<td>Baking Soda Rockets</td>
<td>• Creative Design</td>
<td>• Multisensory Learning.</td>
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<tr>
<td></td>
<td>• Learning about pressure.</td>
<td>• Critical thinking.</td>
</tr>
<tr>
<td></td>
<td>• Learned about chemical reactions.</td>
<td>• Expresses emotions via competition.</td>
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<td>• Builds social-emotional skills.</td>
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<td>• Educational retention</td>
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</table>

*Limited interpersonal engagement.*

*Table 5: Activities for pilot tests in Lezhë and Bushat*
Figure 82: A teacher translates instructions in Lezhë
For this activity students were challenged to make a rubber band powered car from cardboard and CDs. This was focused on teaching energy, specifically potential and kinetic energy, and the conservation of the two. We explained these two through using an example of a rubber band. By stretching a rubber band and shooting it across the room, it demonstrates a perfect example of the transfer of energy from potential to kinetic.

This activity fosters several important social skills. This was a team activity, leading to some constructive discussions between students about the design of the car. By using their hands to build their car, the students were able to develop through multisensory learning. This increased student engagement to subject material as well as critical thinking for them to solve some problems that arose during their building. For example, they struggled with ensuring that the axle would turn freely because of the friction between the dowel and the cardboard. They kept asking the teacher questions as well as looked at the example we provided for inspiration. Through trial and error, many groups found their own solution.

After the set time came to an end, all of the students had a working contraption which they were excited to try it out. Through this showcase of socio-emotional skill development, they were able to celebrate their finished product.
Spaghetti Towers:

The second activity was Spaghetti Towers which went much smoother than the previous activity. The objectives were much clearer and easier to achieve, so the students asked less questions. The student groups competed to create the tallest tower from just spaghetti, marshmallows, tape, and string. The main concepts we taught was about how triangles are the strongest shape in a support structure.

The main STEAM concepts that were communicated during this activity included working on their creative design skills, learning about structural integrity, and managing materials. Building a tower using only prior knowledge, can show each group's unique vision of how this structure will be constructed. Each member of the group has a different experience that they can contribute to the design process. Through working with materials that are pretty common, participants get a basic understanding of how to create something that takes into account how different building blocks will stand. They also have to understand how to utilize the limited materials and divvy each component, whether it be tearing the marshmallows to act as connector for spaghetti or breaking up the tape to connect different spaghetti lengths, and still create a tall tower.

Figure 84: Students develop a spaghetti tower in Lezhë
During this activity, there were two teams comprised of both boys and girls. On each of these teams, the boys were less engaged while girls more active in the building. One of the WPI students and the teacher had to encourage the boys to start helping before they started to become more actively involved. Even though there was initially a lack of communication, there was still a positive sense of team building and engagement between team members. Through the management of materials, students had to use critical thinking to build the tower and make sure it was free-standing. Since they are using their hands, this develops multisensory learning as well as helps them retain the information better. Through the fostered sense of competition, the students became invested into this challenge, causing their emotions to get a flare. By the end of it, they all were excited to see who made the tallest tower.

**Baking Soda Rockets:**

The third activity that was in our second set of pilot tests was Baking Soda Rockets. In this activity, participants are given the opportunity to build and launch a rocket made from a water bottle, baking soda, and vinegar. Participants were each given the materials to decorate their rocket and add some individuality. Unfortunately, this does limit the interpersonal engagement the participants are exposed to.

There were some important STEAM concepts that participants embraced while creating and eventually flying their rockets. When decorating, each student got display their individuality by either making butterfly wings or wrapping their entire bottle with one piece of paper. Once testing started, this is when we taught about chemical reactions and pressure. The mixture of baking soda and vinegar releases gas at a steady rate and continues until there is no more baking soda left to react with. Pressure is built up in this situation when participants insert their cork into the bottle opening. The interior of the bottle builds up pressure until the cork is shot out and launches the bottle into the air.
Through adding baking soda and vinegar to their bottle, although it was regulated by the facilitators, the participants still had to analyze how quickly their reaction would happen and how fast to act with placing in the cork. They could feel the bottle expanding as they put the cork in giving them another way to understand what this reaction was doing. We saw an impressive sense of critical thinking from the participants when making the components of their rocket. For example, during the formation of this activity, we made our corks fit a bottle using tape. However, the students used the construction paper we gave them because they felt it would work better. This activity also brings about a little sense of competition. Each participant wants to make the rocket that flies the highest, so they all want to pay attention to how to best set up their rocket and add the most materials. They were excited to see their creation take off into the sky and even wanted to repeat their trials when it failed or did not go as high as they hoped. We had multiple participants as well as bystanders ask us for more baking soda and vinegar so they could see a bottle fly again. One of the major ways that we saw the retention of information was an older participant was explaining how the chemical reaction worked to a young bystander who had a look of awe on his face. In addition to this, when one of the participants was leaving, a facilitator asked her if she wanted to take some extra materials to do the experiment again. She replied “No, I want to do it myself.” Rather than taking the kit home, this participant challenged herself to find the activities at home and replicate the experiment. This just reinforces the ideas of educational motivation and engagement.
Figure 87: Students customize their baking soda rockets in Bushat
Effectiveness in fostering STEAM understanding and interpersonal engagement

Two effective methods of understanding the retention that hands-on material are reflection and metacognition. Reflection is having students think back upon their lesson and activity and do a little self-analysis (Concordia, 2018).

In that said, we facilitated a reflection session in Lezhë by asking questions about what they learned from the activity. There were two major successes for the learning objectives we observed from this. First, there were multiple students who wanted to speak about what they learned so that was an indicator they learned something new. Second, the students provided a comprehensive explanation of something they learned, that came as an original thought. This takes into account the fact that students had some sort of previous knowledge about building and was able to apply it here. That requires critical thinking and proved were fostering learning.

Another way to analyze whether learning is effective is by observing or eliciting metacognition (Concordia, 2018). This is when a student is able to understand that they learned by reiterating what the learning objectives are while describing why everything works (Concordia, 2018). This helps them articulate how they are learning. By discussing with another student what they learned, it reflects how they learn. In Bushat, a student was able to explain how the Baking Soda Rockets worked without the assistance of one of the WPI students. By being able explain the problem and solution to someone else, the student exemplifies metacognition by showing she was aware of her thought and problem-solving process. Another example of this was seen in Koplik. During the Friendship Bracelet activity, students began to help each other when they were struggling. By helping a peer who is struggling with something that was challenging in the past, the student reinforces her understanding of the material.

Figure 88: Metacognition Diagram. Retrieved from http://www.queensu.ca/teachingandlearning/modules/students/images/metacognition.png
How might the STEAM machine support community engagement?

A STEAM Machine can assist in bridging the gender gap

A gender divide was a recurring theme across every village we visited. In Bushat, we witnessed men in public spaces, like cafes drinking and chatting, playing billiards or chess, or working in jobs such as construction. Conversely, we witnessed few women on the streets, apart from the occasional grandparents taking care of a young child or picking up groceries from the store. Damien mentioned, “[Girls’] parents would not let them go on a field trip to the beach with just me. Once Arta (a past teacher who now works at the Bashkia in Vau Dejës) said she was coming with [them], mothers were much less wary about letting their daughters go.” Veronica, a 9th grader from Vau Dejës, spoke to us about how it is impossible for her to participate in after-school activities without first getting permission from her father. She mentioned that “her parents will only approve of school related activities” and are more likely to “get permission to go to an after-school event if [her] parents know [her] friends will also be in attendance.” This topic was not uncommon when talking to girls at schools, it was in no way apparent with males.

Through our activities we were able to start to bridge the gender divide, since we encouraged boys and girls to work together on these activities. This can potentially help young women and men change their notions of gender roles by challenging what they see as traditional roles for boys and girls.
Girls are more engaged in hands-on STEAM activities than boys are.

Throughout our pilot tests, girls tended to be more engaged in the activities than the boys. This was unexpected given the general lack of extracurricular opportunities available to girls outside of school, compared to boys we had previously observed.

During pilot testing, girls tended to need less encouragement to participate in activities than boys, with the exception of the Non-Newtonian Fluid activity, because, to quote some of the debrief responses (Figure 71), girls and young women “did not like” the activity because it was “messy” and “weird.” In all other cases we observed the girls being much more intuitive and engaged than the boys were.

In engineering design activities, such as the spaghetti tower activity in Vau Dejës, and the tin foil boat activity in Koplik, girls tended to lead the design process. The leader of the design process tended to lead group discussions, bring up most, if not all, of the group’s design ideas, and many times would lead the build process. They would do work themselves as well as delegate work to partners.

In cases where girls and boys were in gender-segregated groups, groups of boys tended to copy the designs of female groups. This happened particularly in Vau Dejës during the Spaghetti Tower activity. In mixed-gender groups, who led the design process usually depended on the ratio within the groups. In pairs where there was one boy and one girl, the girl was almost always leading the boy throughout the process; telling him what to do, and generally leading the designing again, this was apparent during the Spaghetti Tower activity in Vau Dejës, with the singular mixed-gender team being led by the female participant (Figure 85). In three-person groups, whichever gender had two members tended to take control and would lead designing the project. During the Spaghetti Tower activity in Pukë, there were two groups, one with two girls and one boy, and the other with two boys and one girl.
In one group, the two girls took an active leadership role, often being more talkative and engaged while the male participant followed their instruction. In the group with two male participants, the boys often dominated the design and construction as the female participant stayed off to the side and was not as active. When the ratio of boys to girls was closer to 1:1, boys and girls participated in activities evenly. They had equal contributions to the design of a building or helped lead team discussions. In general, mixed groups tended to perform better than all-boy and all-girl groups.

From our observations, we surmise that although girls receive fewer opportunities than boys, when they receive opportunities they are much more receptive of them. We do not know, but wonder whether this might be because girls and young women have few chances to pursue their interests, so whenever they do get an opportunity, they make the most of it, not knowing the next time they will have another. Boys, on the other hand, are more used to having opportunities to pursue interests, so they are less inclined to make the most of every opportunity that comes around. They may think that if they don’t use this opportunity, another will come along soon enough, which is a luxury that girls simply do not have.
STEAM Machine activities can provide new opportunities for interpersonal engagement

We regularly noticed a lack of free space for children to meet after school. With school yards that lock immediately at the end of the school day, there were few locations for students to meet. Both Koplik and Vau Dejës have football fields, but these must be rented out, and children would need to pay to use them, which makes them inaccessible to many children.

Koplik was the only town we visited that seemed to have any kind of open public space. (Figure 93) This area was tiled, and was located between two busy roads, which deterred any children from playing games in this area. There was nothing in this area during either of our visits to Koplik, and Derek informed us that he had never seen anyone there aside from the occasional street merchant.

We interviewed many students in order to determine what kinds of activities they participate in after school. The majority of girls we interviewed, such as Paula and Veronica from Vau Dejës, as well as Larissa and Antea from Koplik said that she went straight home after school, or commented that she would occasionally do things with friends, like go out for coffee.

Boys we interviewed would occasionally mention going straight home, but many spoke about going out with friends to bars and coffee shops, as well as billiards halls, or video game stores. One boy in Koplik named Auron travels to Shkodër to play basketball after school, but he was the only one out of 80 students interviewed who mentioned anything about travelling to another city to participate in a regular after school activity such as an organized sport.

Many of the Peace Corps workers we spoke with had started after school clubs in their schools, and in almost every one of these cases, the clubs started by the Peace Corps volunteers were the only ones available at the schools.

This lack of free, accessible after school activities supports the need for this STEAM Machine to provide opportunities for youths in these locations and others like them throughout the Shkodër prefecture.
Figure 95: Facilitator and students finish their bottle rockets.
Understanding the potential for sustainability and obstacles of this project

Through interviews with Peace Corps volunteers, we discussed a pessimistic outlook that seemed to be apparent in many schools. Derek said that efforts to start new clubs was halted by this attitude. Minju confirmed it as a reason for the lack of clubs and extracurricular activities. In an interview with a former teacher now at the municipal government (the Bashkia) in Vau Dejës, we asked her thoughts on whether the Bashkia would be interested in working on a creating a vehicle for hands-on activities. She laughed and shook her head no; not only does the Bashkia have other priorities, but she recommended that it wasn’t worth it. In the past, funding for projects were dropped randomly, although funding was promised. These responses indicate that a lack of interest in starting new projects may create a challenge for any support for the STEAM Machine.

Additionally, this project will have to overcome the challenge of students and teachers having to leave after school to travel home. This was exemplified during the last pilot test in Bushat. When inquiring the Peace Corps volunteer and teacher about if any of the students wanted to stay longer, they quickly responded that many students had to catch the furgons back to their respective villages. As the activity ended all but a handful of students hurriedly left, followed by the teacher who went to board a separate furgon.

Our group became puzzled by the lack of discipline and rules within schools. We saw students who would hop the schoolyard fence in the middle of school as well as teachers and directors who would leave in the middle of the session. The comparison of teacher engagement to the interest of students to STEAM and hands-on learning allowed us to gain interesting revelations to the limited role that schools should play within this STEAM Machine.

Another challenge this STEAM machine faces is the difficulty accessing public spaces. When interviewing key informants, we learned that schools were meant to double as community centers. However, this was usually just used as a title since the schools are locked shortly after session restricting access to a potential public gathering space. A Peace Corps volunteer emphasized the culture around closing space. Once, during one of their clubs, the janitor shut the electricity because he wanted them out of the building. The community center is supposed to be a place for residents to gather but if it’s locked up, it restricts one of the rare public spaces the bus could set up.

*Figure 96: Fenced in space behind Van Dejës space*
Ethics, Limitations, and Concluding Remarks

Figure 97: Boys in Lezhë focus hard on finishing their cardboard car
Ethics

By visiting five schools, we got to interact with a multitude of people from students to teachers. Our goal was to gauge interest of STEAM education and conduct pilot test to determine the feasibility of including these activities in our sponsor’s mobile library program. We had to be careful when talking to interviewees, especially students, when mentioning the potential of involving these “STEAM Machine” activities because we didn’t want make a promise that wasn’t going to be fulfilled. When we visited schools more than once, students often assumed that we would be coming more frequently, providing their schools with supplies, however this was out of the scope of our project.

Figure 98: Two girls follow instructions in Van Dejës
Another question that almost all IQP teams face is, “What makes you foreigners experts on what should happen in our home country?” We attempt to address this by making sure to emphasize that we are merely drafting suggestions that can be an addition to their project and not the direction their program should take. We have only been in this country for 7 weeks and do not claim any expertise over how their culture works and should work. However, our project pushes students to collaborate and use critical thinking in a different setting than usual. ARKA’s mobile library could offer these opportunities that challenge participants to exit their comfort zones by introducing these new experiences for people to be engaged outside of work and school.

Figure 99: A student pauses while decorating his bottle rocket
Limitations Bias

Although we have gathered a plethora of data through observations and interviews we found it impossible to exclude personal bias from interpersonal interactions.

Participant Bias

Our data only represents a certain demographic in the schools we visited. These schools were always in locations where Peace Corps volunteers currently served. Our project lead explained that the volunteers would not be sent to extremely conservative villages or very rural ones due to safety concerns such as transportations to health facilities. The Peace Corps only sends volunteers to locations that request help and have the resources to host these volunteers for at least two years.

We only visited locations where Peace Corps volunteers were stationed because this was the only realistic way to access schools and interact with students with our limited time and resources. We did not have enough time to develop relationships on our own and instead used the already-existing connections that the Peace Corps volunteers created to visit these schools.

When conducting pilot test, our audience tended to be classes which Peace Corps volunteers had selected. These selections were based off of student’s English and engagement levels.

Interview Bias

Due to convenience sampling, our interview selection presented a bias into our project. Of the informants we interviewed, five were American Peace Corps volunteers.

The fact that our project lead, Jay, was a Peace Corps volunteer, we were provided with many connections throughout various schools in Northern Albania. With so many interviews from Peace Corps volunteers, our data inherently has a bias towards a volunteer’s perspective.

We also interviewed 80 Albanian students, which provided us with more insights from Albanian citizens, though this posed as another inherent bias in several of these interviews. Since we could not speak Albanian, we tended to interview those that could speak English. Peace Corps volunteers selected students that were well behaved and proficient English speakers to be interviewed.
Response Bias

Local participants and key informants were excited to hear that we were from America and would often times give us special treatment. Both students and teachers alike were excited to hear about us and our project; many wanted to know why we would ever choose to leave America and come to Albania.

Their fascination with us and where we came from often led people to try and impress us. This was an issue when trying to figure out on what everyday life was like. Students would sometimes become distracted from the current topic, and would question us about sensitive topics like political standing and drugs. While it was important to build rapport we had to focus on our project due our short time at the school. Students also tried to impress us by exclaiming they enjoyed our pilot activities, even if they did not seem active or engaged during certain

One Peace Corps volunteer, Damien, mentioned that teachers would often change the way conducted their class by involving more hands-on lessons when they were informed about being observed by Peace Corps Officials. However, teacher would then revert back to their typical lesson format once the officials left.

We believed that the Peace Corps volunteers were unlikely to try to impress us as they are our peers and contemporaries.

Limited Testing Locations

Of all the places we visited, Bushat was the only location defined as a rural village. All of the others are slightly larger, more developed areas, and are considered peri-urban rather than rural. This limits our ability to apply our knowledge directly towards rural locations, but it does answer the underlying question of the interest of hands-on STEAM activities. Moreover, the STEAM Machine could potentially be visiting both rural and peri-urban locations due to the lack of STEAM based activities in both areas. In order to better extrapolate our findings to various rural locations around the Shkodër region, more pilot testing in rural villages would be needed. From our findings, it seems that most places outside of big cities are similar in their lack of resources and interactive learning, but this can be better observed through more site-specific interactions.

Recent Statistics are not available

An issue we faced during our research on the background of the Shkodër region is the general lack of recent studies on social issues and educational statistics. While this was not a substantial problem, it would’ve allowed better context of potential problems the mobile library program could address.
**Conditions**

**Time Limits**

For each pilot test, we were given a limited amount of time to do activities. However, many pilot test started late because of inconsistent departure times, calming students down, or preparation of materials. Multiple tests ended much earlier than scheduled because the period ended sooner than expected. In another case, our translators had to leave half an hour early which forced us to end our testing. Due to the delayed starts and early endings of these pilot tests, we did not always get to complete all the activities we had planned, nor could we properly debrief the participants. This inhibited us from fully developing our debrief strategies in the first set of pilot test.

**Small Sample Size**

Although we obtained a large amount of data from our fieldwork, we only performed pilot tests at each school once. It is difficult to draw a representative conclusion from a limited amount of trials. We based our suggestions by extrapolating the data we had obtained so our claims are not concrete conclusions.

**Language Barrier**

Whether they were Peace Corps volunteers, older students, or teachers, we had a translator in every location. Despite the constant presence of a translator, we often had a difficult time conveying scientific and engineering concepts. This was due to a few problems; the translator did not know how to explain some STEAM vocabulary to participants; we did not know the correct way to describe something to younger students; and we did not know how to teach someone who did not have extensive STEAM education. Since we are all engineering students, we constantly think about how and why things happen. This may not be a common concept within rural Albanian schools. Students quickly picked up an understanding of what happens, but struggled to communicate their understanding of the reasoning behind it, which was an issue that we tried to overcome in our debrief sessions.

There were also times during pilot tests and group interviews where there was an overwhelming number of students asking. This posed an issue particularly when the participants did not know English very well. If one student had a question, we could easily get the translator to answer their questions, but when there were multiple questions being asked, the translator would quickly become flustered. While this was an issue with our project, this likely will not be an issue for the future of the STEAM Machine, particularly if it is staffed people who are fluent in the language.

*Figure 103: WPI students in Lezhë public library with Albanian student*
Team Understanding of the Project

We received this project much later than we had anticipated, leading to a lack of background research before we got to Albania. This lack of background knowledge caused us to have a rocky start as we struggled to define the specifics of our project. We did not know that we would be entering schools until we were already in Albania. From our lack of preparation time, we also struggled finding locations to visit, just another contributing factor to why we relied so much on our Peace Corps volunteers. If we had more time to research locations, and find more people to develop relationships, we may have found a wider range of schools to visit.
Concluding Remarks

Improvements

Although we are proud of the work we have done, there are some improvements we would make to better qualify our findings and conclusions. We would have liked to visit each of the pilot test locations in multiple iterations as a triangulating measure. In addition, we would be able to witness varying attendance as to decide the future sustainability of the program.

Moreover, additional pilot tests may have allowed to apply more thorough debriefs which would better conclude the effectiveness of a STEAM Mobile Library program. We could also observe how well participants retain information between visits, modeling how the STEAM Machine could run during actual visits.

Lastly, we believe we could have developed more activities that could both provide the technical STEAM aspect as well as the social skills. These activities would ideally mirror activities like the Spaghetti Tower, which were both successful and fostered the technical and social aspects.

Indicators of Success

Success in this project could be measured based on three indicators: continued attendance, demographic diversity, and increased classroom engagement. Continued attendance and demographic diversity will prove the vehicle as a tool for community engagement while increased classroom engagement will prove as a tool for educational engagement.

The demographic diversity and attendance rate of community members could be monitored through a library card system. First-time visitors can fill out a form about age and gender. Monitoring the demographics of visitors will provide ARKA with site-specific statistical data on the retention rates. The program can be deemed successful in this aspect when both men and women of all ages in the community are represented with reasonably high return rates.

The third indicator can be measured by two functions. Educational engagement can be determined via qualitative analysis of discussions with local school teachers. As teachers have first hands accounts, they can give the most direct response to this indicator. Secondly, focus groups can follow up with local students regarding specific books or activities that they were interested in. These follow-ups can also generate information by inquiring about the current curriculum. The library driver for the vehicle can conduct these short interviews and informal focus groups during each visit.

Figure 105: Participants, teacher, and facilitators in Lezhë
Potential for developing further Community Engagement

Develop Community Engagement

Hands-on STEAM activities provide much more than purely educational benefits and we believe that such activities can be used in situations that are non-educational. Having spent seven weeks working on developing hands-on activities and analyzing how and why they work on both STEAM content and social skills, we believe there is some potential for these to be used in social settings because of the joy and curiosity they facilitate. Hands-on STEAM activities like those provided by the STEAM Machine could act as a creative outlet.

Victoria, the Peace Corps volunteer in Bushat commented that many people in these rural places are resourceful because of their lack of resources, but they tend not to be involved because there are no opportunities to do so. Hands-on STEAM activities like those provided by the STEAM Machine could act as a creative outlet.

Interactive opportunities, such as those we have studied throughout this project, hold the potential to serve as ice breakers in community meetings or other public events. Many of these activities, particularly those involving teamwork, encourage communication between participants, regardless of age, gender, or education level.

Ingrid, from the Tirana mobile library, commented that the mobile library was a meeting place for the older women of the community. Incorporating this knowledge in the program may offer a chance for older residents to gather and socialize in a different setting. Additionally this vehicle could provide a community center providing events for the village it is visiting. Community engagement often comes in the form of new experiences. Some of these are workshops, plays and concerts. These new experiences are essential to developing interpersonal skills with different genders and ages.
Bridging the Gender Divide

In order to ensure female involvement, the STEAM Machine will need to stay attentive to creating mixed-gender teams and opportunities. Moreover, it is imperative that the STEAM Machine be staffed by both male and female facilitators as much as possible. Equal representation of staff may show the participants how these activities are suitable for both girls and boys. Girls tended to be much more open to the female member of our group, which comments on the presence a female facilitator will likely have on increasing female participation and engagement in the activities.

Bridging Generational Divides

While it is easy to solely focus on children within a mobile library initiative, it is just as important to discuss the effect a project like this may also have on adults. From the study of literature, it is clear that the involvement of parents in school years varies. As the child progresses through more classes, parental involvement decreases in school life and in their child's education. The interest from the parents, however, only progresses. When children participate in higher level classes, parents feel difficulty in understanding and are often found near their children and perhaps seek the support of the school and especially the teachers who have the necessary expertise (Bushati, 2014).

ARKA may want to take note of this and even incorporate activities into the STEAM Machine that are geared towards adults. This inclusion of adults in the program would not only create new ways for parents and children to spend time together, but also give an opportunity for adults to be involved in activities that are fun for all ages.

Of our pilot tests, specifically in Pukë, there were 3 adults participating in the activities along with high school students; they all seemed to be having just as much fun as, if not more than, the students were. From this, we see the potential interest that this could raise, and when adults are participating, more children may be able to participate. A parent may be more willing to let a child participate in an after school program if they see a trusted community also being involved.
Further Recommendations

While we only had seven weeks to work with this project, our team has come up with many ideas and recommendations that we consider are important additions outside the scope of our project.

When we first interviewed students and asked what they’re favorite subject was, many answered gym class. We believe that in time, a sport aspect could be added to the mobile library program in order to combat the lack of physical education in many schools, as well as gain more interest from potential participants.

Another area that we found lacking that did not fit with the scope of our project was the sexual education, or lack thereof, in the areas we visited. While sexual education is partially science; we believe that it is a much broader topic that requires much more attention and care. Sexual education and orientation appear to be taboo topics. Nevertheless, the STEAM Machine may be able to address the need for knowledge about sexual health and issues related to sexuality.

Our other recommendations and ideas have less to do with the educational aspect of the mobile library program, but more on the execution and operation of the vehicle itself. We believe that having a question/suggestion box, as well as a digital form for questions and suggestions would be an important aspect to better engage a community. This will allow the program to better tailor its activities to the needs and wants of the locations it is visiting in order to create the best experience for all participants.

Another aspect to the STEAM Machine that we believe should be taken into consideration is focused on the logistics and organization of the vehicle itself. Aspects that make other mobile libraries successful include permission forms from parents to ensure that they know about and approve of the activities that their children will be participating in. This, along with a check-in and out system for both books, activities, supplies, and participants may lead to a more organized STEAM Machine. If on the permission form, there is a line about needing to reimburse lost or damaged books or supplies, this could encourage children to take better care of the equipment.

Lastly, we believe that ARKA would benefit greatly by including phones and social media to this initiative. Whether this be to advertise programs or to incorporate the use of educational apps, such as Kahoot into activities. Most students in have cell phones, which may provide an easy opportunity to entice them to participate in this program, as well as making the program relatable and accessible.
References

Albania, BASHKIA E VAU DEJES, BUXHETI. (2017). Vau Dejes, me historinë, mëkpriten e burimet natyrore, një komunitet që jeton e zhvillohet, derë e hapur për integrim.


Bala, Suela. (2018, November 06), Semi-structured interview


Appendicies
Appendix A: Guiding Questions for Initial Insights

American Peace Corps Volunteers Illustrative Interview Topics Guideline

School System
- What does a normal school day look like for you?
- What existing co-curricular or extracurricular do students participate in?
- How would you say your interactions with the teachers are?
- How are your interactions with the students?

Social Stigma
- How do gender roles play a part in this community?
- Are parents very involved in student's education?

Mobile Library
- What are some key components for this project to succeed here?
- Would there be any existing local individuals or organizations willing to assist with this program?
- What obstacles would this program face?

Key Informant Walkthroughs: Academic Faculty such as Teachers and Directors

Illustrative Interview Topics Guideline

Teachers - School System
- What does a normal school day look like for you?
- What do you think of the current curriculum?
- What are its strengths and how could the learning environment be improved with additional educational activities?
- How would you incorporate hands-on activities into your lessons?
- How do gender roles play a part in the classroom and outside of the classroom?

- Mobile Library
  - How could a mobile library assist you in teaching your material?
  - How could a mobile library impede your teaching?

Directors - School System
- What does a normal school day look like for you?
- Mobile Library
  - How do you see a mobile library fitting into your school system?
  - What obstacles would this program face?

Individual Respondents: Students ages 18 and under

Illustrative Interview Topics Guideline

School
- What is your favorite subject in school?
- Why is that your favorite subject?
- What do you do after school?
- What kinds of activities do you wish were included in school?
Appendix B Debrief Questions

Pilot Demonstration Debrief Questions

1. Have you done any activities like this before?
2. What did you like about it?
3. What did you not like about it?
4. Were you confused by anything?
5. Would you want to do this activity or something like it again?
6. Did you learn anything from this?
Appendix C: Guiding Questions for Sustainability

Key Informants: Academic Faculty such as Teachers, and Director Illustrative Interview Topics Guideline

Teachers
- Do you know of any community members or NGO's that would be likely to help with a project such as a mobile library?
- Do you think the parents of students would be willing to help out with a mobile library project like this?
- Do you have any students that would be helpful as facilitators when running the project?

Peace Corps Volunteers
- Do you have any projects or clubs that you have started after school?
- Do you have help from any other organizations or community members with these projects or clubs?

Director
- Do you know of any community members or NGO's that would be likely to help with a project such as a mobile library?

Key Informants: Potential Stakeholders Illustrative Interview Topics Guideline

Interest Assessment
- Are you interested in introducing opportunities for hands-on activities with students?
- Would you consider incorporating STEAM, Science, Technology, Engineering, Art, and Mathematics, into activities like this?
- How willing would you be to work on a project like this mobile library?

Resource Assessment
- Are you or your associates able to volunteer for or assist in this project?
- Do you or your associates have any knowledge or skills in any STEAM topics that could be useful in this project?
- Are you able to donate any money to this project?
- Are you able to donate any books or other supplies for the project?
Appendix D: Consent Script

Oral and Audio Consent Script - English

Hello! We are students from Worcester Polytechnic Institute and we are doing a project here in Albania. We are performing a needs-based assessment of villages in and around the Shkoder prefecture. The eventual goal is to create a mobile library to bring books and hands-on STEAM activities to these rural villages.

By talking to people like you, we hope to get an understanding of the educational system here in Albania and how we can enhance the existing curriculum with after-school, hands-on learning activities. Your participation in this interview is completely voluntary and you may withdraw at any time. This interview will take approximately 60 minutes. Audio and photo may be recorded. As a reminder, you may withhold or withdraw your audio or photos at any time. No names or identifying information will appear in any of the project reports or publications unless consent is given. Your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study. You can reach us at gr-ARKA@wpi.edu with any questions or concerns. Please indicate if you would be willing to give consent for this interview to be audio recorded. Would you like your first name and any details that would identify you to remain confidential in all data that we collect for this interview? Do you have any concerns about how your responses will be used or recorded? Please let us know when you are ready to begin the interview.

Oral and Audio Consent Script - Albanian Translation


Nga duke biseduar me njerëz si ju, ne shpeshojmë që të keni një kuptim të sistemit arsimor në Shqipëri dhe se si ne mund ta përmirojmë kurrikulën ekzistuese me aktivitete mësimore pas shtkollore. Pjesëmarrja juaj në këtë intervistë është tërësisht vullnetare dhe ju mund të tërbieni në çdo kohë. Kjo intervistë do të jetë 60 minuta. Audio dhe foto mund të regjistroben. Si një kushtësi, ju mund të mbani ose të bëni audio ose fotot tuaja në çdo kohë. Asnjë emër ose informacion identifikues nuk do të shfaqen në asnjë prej tyre raportet ose publikimet e projektit nëse nuk jepet pëlcimi. Pjesëmarrja juaj vlerësohet shumë. Një këpue e rezultative tona mund të jepet në fund të studimit. Ju mund të na kontaktoni në gr-ARKA@wpi.edu me ndonjë pyetje apo shtëqësim. Ju lutem tregoni nëse do të jeni të gatsmbë të jetni për çdo këtë intervistë që të regjistrohet në audio. Do të doni emrin tund të parë dhe çdo detaj që do të identifikonte që të mbetë konfidencial në të githa të mbledhim që mbyllet për çdo intervistuar? A keni ndonjë shtëqësim se si për të jepi ose të tërësinvësh që të regjistrohet? Ju lutem tregoni kur jeni gati për të filluar intervistën.
Appendix E: Development of Activities

The internet is a perfect place for this type of research. Finding activities is really easy; websites full of activities are just a google search away.

One of the really interesting parts of this research was seeing activities we had done when we were in elementary and middle school. The reaction we had helped us realize that those specific activities would be perfect for participants who had ever seen them or anything like them before.

One of our initial concerns was being able to get all the materials for these activities and demonstrations. When looking through markets, we were unable to find materials we considered trivial, like marshmallows or baking soda. It took a while to find these two, but they were either in obscure markets or the city. Some materials we still have not found, like food coloring. As we continued to choose future activities, we had to take into consideration what materials we had access to, which led us to spend time in markets.

Every activity has some set of instructions or way to do it, normally found online. These instructions, we found, could be complex and difficult to translate. We had to adjust the language and wording of these activities to make more sense for our pilot tests so we could easily explain them to someone else in their second language.

Another thing we found would be very helpful for more complex activities is initial demonstrations. By showing how the activity is done, the participants get a proper understanding of what the outcome is.

While we had already done and seen some of these activities, there were other ones we found that we had never encountered before. So, we felt it was best for us to test them out, understand how they work and the best way to approach whatever problem the activity was posing. This also helped us determine if the activities were feasible to do with a group either watching or participating. For example, when testing the “Bottle Rocket” activity, see Appendix D, we found that we wasted too much baking soda and our corks were not functional enough, so we did not take it to a pilot test.

After collecting a plethora of activities, we planned to conduct a pilot test of how these might potentially run as part of the “STEAM Machine” program. We choose the activities based on the STEAM principles, making each activity encompass a different aspect. Subsequently, we used the debrief questions detailed in the methods chapter to gain feedback when each activity was completed. After each school visit we changed the activities and debrief process depending on the response we observed and challenges we faced. The pilot tests evolved over time.
Appendix F: Reflecting on our Work: Curiosity, Connections, and Creating Value

Curiosity

When first entering a new country, new questions and curiosities naturally arise. What is the culture like? What social conditions exist? Obviously, these questions are difficult to answer, however, they are important to every aspect of our project. Our team truly began our inquiries when we first left Tirana and entered Northern Albania. We came to Shkodër ready to immediately start working on a project we were so excited about. We were quickly taken aback, though, by the unofficial Albanian motto: avash avash or slowly slowly, that describes the relaxed Albanian culture of taking life one day at a time and not rushing to do immediate tasks. We found ourselves dumbfounded when we visited schools and set dates to return, but instead were faced with last minute cancellations. Why would someone so excited for this program cancel last minute? Regardless of why, we found this to provide an answer to what problems we may face with sustainability. New questions were fostered and we emphasized observing what areas within our specific project this would affect.
Connections

Many classes at WPI have taught us the idea of theory and practice, which we took to a whole other stage during IQP. While we all have experienced group projects, which prepared us at a basic level, we understood that this will be much more of a challenge than any other project and will need to plan for a new ethic of work. This IQP experience has forced us into more uncomfortable situations with our teammates as well as working with people we have never met in a foreign country. We have learned to adapt to these situations to ensure we produce stellar work and understand as much information we need to develop our project.

Going forward, we have all adjusted our work ethic which we will apply to our future projects as well as careers. We now have a much more thorough understanding of how short deadlines, as well as working with a variety of peers and superiors, can affect work produced as well as how to produce an optimal result in the time given.

We have also learned how to balance what our team, sponsor, and professors see as the direction of our project. As engineers, we need to take into consideration these positions and balance them to give an ideal result that will satisfy both our boss and clients. These three entities are all a team and within that team, there needs to be open communication throughout the entire project to ensure success for everyone.

Creation Value

There was a lot of value that came from this project. We developed many different outlets for people to benefit from, whether it be us, our sponsors, or school students throughout the Shkodër Region. For us, we now have a sense of pride in this project. We have spent almost two months of our time solely dedicated to developing the ideas and materials that will help our sponsor succeed with this project. Through our struggles, we have learned the specific skills that are required to complete a project of this magnitude, so it will benefit our future as engineers greatly.

Providing ARKA the information we gathered will allow them to develop something that will assist them in achieving their goals as a youth center. ARKA’s goal as an organization is to increase leadership and opportunity for youth in the Shkodër region. By providing hands-on learning opportunities for children who have never experienced anything like them before, we are enhancing the skill sets these children already have, while also developing new ones. The students the STEAM Machine will reach will receive a sense of community and learn new skills, while still having fun. The benefits of having hands-on activities are exactly this, they bring people together and encourage them to learn by participating in something that is enjoyable to them.
Appendix G: World Connect - Offline Grant Application

Project Title: Mobile Library: Driving education within the rural environment

Select your project primary category (please select ONLY one):
☐ Economic Opportunity
☐ Health
☐ Environment
☑ Education

Country: Albania
Region/Province: Northwest Albania
District/Department: Shkoder County
Nearest Town/Municipality: Shkoder, Malësi e Madhe, Vau i Dejes
Village/Community: Hajmel, Bushat, Koplik, Vau i dejes, Berdicë, Dajc, Dedaj, Rec
Language/s spoken locally: Albania

Community Organization

Name of Community Organization:

Qendra Rinore Arka

Where specifically is the Community Organization based?

Shkoder, Albania
Community Organization’s website or website where we can learn more about your work (if available):

http://www.arkayouthcenter.com/

What is the mission of the organization? (100 word limit)

Arka’s mission is the definition, study and promotion of initiatives aimed at promoting the development of social, cultural, economic and employment opportunities within a framework that combines the fight against poverty with the promotion of integrated and sustainable development of the territory.

What are the organization’s current programs/activities? (250 word limit)

Arka Youth Center: This center inspires young people to be innovative and helps them discover new possibilities. Arka's activities offer entertainment, education, and training for all young people in the Shkoder region. It promotes art, culture, and fosters creativity.

Project You Power: project promoting civic engagement and participation amongst young people from Shkodra, Vau Dejësi and Malësia e Madhe. This project creates an environment conducive to the exchange of creative ideas and positive energies regarding social/political awareness in order that young people are empowered and encouraged to contribute to the development of their local municipal structures and overall society.

The Future Community; Inclusion of Shkodran Orphans into the Labor Market: Project emphasizes investment in the social, educational, and career development of disadvantaged youth. Activities include, creating vocational training curriculums and courses to improve learning competencies of orphans over the age of 16, creating a Residential Educational Community designed for 10 children, and begin entrepreneurial and foreign language training for youth.

Arka Social Coffee: Periodic meetings with young people to discuss their everyday issues.
Youth Book Club: Our youth Book Club joins the Ministry of Culture National Reading Movement and will host of periodic book review meetings at Arka Youth Center.

Project Leader

The Project Leader must be a host-country national. We prioritize working with women as Project Leaders, though it is not required.

First Name: Arta
Last Name: Nikolli

Gender: ☐ Male  ☑ Female

*Must match information exactly as shown on a government-issued ID

Email: artanikolli@gmail.com

Local Address: Rruga Paloke Kurti,1, 4001 Shkodër, Albania.

Highest Level of Education: Graduate Degree

Established Field Partner

The role of the Established Field Partner is to support local leaders and to be a bridge for communication and reporting between local leaders and World Connect.

Are you affiliated with one of World Connect’s established field partners?

☑ Peace Corps Volunteer (PCV)
☑ Returned Peace Corps Volunteer (RPCV)
☑ CorpsAfrica Volunteer (CAV)
☑ Voluntary Service Overseas Volunteer (VSO)
☑ Young African Leaders Initiative (YALI)
☑ Haitian Education and Leadership Program (HELP)
☑ Leadership, Effectiveness, Accountability & Professionalism Africa (LEAP)
☑ Other, authorized by World Connect staff

First Name: Jermaine
Last Name: Hartsfield

Gender: ☐ Male ☐ Female

*Must match information exactly as shown on a government-issued ID

Phone: +355 69 700 2967
Email: Hartsfield.jc@gmail.com
Local Address: L.Perlat Rexhepi - Rruga Kukley # 104, Shkoder, Albania
Highest Level of Education: Graduate Degree

How long have you been living and/or working in the primary project site?

18 Months

When do you expect to no longer be living and/or working in the primary project site?

05/13/2019
Project Design

1. **When will this project start (month, year) and what is its estimated duration in months? (25 word limit)**

   This project aims to begin in September of 2019 and continue until resources hinder its capacity to do so.

2. **Please write a succinct, compelling description of the project that is being pitched to World Connect. This description will be posted to our website if the project is approved. (250 word limit)**

   Much of Shkoder County consists of small villages and isolated rural communities. Presently rural communities in Albania have over a 50% poverty rate than urban areas of the country. Thus, an overwhelming amount of schools in Shkoder County are severely under-resourced, therefore leaving many youth limited access to books and resources to improve their learning and overall student development. The creation of a mobile library aims to improve youth’s literacy in select rural communities of Shkoder County by providing young people from middle school through high school with much needed educational materials and resources. With much-needed funding our mobile library will not only be stocked with a wide selection of books but will include trained personnel who will engage youth with fun and skill building activities during each library visit. This mobile library will be used as an important tool to help the advance the cultural, artistic, and academic growth of regional youth. Objectives include providing youth a space and opportunity to borrow much-needed books and to stimulate the create meaningful learning experiences among young students through interactive activities. The implementation plan includes four main activities in each participating community: 1) Host local meetings to discover the academic interest of local students; 2) Supply community with books via the mobile library; 3) Collaborate with local school teachers and trained professionals to engage students in fun, skill-building activities; 4) Develop focus groups in order to follow up with local students regarding specific books or activities.

3. **Please provide a description of the affected community/ies as it relates to this project. Focus on characteristics such as the number of people and households, climate and topography, presence or absence of nearby schools and health facilities, sources of local employment/income, relevant cultural traditions, local politics, etc. (500 word limit)**

   The prefecture of Shkodër is located in the northwest region of Albania and is made up of 33 municipalities and communes, with an estimated population of 215,347, and is the fifth most populated region in Albania, with 55.6% of its population living in rural communities (Republic, 2012). Forty-six percent (46%) of the Shkodër population is under the age of 30 (Republic, 2013). The poverty rate of the region is 15.4% (National, 2015). Forty-four percent of the populace attends, or has attended, basic
education (grades 1-9), but only 8% of residents are currently in, or have finished, university (Republic, 2012).

Rural schools lack quality education and resources, compared to their urban counterparts (United, 2017). The central government spends 2.9% of its GDP on public education compared to the EU average of 4.5% (Psacharopoulos, 2017), and per-student subsidies in rural areas are lower than in urban schools (United, 2017). Many village schools have poor infrastructure, leading to low attendance rates (United, 2017). Depopulation of rural regions accounts for the creation of more than 1000 micro-schools in rural Albania (Martino, 2018). These low populated, mix-gendered, single classroom institutions, have "low-quality teaching and [a] lack of teachers with adequate education" (United, 2017).

During the post-communist transition, more than 40% of academic and scientific workers migrated abroad, contributing to the deterioration of education and health services especially in remote and rural areas (Gedeshi & Jorgoni, 2012).

According to a study done by Albania’s Demographic and Health Survey, 11% of internal migrants and 12% of international migrants have left children back at home (Gedeshi & Jorgoni, 2012). Fifteen percent (15%) of rural households look after children of international migrants, 98.5% of which are male (Gedeshi & Jorgoni, 2012). Many unskilled, low-income migrants leave their children with grandparents (Gedeshi & Jorgoni, 2012). However, studies show that many grandparents cannot fulfill their grandchildren’s economic, health, social, and educational needs due to economic strain (Gedeshi & Jorgoni, 2012).

According to the World Bank 2007 Poverty Assessment, there is evidence that migration has a negative impact on school enrollment rates, particularly for females and high school-aged children in rural areas (Gedeshi & Jorgoni, 2012). Opportunities to work abroad in low skilled jobs lowers the incentive to attend school (Gedeshi & Jorgoni, 2012). Children who are members of families who have migrated are more likely to choose working elsewhere rather than going to school (Gedeshi & Jorgoni, 2012).

More rural women have completed basic education than men, but, only 23% of rural women have finished secondary school (grades 10-12) versus 53% of urban women (Zhllima, 2016). Evidence suggests that early-age marriage, dropout due to poor school location, and migration to urban cities has been the cause for the gap between rural and urban women’s enrollment in secondary education (Zhllima, 2016). Additionally, poor school infrastructure, weak road networks, lack of transportation, as well as the increasing opportunity costs are some major barriers to young women attempting to complete high school (Zhllima, 2016).
4. **Please describe a typical day in the lives of the participants of this project. (250 word limit)**

   Students begin their day typically with school at 8:00 am. Depending on student's home village, some have to take local buses to neighboring areas to go to school because their village does not have a local school. After several class periods, the students have a 30-minute break, which many use as an opportunity to socialize with friends, relax, or purchase snacks from nearby shops. After their break, classes resume and students remain in their lessons until school ends at 1:00 pm. Once school is over students generally return home, especially if the student has to take a local bus home or carpool. Lunch is eaten at home around 2:00 pm. After lunch, students spend their time in different ways. Students whose families can afford private academic lessons attend afternoon courses. In communities which have recreational facilities, students have an option to play sports with friends. Due to a lack of jobs, very few teenagers work part-time and the majority who don’t work typically spend much of their afternoon at home with family or in town with their peers. The seasons play a huge role in the after-school activities of the students also. During warm weather months, many students will hang out with their friends and family in the town square. Oppositely, during cold weather, most students remain indoors at home after school. Dinner usually begins anytime from 8:00 pm through 9:00 pm, and is followed by family time or homework.

5. **What is the origin story for this project? How was the focus/idea of the project determined to be a priority in the community? Who was included in this conversation/process? (250 word limit)**

   A questionnaire filled out by forty students found that bookshops, libraries, and recreational activities are missing within the district. Instead, students spend their afternoons alone at home after school, often using digital devices as a replacement to the limited range of activities available. ARKA, however, suggests that reading is a better use of free time, so the organization has proposed the creation of an itinerant library, a tool for the personal and cultural development of the children.

   The idea for the ARKA Mobile Library was passed along to four Worcester Polytechnic Institute (WPI) students who, under the guidance of Jermaine Hartsfield, examined the feasibility of this project, as well as the effectiveness of different activities to bring to the communities the library will visit.

   The WPI students visited various schools in the region, where they confirmed both the need for this project, as well as the potential interest in it. Of the schools they visited, only one had a library that allowed children to take books home with them. Through informal interviews with students and more formal interviews with teachers the WPI students found that many students often go directly home after school for a range of reasons, including the absence of opportunities to do anything otherwise. The WPI students, conversely, found that a vast majority of the Albanian students expressed interest in a potential after-school program that would provide them with books and other activities.
6. How does the project build upon the efforts of the local community and/or other locally-led groups, such as neighborhood associations, women’s groups, health clinics, local government, etc., which are not the listed Community Organization partner on this application? (250 word limit)

With this project’s aim to be a vehicle for community engagement, every aspect of it builds upon the efforts of the local community. The Shkoder prefecture, in particular, has made tremendous leaps towards increasing outlets for youth outside of cafes, billiards bars, and video game lounges. YES Future, funded by the Italian-Albanian Debt Conversion Program (IADS), seeks to focus on social inclusion of youth by providing access to formal education, informal education, and entrepreneurship culture, regardless of social status or demographic orientation (Code Partners, 2018).

The Italian Consulting and Development (CODE) Partners organization of Albania has so far created not only Atelie’s Public Youth Center for the programming, scheduled to open in January of 2019, but has also organized a support network for youth interest groups and NGOs to collaborate with the Directorates of the Shkodra Municipality. The You Power project, moreover promotes civic engagement by generating an ARKA Youth Council composed of students in Shkodër, Vau Dejës and Malësia e Madhe municipalities in the Shkodër District. By creating an environment conducive to the exchange of ideas on social and political awareness, involved youth have been encouraged to contribute to the development of their local municipal structures and overall society. These programs all act in combination with other community engagement initiatives, only emphasizing the use of the ARKA Mobile Library as a tool for educational and community engagement.

7. Please provide an overview of what sustainability will look like for this project. For example, five years from now, what will remain, who will be managing and/or responsible for what remains, and how will they do so? (500 word limit)

Through the research of the WPI Students, it was found that many mobile libraries are staffed by two people at a time, a driver and a librarian. In the case of the ARKA mobile library, it is likely that at least one of these staff members will be trained as a librarian, and both will be trained to facilitate the activities that will be brought with the library. ARKA has members of their staff that are able to perform these tasks, and ARKA also looks to find volunteers that would be willing to partake in this mobile library initiative as additional members, which means that no additional money will be needed to provide a salary for these workers. The staff members and volunteers for this library will be people who work well with kids and are able to lead group activities with large groups of children in a wide age range.

For the ARKA Mobile Library to remain sustainable, funding must be a priority. Many other mobile libraries are funded through crowdfunding and various donation, which create no problem for ARKA. Not only does ARKA obtain funds from the accompanying hostel, but donations from online crowd-funding websites and other grants will also the vehicle, its expendable materials, as well as salaries for the ARKA staff members already a part of ARKA’s budget. Moreover, ARKA already has a large collection of books to bring onto this mobile library, which will only be added throughout its operation.

In five years, this project will grow, attaining more books and activities to provide to the communities it visits. While it is likely that there will be damage done to books, and some will be lost over time, there will be more books gathered along the way. As time goes on, the list of activities provided by the mobile library will grow as ARKA determines what kinds of activities work best in various locations. These
activities will also become more tailored for educational and social concepts they are trying to portray to the participants, which will make the mobile library even more effective in its goal the longer it is in operation.

8. **How will success be measured for this project? Please list the three most important indicators, determined in conversation with those who will benefit from or participate in the project directly, particularly women. Please describe clearly how each of these three indicators will be measured and by whom. (500 word limit)**

Success in this project will be measured based off of three indicators: continued attendance, demographic diversity, and increased classroom engagement. Continued attendance and demographic diversity will prove the vehicle as a tool for community engagement while increased classroom engagement will prove as a tool for educational engagement.

The library attendance will be monitored by an electronic attendance system. Anyone who visits the library will be asked to fill out a form, which will need to be signed by a guardian for any minors. After participants fill out this form, they will be given a library card or other form of identification to use at each visit. This will allow the mobile library to keep track of the attendance and retention rate of each location. It can also be used as a way to determine the peak points of the year when the attendance rates are the highest, as well as valley points, where fewer people are visiting the library. Each visit is expected to have fluctuating attendance, but the fact that attendance is consistent will demonstrate project success.

The demographic diversity of library visitors will also be monitored through the library card system; first-time visitors fill out a form about age, gender, as well as economic status. Monitoring the demographics of visitors will provide ARKA with site-specific statistical data on the retention rate by gender and age. The program will be deemed successful in this aspect when both men and women of the community are represented with reasonably high retention rates.

The third indicator will be measured by two functions. Educational engagement will be determined via qualitative analysis of discussions with local school teachers. As teachers have first hands accounts, they give the most direct response to this indicator. Secondly, focus groups will follow up with local students regarding specific books or activities that they were interested in. Indirectly, these follow-ups will also generate information by asking questions about the current curriculum in schools and how much they remember. The library driver for the vehicle will conduct these short interviews and informal focus groups during each visit. Success is shown by the increased continuation of engagement of students.

9. **What will be the impact of your project on the community and specifically on women and/or children? What will it change for the community, and specifically for women and/or children? (250 word limit)**

This project is focused on educating middle and high school age students. Youth are more likely to embrace new ideas and learnings with great zeal and passion. Therefore, this project will engage directly with youth in order that they will be inspired to be the catalysts for change within their communities.
Through the proposed mobile library we aim to cultivate a better relationship and perspective between youth and reading. This mobile library will be a practical and usable tool for all youth in our region, especially for the ones who do not have access to libraries or the bookshops. The youth in our targeted communities will have a great alternative to spend their free time reading books and utilizing resources that will help foster their cultural, artistic, and academic growth. Additionally, teachers within these communities will have new literary resources which would help teachers provide more innovative lesson plans for students.

10. Is there anything else we should know that will help us make a decision about supporting this proposed project? (250 word limit)

A Mobile Library initiative such as the one proposed by ARKA has the potential to do much more than merely provide books and activities to children. Hands-on activities like those that will be provided by this program foster the development of various social skills, such as teamwork and critical thinking skills.

This project also serves the potential to boost community engagement in ways such as bridging generational and gender divides. Studies show that parents are less involved in their children’s education the older their children get, not because of disinterest, but because they feel as though they cannot relate as their children take harder classes. The activities provided by this mobile library may serve as a way for parents to get more involved in their children’s education without feeling overwhelmed or inferior.

Gender differences also are a glaring issue in rural Albania, which is yet another issue that could potentially be tackled by the ARKA mobile library initiative. The library would provide activities for both girls and boys alike, regardless of age range. Through pilot testing of some potential activities for this mobile library, it was found that such activities inspire collaboration between boys and girls where there otherwise may not be.

Applications should be submitted online at http://www.worldconnect-us.org/submit-projects.
The STEAM Machine
The STEAM Machine

Was developed by:
Adam Collins, Jason McGrath, Joseph Niski, and Summer Thurlow. With the help of Arta Nikoli and Jermaine Harts from ARKA, as well as the guidance of Professor Leslie Dodson and Professor Robert Hersh, as part of an Interactive Qualifying Project through Worcester Polytechnic Institute.

The goal of the STEAM Machine is to encourage educational and community development through hands on STEAM activities.
Baking Soda Rockets

Combine baking soda and vinegar in a bottle to create a reaction, where gas builds up, subsequently shooting the bottle in the air.

Social Skills
- Communication

Take Home?
Yes

Individual Or Team (2-4)
Activity

Technical Concepts
Chemistry-Physical Reaction

Companion Book
There’s No Place Like Space by Tish Rabe
Who was Neil Armstrong? By Roberta Edwards
<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottle (either 1 or 2 L)</td>
</tr>
<tr>
<td>Cork</td>
</tr>
<tr>
<td>(3/4) Dowels or Pencils</td>
</tr>
<tr>
<td>Tape</td>
</tr>
<tr>
<td>Paper Towels</td>
</tr>
<tr>
<td>Baking soda</td>
</tr>
<tr>
<td>Vinegar</td>
</tr>
</tbody>
</table>
Instructions (For Facilitator):
Students can get a basic understanding of how some chemical reactions [reaksion kimik] produce more gas and pressure [presion] build-up can cause quick physical changes

Preparation for Activity
The facilitator should provide the material based on the number of participants. If there are many participants then the facilitator can split them into teams.
Introduction of Activity

The facilitator can start by explaining the basics of reactions. They can talk about physical vs. chemical reactions. The one they are about to conduct is a chemical reaction. They can also talk about how when pressure builds up inside of something it can go through a sudden physical change.
Execution of Activity

The facilitator can explain the activity and then help any participants that have trouble getting their reaction to work.

Debrief from Activity

The debrief should include reflecting on how each participants rocket performed. What went wrong? What was successful? What would improve the reaction? Then the facilitator can ask how things would’ve changed: What if they used a smaller bottle, less(or more) vinegar, less(or more) baking soda? How high the rocket is of the ground? The students can gain a better understanding of the activity by exploring these kinds of questions.
Instructions (For Participants)

1. Take the dowels or pencils and tape them around the bottle so that the opening is about 2.5 cm from the ground when the bottle is using the dowels to stand upside down.
2. Decorate the bottle but make sure the bottle opening has nothing near it and can still stand by itself.
3. Create a little packet of baking soda by pouring the soda into a piece of paper towel about 2.5cm by 2.5cm.
4. Quickly check if the cork fits tightly into the bottle opening. If it’s too small you can use tape to increase the diameter of it.
5. Pour about 5cm of vinegar into the 2L bottle.
6. Drop the baking soda packet into the vinegar, quickly insert the cork into the bottle opening, and turn the bottle upside down.
7. Watch as the gas expands inside the bottle, building pressure until it forces the cork out, and the rocket goes flying.

Notice: This rocket can sometimes take a couple minutes to launch so be careful. Even though it looks like it failed it could still be building up pressure so do not stand over it!
Miscellaneous

Here is a video of the activity
https://www.youtube.com/watch?v=_VVnT2dLSQs
Create a Non-Newtonian Fluid with Cornstarch and water!

Caution! Very messy

Social Skills
- Managing materials

Take Home? Yes

Technical Concepts
States of Matter

Companion Book
Lab in the Lab by Wendy Maxey
<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn Starch</td>
</tr>
<tr>
<td>Water</td>
</tr>
<tr>
<td>Bowl or Cup</td>
</tr>
</tbody>
</table>
Instructions (For Facilitator):

Preparation for Activity

Make sure there are enough materials for all of the participants. There will be mistakes with people putting too much cornstarch or water, so be ready to add more of each to their mixtures.

The materials should be added in two (2) parts cornstarch to one (1) part water. Have this prepared beforehand if possible, with the materials available so it is easy to hand out to participants.
Introduction of Activity

There are three main states of matter: **solid**, **liquid**, and **gas**. These are known to be absolute and some materials can switch states. For example, water can be seen as all three. Ice, which is a solid, can be melted into water, which is a liquid, which can be **evaporated** into mist, which is a gas.

You can read/say something along these lines:

“What are we learning? States of matter! There are three states of matter: solid, liquid, and gas! What we are going to make today is a mix of two states of matter! It is called a non-Newtonian fluid! That means it does not move like a normal liquid, like water! Let’s now look at how this works!”
Execution of Activity

Follow exactly the instructions for participants.
Pay attention to the mixtures participants are mixing and have extra materials on hand.

Debrief from Activity

Have the participants discuss potential real world applications of this type of material.
Instructions (For Participants)

1. Pour cornstarch into the large bowl
2. Start pouring water into a bowl or cup (1 part water for 2 parts cornstarch)
   a. Add 3 or 4 drops of food dye
3. Mix with hands
4. As you pour water, start to feel the mixture
   a. If you can roll it into a ball and let it “melt” through your fingers when you stop moving, you’re done!
   b. If doesn’t roll into a ball, more cornstarch!
   c. If it doesn’t “melt”, more water!

Miscellaneous

https://babbledabbledo.com/how-to-make-oobleck/
Egg in a Bottle
Put an egg in a bottle without breaking it!

7th-12th Grades
5 min

Indoor or Outdoor

Science

CAUTION: Fire

Social Skills
None

Take Home?
No

Technical Concepts
Air Pressure

Companion Book
None
### Materials

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard-boiled egg</td>
</tr>
<tr>
<td>Glass Bottle</td>
</tr>
<tr>
<td>Matches or Lighter</td>
</tr>
<tr>
<td>Paper to light (optional)</td>
</tr>
</tbody>
</table>
Instructions (For Facilitator):

Preparation for Activity

Make sure that you hard boil and peel an egg before the demonstration. The egg will not be able to go into the bottle if it is not peeled. Additionally, please make sure that the bottle is dry so that the fire does not go out when the match is lit and put at the bottom of the jar.

Introduction of Activity

Show the participants the egg and glass bottle, then show them how the egg does not fit through the hole of the bottle.

Say to the participants:
“Would you believe that I could fit this egg into this bottle without breaking it? I guess we are going to have to find out.”
Execution of Activity

Either:

Light a match and put it in the jar
...or...

Light a piece of paper and drop it into the jar, making sure it remains lit.

...Then quickly put the egg on the top and wait.

Over the course of a minute (more or less depending on the situation), the egg will slowly be sucked into the bottle.
Debrief from Activity

Before explaining how this works, ask participants if they think they know why. Once one participant answers, or if no participants are confident in their answer, give them an explanation: when you add a match to the inside of the bottle, you cause the air inside it to heat up and expand. As it cools down, however, the air begins to shrink. The molecules in it get closer together. The pressure from outside then wants to match the inside pressure and pushes the egg in from the inside sort of like a vacuum. Because the egg is flexible, it fits into the bottle.

Instructions (For Participants)

Students are not recommended to complete this activity alone.

Miscellaneous

None
Elephant’s Toothpaste

Experience Exothermic Reactions with Elephant’s toothpaste!

Outdoor 5 Min

4th-12th Grades

Cautions

Requires safety goggles. Skin & Eye Irritant

Social Skills

• Communication
• Critical Thinking

Take Home?
No

Technical Concepts

Exothermic Reactions

Companion Book

Elephant’s Toothpaste by Geralyn Skasko & Sharon Disher

Ideal Group Size: 20-30

Group demonstration
Materials

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 ounce soda bottle</td>
</tr>
<tr>
<td>½ 20-volume cup hydrogen peroxide</td>
</tr>
<tr>
<td>1 tablespoon (or packet) yeast</td>
</tr>
<tr>
<td>3 tablespoons of water</td>
</tr>
<tr>
<td>Liquid dish soap</td>
</tr>
<tr>
<td>Food Coloring</td>
</tr>
<tr>
<td>Small Cup</td>
</tr>
<tr>
<td>Safety goggles</td>
</tr>
</tbody>
</table>
Instructions (For Facilitator):

Preparation for Activity
Make sure that the facilitators have safety glasses and the children stay far away from the experiment until the reaction is fully completed.

Introduction of Activity
Explain to the students that you will be showing them a chemical reaction.
Be sure to tell them that the reactants are harmful to the skin and eyes so they need to stay back.
Execution of Activity

1. Carefully pour the hydrogen peroxide into the bottle.
2. Add 8 drops of food coloring into the bottle.
3. Add about 1 tablespoon of liquid dish soap into the bottle and swish the bottle around a bit to mix it.
4. In a separate small cup, combine the warm water and the yeast together and mix for about 30 seconds.
5. Pour the yeast water mixture into the bottle (a funnel helps here)
6. Watch the foaminess begin!
Debrief from Activity

When the reaction is finished, pass around the bottle around, and let the participants feel how it is warm. You may want to walk around with the bottle and just let the participants feel, especially if they are younger children. Explain that because the bottle is warm, this means that this was an exothermic reaction. An exothermic reaction is a chemical reaction that releases heat.
Instructions (For Participants)
None

Miscellaneous
Links:

- [https://sciencebob.com/fantastic-foamy-fountain/](https://sciencebob.com/fantastic-foamy-fountain/)
  - This website provides a great video to show how to perform this reaction
Coke and Mentos

Combine Coke and Mentos and witness the reaction produce an eruption

Social Skills
• Not Applicable

Take Home?
No

Technical Concepts
Chemistry-Physical Reaction

Companion Book
None
### Materials

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet Coke or (Coke Zero)</td>
</tr>
<tr>
<td>Mentos</td>
</tr>
</tbody>
</table>
Instructions (For Facilitator):
While the activity covers a large age range, explaining the science behind it should differ between grades. Older participants can learn about physical and chemical reactions using actual formulas. Younger participants can enjoy the reaction and gain a basic understanding of what happened.

Preparation for Activity
The facilitator should provide coke bottle(s) and Mentos depending on what they deem necessary for the number of participants.
Introduction of Activity

The facilitator can start by explaining the basics of reactions. They can talk about physical vs. chemical reactions. The one they are about to conduct is a physical reaction. Then the facilitator can explain how the reaction works: To create bubbles, the carbon dioxide needs to interact with itself, which means that its bonds with water in the Coke must be broken. The Mentos candy can help start and speed up this reaction. Although a Mentos candy may look smooth, if you looked at it under a microscope you would see tiny bumps coating the entire surface of the candy. This rough surface allows the bonds between the carbon dioxide gas and the water easily break, helping create carbon dioxide bubbles and cause an eruption. As the Mentos candy sinks to the bottom of the bottle, the candy causes the production of more and more carbon dioxide bubbles. The newly made bubbles rise up from the candy and react with carbon dioxide (still dissolved in the soda) to create even more carbon dioxide to be freed and create even more bubbles. This results in an eruption.
Execution of Activity

The facilitator can either demonstrate or allow the participants to conduct the reaction.

Debrief from Activity

The debrief should include giving examples of other reactions both physical and chemical (ex. A fire is a chemical reaction; ice melting is a physical reaction). With older participants, facilitators could show some examples of chemical reaction using nomenclature. They also can explore how the amount of Mentos of added or how other carbonated beverages effect the reaction. Additionally, they can experiment with other objects other than Mentos or the temperature of the coke effects the geyser.
Instructions (For Participants)
Take your Mentos and quickly insert them into the coke bottle. Step back and watch the reaction.

Miscellaneous
Not Applicable
Spaghetti Towers

Building towers through marshmallows and spaghetti

4th-12th Grades

Indoor or Outdoor

15 min

Engineering

Technical Concepts

Structural Integrity

Architecture

Companion Book

None

Social Skills

- Teamwork
- Communication

Take Home?

Yes

Ideal Group Size

12-18

Split into groups of 2 or 4
<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box of uncooked spaghetti</td>
</tr>
<tr>
<td>Bag of marshmallows</td>
</tr>
<tr>
<td>String</td>
</tr>
<tr>
<td>Tape (optional)</td>
</tr>
</tbody>
</table>
Instructions (For Facilitator):

Preparation for Activity

This activity doesn’t require much preparation other than creating the group kits of 10 pieces of uncooked spaghetti, 2 marshmallows, and two 0.5-meter-long pieces of string.

Introduction of Activity

Find a building and point to it (if in a building, simply ask what they are in right now). Ask students if they know what makes a building so special and how hard it is to create a building.
Execution of Activity

Break the group up into teams of two or four. These teams will be the bridge building teams. Explain to the group what exactly they are doing. They will have 10 minutes to build a free-standing tower. In other words, participants must make a structure that will not fall over when nobody is holding onto it. It should take about 3 minutes to set up teams, 10 minutes for execution, and then 2 minutes for a debrief. Giving them an example of a tower is optional and can vary by age.

At the end of the 10 minutes, tell participants to stop, take their hands away, and look around at all of the other towers.

Compare the different tower’s heights to find a winner. Then debrief the activity.
Debrief from Activity

Before explaining how a tower works, ask participants to answer. Once a participant answers, or if no participants are confident in their answer, give them an explanation: Towers are very similar to bridges in that they use shapes to be strong. In other words, the weight of a building uses different forces acting against each other to create a stable system.

Just like all projects, buildings require careful planning, especially when you have limited materials to work with. You have to plan your budget, so you can finish your project as best as you can and not run out of materials.
Instructions (For Participants)

This activity is pretty simple, but it requires your imagination. What can you make with just spaghetti, string, and marshmallows? It’s quite simple, a tower!

1. Please break up into teams of three to complete this activity. Your goal is to create the most stable tower (a tower that won’t fall over) in 10 minutes with just spaghetti, string, and marshmallows.

2. Read, set, go!

3. At the end of those 10 minutes, we will see who had the best design.

Miscellaneous

None
Tin Foil Boats

Create a boat using only tin foil

Outdoor
7th-12th Grades
15-20 min

Technical Concepts
Surface area, water displacement, buoyancy

Companion Book
The Sailor Dog by Margaret Wise

Social Skills
• Teamwork
• Communication

Take Home?
No

Ideal Group Size: 30
Split into groups of 4 or
<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tin Foil</td>
</tr>
<tr>
<td>Small Weights or Rocks</td>
</tr>
<tr>
<td>Bowl of Water</td>
</tr>
</tbody>
</table>
Instructions (For Facilitator):

Preparation for Activity
Cut Tin foil into square sections. Each group should get two squares of foil.

Introduction of Activity
Tell the groups that they need to make a boat out of tin foil. Explain that they will be making two boats, and that they can come up and test their two boats as much as they want before time is up, but when it comes to the final testing, they can only use one of their boats.

Give the participants a set amount of time to complete their boats.
Execution of Activity

During the build stage of the activity, walk around throughout the groups, and answer any questions they may have.

One facilitator should stay with the bowl of water to assist any groups that want to test out their boats.

When the building time is complete, have each group bring forward their boat of choice. Test out one boat at a time.

To do this, place the boat in the bowl of water, and slowly add one rock or weight at a time. Try to space out the rocks out evenly in the boats to not prematurely sink them.

The boat that can hold up the most rocks without sinking wins!
Debrief from Activity

Ask the students what was so special about the winning boat that made it win.

Explain to the students how water displacement, surface area of the boat, and buoyancy relate to one another. The boats that have the most surface area displace the most water, which creates the largest buoyant force, which allows the boat to hold much more weight.
Instructions (For Participants)

1. Think about what will make a boat float
2. Make the tin foil boat.
3. Put rocks in the boat while it is on water to see how well it works and what you might need to change before the final test.

Miscellaneous

None
Bridge Building

Building bridges through marshmallows and

Indoor or Outdoor
7th-12th Grades
20 min

Engineering

Social Skills
- Teamwork
- Communication

Take Home?
Yes

Ideal Group Size 12-18
Split into Groups of 3

Technical Concepts
Construction
Static Structures

Companion Book
The Three-Arched Bridge by Ismail Kadare
### Materials

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 Toothpicks (Per group)</td>
</tr>
<tr>
<td>10 Marshmallows (Per group)</td>
</tr>
<tr>
<td>Small rocks or weights</td>
</tr>
</tbody>
</table>
Instructions (For Facilitator):

Preparation for Activity

This activity doesn’t require much preparation other than creating the group kits of 50 toothpicks and 10 Marshmallows beforehand.

If you wish to use *The Three-Arched Bridge* to accompany this activity, be sure to assign the reading to participants during a prior meeting, giving them enough time to read the novel. Let them know when assigning the reading that there will be an activity to go along with the reading at the next meeting, so they should be sure to read it. The novel focuses on an Albanian monk watching the events surrounding the construction of the Ujana e Keqe, or “Wicked Waters.”
Introduction of Activity

If using *The Three-Arched Bridge*

Begin with a discussion about the book and climate of Albania during the time of its construction. It parallels the developments in modern-day Europe and the fast-changing conditions of the Balkan peninsula in the 14th century. The bridge is a representation of the disintegrating economic and political order. Discuss what participants liked about the book, as well as didn’t like about the book.

If not using *The Three-Arched Bridge*

Who has seen a bridge before? Dumb question, right? They’re everywhere! Simply explain the use of bridges over time has very much changed the way we live; transportation can change everything.
Execution of Activity

Break the group up into teams of three. These teams will be the bridge building teams. Explain to the group what exactly they are doing. They will have 10 minutes to build a bridge that can free stand above a gap and hold some weight. In other words, participants must make a bridge that can hold rocks. It should take about 3 minutes to set up teams, 10 minutes for execution, 5 minutes for testing the bridge, and then 2 minutes for a debrief. Giving them an example of a bridge is optional.

At the end of the 10 minutes, tell participants to stop and bring their bridges up. Use anything you deem necessary as a weight (rocks can work if you put them in a plastic cup).

Compare the different bridges to find a winner.
Debrief from Activity

Before explaining what makes a bridge sturdy, ask participants to answer. Once or if no participants are confident in their answer, give them an explanation: There are different shapes that are stronger than others. The strongest is a triangle. If you look at most bridges, you will see triangles everywhere! This is because triangles can deal with pushes and pulls well when there are a lot together. In other words, uses different forces acting against each other to create a stable system.

Just like all projects, bridges require careful planning, especially when you have limited materials to work with. You have to plan your budget, so you can finish your project as best as you can and not run out of materials.
Instructions (For Participants)

This activity is pretty simple, but it requires your imagination. What can you make with just toothpicks and marshmallows? It’s quite simple, a bridge!

1. Please break up into teams of three to complete this activity. Your goal is to create the most stable bridge (a bridge that won’t break or fall) in 10 minutes with just toothpicks and marshmallows.
2. Read, set, go!
3. At the end of those 10 minutes, we will test the bridge and see who has the best design!

Miscellaneous

None
Paper Airplanes

Use paper to create an airplane applying different folding techniques.

Social Skills
• Not Applicable

Take Home?
Yes

Technical Concepts
Physics – Aerodynamics
Math – Geometry

Companion Book
Miracle on the Hudson: The Extraordinary Real-Life Story Behind Flight 1549, by the Survivors with William Prochnau and Laura Parker
## Materials

<table>
<thead>
<tr>
<th>Item</th>
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<tbody>
<tr>
<td>Paper</td>
</tr>
<tr>
<td>Paper Clips (Optional)</td>
</tr>
<tr>
<td>Scissors (Optional)</td>
</tr>
</tbody>
</table>
Instructions (For Facilitator):

While the activity covers a large age range, explaining the science behind it should differ between grades. Older participants can explore the specific forces that make a plane fly while younger participants can focus more on creating the best plane.

Preparation for Activity

Provide every participant with a sheet of paper.
Introduction of Activity

The facilitator can start by explaining the basic physics of an airplane. Depending on the age range, the explanations might vary. For example, paper airplanes experience multiple forces when flying. These forces include thrust, drag, gravity, and the weight of the plane. When you throw a paper plane in the air, you are giving the plane a push to move forward. That push is a type of force called **thrust**. While the plane is flying forward, air moving over and under the wings is providing an upward **lift** force on the plane. At the same time, air pushing back against the plane is slowing it down, creating a **drag** force. The **weight** of the paper plane also affects its flight, pulling it down towards Earth. Weight is the force of Earth's **gravity** acting upon the paper plane.
Execution of Activity

While the participants are creating their plane, facilitators should walk around the space and assist any in need. They must keep in mind that the participants get to choose the design of their paper airplane and the facilitator can only help them by providing resources (Scissors or extra paper) and instructions on specific folds.
Debrief from Activity

The debrief should include how real airplanes experience these forces (gravity, thrust, drag, and lift) like paper ones (ex. What provides thrust on a real airplane?). Afterward, questions that explore how adding more drag or weight will affect the plane’s flight, can further enhance the participants understanding of aerodynamics. (ex. What is drag and how do you increase it? What happens to the plane’s flight? What happens when you add paper clips to your plane? How does it affect the plane’s flight?) This debrief can be followed by more experimenting with the designing of planes so participants can experience the changes.
Instructions (For Participants)

- Using the piece of paper provided, create a paper airplane with a variety of folds.
- Think about what planes look like, think about what keeps them in the air.

Miscellaneous

This a URL that provides some sample airplanes students could make. Some of these designs are simple while others are quite complicated and involve using scissors.

http://www.amazingpaperairplanes.com/simpledesigns.html
Cardboard Racers

Make cars out of cardboard powered by a rubber band

Social Skills
• Teamwork

Take Home?
Yes

2-4 students per group
5-6 groups per facilitator

Technical Concepts
Energy (kinetic and potential)
Conservation of energy

Companion Book
Good Driving, Amelia Bedelia by Herman Parish
<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 CDs</td>
</tr>
<tr>
<td>Duct Tape</td>
</tr>
<tr>
<td>2 Rubber Bands</td>
</tr>
<tr>
<td>Cardboard Sheet</td>
</tr>
</tbody>
</table>
Instructions (For Facilitator):

Introduce these concepts:
Energy and its conservation are taught through the utilization of rubber bands as the “power source” of the cars. Kinetic and potential energy are taught as different terms and types of energy.

Key Terms:
- Kinetic Energy = energji potenciale
- Potential Energy = energji kinetike
- Conservation = ruajtje

Preparation for Activity

If pre-cutting cardboard (grades 4-9):
Cut cardboard according to step 1 of directions then follow non-precutting cardboard steps.

If not pre-cutting cardboard (grades 10-12):
Set up kits using the materials above. Give out one 30 cm long piece of duct tape and, if scissors are available, give one set to each group.
Introduction of Activity

Introduce the idea of potential/stored and kinetic/moving energy in relation to a rubber band. Explain how total energy in all objects stays the same, regardless of it is moving or sitting. If something is just sitting, like a rock, it has no energy. If a ball is dropped off a cliff, it has little kinetic energy, but a lot of potential energy. As it speeds up while falling towards the ground, it gains kinetic energy and loses potential energy.

The participants then get the allotted time to create their car that is powered by a rubber band. They do not get extra materials, they do not get extra time, they can work together with other groups, but this can be made into a competition so students will not want to work with other groups.
Execution of Activity

Certain aspects the participants will most likely struggle with is letting the axel turn freely and securing the wheels properly. The way to ensure the axle turns freely it to keep moving it back and forth in the cardboard as well as spinning it over and over again. With the wheels, by putting duct tape that connects the axle and wheel in different angles, this will help secure the wheels better.

Keep in mind that sometimes the rubber bands are not long enough, two can be tied together like this (see image below) to make them twice as long.

![Image of rubber bands tied together](https://www.instructables.com/id/How-to-Make-a-Rubber-Band-Ball/)

Allow them to start working, give warnings at 10, 5, and 2 minutes left. Once they are done building, they can wind up their cars, set them on a line, and let them go to see whose goes the furthest.
Debrief from Activity

Use the following questions to guide the discussion:

- What potential could you do to make it go further?
- What changes could you make to make it go faster?
- What would happen with bigger or smaller wheels?
- What is another object that has potential/stored energy?
- What is another object that kinetic/moving energy?
Instructions (For Participants)

1. (Grades 10-12 only) Notch the front of the body. Turn the cardboard so that, as you hold it flat, the corrugations run right and left (i.e., not forward and back). Cut across the corrugations and make a 2-inch-wide and 1 1/2-inch-deep notch in the center of the side. Throw away the piece you’ve cut out.

2. (All ages) Make the axle. Slide the skewer through the cardboard, close to the outer edge. Make sure the axle sticks out the same amount from each side of the body.

3. Modify the axle. Find where the skewer goes across the notch. In the middle of this section, wrap a small piece of tape to make a “catch” for the rubber band.

4. Assemble the wheels. Put a piece of tape over either side of the hole in the CD. Poke the dowel through. Add extra tape if the CDs do not turn with the axle.

5. Attach a rubber band. Choose one of the rubber bands. Tape one end to the cardboard at the end opposite the axle.

6. Power your car. Wrap the unattached end of the rubber band over the catch.
Miscellaneous

  - This link provides further instructions on how to create a cardboard racer
Origami Cranes
Creating an Origami Paper Crane

6th-12th Grades
Indoor
15 min

Social Skills
- Patience
- Perseverance

Take Home?
Yes

Ideal Group Size: 5-10
1 large group

Technical Concepts
Symmetry, Geometry
Foreign Culture

Companion Book
Sadako and the Thousand Paper Cranes by Eleanor Coerr
<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
</tr>
</tbody>
</table>
Instructions (For Facilitator):

Preparation for Activity

Paper cranes require square paper, so if you have rectangular paper you may want to cut it into squares. This will save time when doing the activity with students, but it is not necessary to do before working with the students, you can just as easily have them do this part as well.

Be sure that you understand the student instructions well enough to help walk the students through the process of creating a paper crane. If you know a different way to make a paper crane, you can use that as well, but it won’t match the pictures provided in the student instructions.

If you wish to use Sadako and the Thousand Paper Cranes to accompany this activity, be sure to assign the reading to participants during a prior meeting, giving them enough time to read the novel. Let them know when assigning the reading that there will be an activity to go along with the reading at the next meeting, so they should be sure to read it.
Introduction of Activity

If using *Sadako and the Thousand Paper Cranes*

Begin with a discussion about the book. This discussion could be focused on World War II, or the theme of the book which is that good things come from hardships. Discuss how although Sadako sadly passed away before she could make 1000 cranes, her family completed the task for her to fulfill her wishes. Discuss what participants liked about the book, as well as what they didn’t like about the book.

If not using *Sadako and the Thousand Paper Cranes*

Explain to the students that origami is the Japanese art of Paper folding. Explain that one of the most popular forms of origami is a paper crane, which is what they will be making.
Execution of Activity

Make sure each participant has at least one sheet of paper. Some participants may rip the paper if they are given rectangular paper. It is recommended to have extra paper ready in case of ripping mistakes.

Throughout the activity, the facilitator will be giving a step-by-step process of how to create a paper crane. The facilitator will likely need to repeat certain steps multiple times. Some steps can be quite confusing without seeing it a few times, and sometimes participants will not be paying close enough attention the first time.

It is recommended to have a piece of paper at each step of the way that students can pass around and examine to see what their paper should look like at various steps throughout the process.

If there are multiple facilitators, it is recommended that the lead facilitator of the activity goes through the step-by-step instructions for the participants, and other facilitators answer questions and repeat steps for confused participants.
Debrief from Activity

If using Sadako and the Thousand Paper Cranes
Discuss how the symbol of 1,000 paper crane represents hope in Japanese culture. Have the students discuss what they think would have happened in the book if Sadako had finished making all 1,000 cranes before she passed away.
Ask the participants what they would wish for if they got a wish. Have them draw a picture of their wish, and how they would react to it if it came true.

If not using Sadako and the Thousand Paper Cranes
Explain that in Japanese folklore, there is a legend that if someone creates 1,000 paper cranes, they receive a wish. Discuss how the symbol of 1,000 paper crane represents hope in Japanese culture.
Ask the participants what they would wish for if they got a wish. Have them draw a picture of their wish, and how they would react to it if it came true.
Instructions (For Participants)

1. Cut paper into a square if it is not already. This can be done by lining up the short side of the paper to the long side and folding the paper as shown below.

2. Remove the bottom rectangle from this paper, giving you a square.
3. Fold the paper in half diagonally

4. Fold the paper in half in the other diagonal

5. Fold the paper in half horizontally
6. Fold the paper in half vertically

7. Using the folds you have made, bring all four corners together and fold the paper into a smaller square
8. Fold in the sides of the top half into the center as shown below. Make sure the open corner is on the bottom
9. Flip over and repeat step 8

10. Fold top triangle down in order to make next step easier
11. Undo all the folds since step 7

12. Open the bottom fold so it looks like a boat
13. Fold down and create a diamond

14. Flip over and repeat steps 12 and 13
15. Fold in the sides to the middle

16. Flip and repeat on the other side
17. Fold up each “leg”

18. Fold over the end of one “leg” to make the head. The other is the tail
19. Fold down each of the wings

20. You are done!

21. Optional: Decorate your crane with crayons, markers, or colored pens!
Miscellaneous

Handouts

Video Links

- https://www.youtube.com/watch?v=KfnyopxdJXQ
  - This is done differently than shown in the instructions but is a great video
  - This can help show there is usually more than one correct way to do things
Friendship Bracelets

Create simple friendship bracelets for yourself or to give to a friend.

Social Skills
- Communication
- Gender equality

Take Home? Yes

Ideal Group Size: 20
Individual Activity

Technical Concepts
Patterns, Foreign Culture

Companion Book
Friendship Bracelets by Laura Torres, Darwen Hennings, Vally Hennings
Frog and Toad by Arnold Lobel
<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embroidery Floss (4 colors)</td>
</tr>
<tr>
<td>Safety Pin</td>
</tr>
<tr>
<td>Scissors</td>
</tr>
<tr>
<td>OR Friendship bracelet Kit</td>
</tr>
</tbody>
</table>
Instructions (For Facilitator):
Preparation for Activity

1. Formation of Bracelet kit:
   a. Cutting string
      i. You will need 4 colors of string per kit
      ii. Cut lengths of string to the approximate length of your arm.
         1. You only need to measure the first string to your arm, the rest you can just compare to each other.
2. It is better to be too long than too short in this case
2. Gather 4 pieces of string together
3. On one end, tie a loop into the four strings
4. Attach the loop to the safety pin so the participants can easily anchor down their friendship bracelet.
Introduction of Activity
Hand each participant a bracelet kit. Explain to them that you will be showing them how to make a friendship bracelet.

Execution of Activity
First, show the participants the proper way to tie a friendship bracelet knot. Show them enough times so they can get a bit of understanding, then walk around and answer any questions participants may have, and make sure they are doing it properly. Be sure to let them know they can change the color of their bracelet by switching which color they are tying the knots with.
Debrief from Activity

Explain to the participants the symbolism behind friendship bracelets, and how in America, they are a common gift to show that the someone appreciates the friendship of the receiver.

Challenge the students to make a bracelet and give it to someone whose friendship they appreciate.
Instructions (For Participants)

1. Attach the safety pin to some kind of sturdy surface. This could be around a shoelace, a belt loop, onto a clipboard, or even taped down onto a table.

2. Select which color you want to be the outside of the beginning of the bracelet.
3. Create the shape of a 4 with this string
4. Pull the string through the 4 and pull up completely
5. To switch colors, just switch which string you are making the “4” with.

6. Continue this same action until you can comfortably wrap the bracelet around your wrist.
7. Remove the safety pin from the loop of the bracelet
8. Give the bracelet to a friend!

Miscellaneous
How to make different kinds of friendship bracelet knots.

Walk Through Paper
Cut a piece of paper in a hole big enough to walk through

Social Skills
• Problem Solving

Take Home?
Yes

Indoor
7th-12th Grades 15 min

Math

Technical Concepts
Geometry
Companion Book
Captain Invincible and the Space Shapes by Stuart J. Murphy
Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Scissors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Paper</td>
</tr>
</tbody>
</table>
Instructions (For Facilitator):

Preparation for Activity
Be sure to have enough paper and scissors for each participant.

Introduction of Activity
Hold up a piece of paper in front of the students. Tell them that you know a way to cut a hole into the paper big enough to walk through.
Challenge them to figure out how to do so

Execution of Activity
Allow students to try different ideas, when they have hit a point of no new ideas, show them the steps in participant instructions.

Debrief from Activity
Say that with geometry, a small area can be converted into a large perimeter. Ask them to try to explain why this works.
Instructions (For Participants)

1. Take your piece of paper and fold it in half
2. Cut about one inch in on either of the shorter sides

3. Cut off the folded edge between the two flaps
4. Start to cut in alternating directions between the pre-cut flaps
5. Continue this all the way down the page
6. Unfold the paper and enjoy your loop!
Miscellaneous

- https://www.youtube.com/watch?v=8y9i8ag2WTk
  - This link shows a video of how to complete this activity
A

**Architecture:** *Arkitekturë*

B

**Buoyancy:** *Pluskues*

C

**Conservation:** *Ruajtje*

**Culture:** *Kulturë*

**Chemical Reaction:** *Reaksion Kimik*

D

**Drag force:** *Zhvendos forcën*

E

**Exothermic:** *Ekzotermik*
Gas: Gaz
Gravity: Gravitet
Ice: Akull
Kinetic Energy: Energji potenciale
Lift Force: forca e ngritjes
Liquid: Likuid
Matter: lëndë

Perseverance: Këmbëngulje
Plane: Aeroplan
Potential Energy: Energji kinetike
Pressure: Presion

Solid: Ngurtë
Teamwork: Bashkërendim
Thrust: Rrëshqitëse

Water: Uji
Weight: Peshë
### Photo of Materials

<table>
<thead>
<tr>
<th>Item</th>
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</tr>
</tbody>
</table>
Instructions (For Facilitator):

These instructions are more in depth and will tell the instructor what they need to do for each step of the activity including prep time and how to split groups (if necessary). This will also include a script of what they should say before and after the activity to ensure that the students are learning the concepts that they should be through the activity. This section will also include photos throughout the process so the instructor can be confident that they are doing the activity correctly. This section may also be translated into Albanian to ensure that there is no confusion over complicated vocabulary.

Preparation for Activity

Explains how the facilitator needs to prepare for the activity before the visit of the STEAM Machine

Introduction of Activity

Explains how the facilitator will introduce the activity to the Participants

Execution of Activity
Explains what the facilitator should do during the execution of the activity

Debrief from Activity
Explains how the instructor should debrief participants after the conclusion of the activity

Instructions (For Participants)
This could be formatted as a handout of instructions to hand out to students, or even just a smaller, less in depth list of instructions on how to carry out the activity. This will not include the script the instructor will use, nor will it include any setup that the instructor will perform before bringing the activity to students. This section will also be translated into Albanian, especially if the handout-format is used

Miscellaneous
This section will be used for any extraneous information such as handouts or examples that are deemed necessary for the activity, either for helping the instructor, or the students.