MADE IN THE CARIBBEAN

FINAL REPORT

CONTENTS

GENERAL PROJECT INFORMATION

	Description
Project Name	*Made in the Caribbean*
Executing Agency	*Caribbean Council for Science and Technology*
Project Description	*The "Made in the Caribbean" Perez-Guerrero Trust Fund project seeks to develop the foundation knowledge, skills, attitudes and behaviours conducive to the development of a culture of science, innovation and entrepreneurship in the Caribbean region.*
Project Manager	*Ms. Lovaan Superville*
Project Sponsor	*Perez-Guerrero Trust Fund*

	Baseline	Actual
Start Date	*July 2012*	*July 2013*
Finish Date	*July 2014*	*June 2016*
Budget	*US$21,000.00*	*$22405.76*

PROJECT DESCRIPTION

The **Made in the Caribbean Project** was launched in Barbados in 2013 through grant funding from the Perez-Guerrero Trust Fund for Economic and Technical Cooperation among Developing Countries. The project seeks to further develop a foundation of knowledge, skills, attitudes and behaviours conducive to the development of a culture of science, technology, innovation and entrepreneurship in the region. The project endeavours to arouse and develop in youngsters a proclivity for applying creative thinking processes to the development of innovative solutions to problems encountered in life and in their community.

The project focused on the concept of Technopreneurship. This concept calls attention to and stresses the dynamic interrelationship of the following elements: Science and Technology, New Products and Product Ideas (i.e. innovation/invention), Creativity and Entrepreneurship (i.e. business of innovation).

Made in the Caribbean had two core components;

1. "**Workshops**"- These "train the trainer" workshops were designed to develop capacity in the teaching of creativity and innovation by means of providing curriculum, resource materials and basic training to a cadre of trainers/facilitators in each island. National facilitators from the three different Caribbean islands were trained to conduct Technopreneurship Camps on the following themes:
    - Creative Thinking, Critical Thinking and Problem Solving
    - Conceptualizing New Ideas, Design and Planning
    - Prototype Building
    - Marketing and Entrepreneurship, including information on intellectual property
2. "**Camps**" - recently trained facilitators were then able to apply knowledge learned from the "train the trainer" workshops to host camps in the related technopreneurship themes. Through these pilot camps, students were able to develop skills in communication and teamwork among participants and; to grapple with and work together to find solutions to pressing issues in their local communities.

It is then expected that these new facilitators would put into practice what they learned to facilitate further camps and workshops on the subject matter.

Made in the Caribbean was held in Barbados, St Vincent and the Grenadines and Tobago.

Barbados

10th-12th & 15th-16th July 2013

The workshop held in Barbados focused on Techno-preneurship and innovation and invention. Techno-preneurship is the process of merging technology prowess and entrepreneurial talents and skills. A cadre of sixteen (16) national facilitators/camp counsellors were trained in the subject matter. The aim of the workshop was to develop indigenous technopreneurial capacity that will create new products and processes using the cultural and physical milieu as a natural laboratory for experimenting with the inventive process. The newly trained facilitators were then able to integrate a two day techno-preneurship camp within the National Council for Science and Technology (Barbados) Camp which accommodated over eighty (80) students.

St. Vincent and the Grenadines

25th -29th August, 2014

The Workshop and camp in St Vincent and the Grenadines was based on techno-preneurship and robotics. As technology evolves ever more quickly in all aspects of modern living, it is important that the next generation know as much as possible about design, electronics, programming and integration in order to stay competitive. This is why robotics is becoming increasingly important at all levels of education. Twenty-five (25) national facilitators/camp counsellors were trained. The techno-preneurship and robotics pilot camp was incorporated into the Office of the Prime Minister (St. Vincent) Camp which accommodated a total of fifty (50) students.

Tobago

10th-12th & 25th -26th June, 2016

The theme for the Tobago installation of the project was 3D Printing. Participants were introduced to the concepts of Innovation and Invention and 3D Printing giving participants the tools to set up their own mini Makerspace. Makerspaces have become very popular on a global scale particularly in STEAM education (science, technology, engineering, art and mathematics). A makerspace is essentially a community operated workspace where people with common interest, often in computers, machining, technology, science, digital art or electronic art, can meet socialize and collaborate. Such “open spaces” are the products of global movements that promote “open data” and “open source”. These movements push for

a more globally collaborative and sharing network of thinkers who creatively find a way to solve any and all problems. A total of twelve persons were trained and hosted a pilot 3D printing camp. There were a total of 30 students in attendance at the two day camp.

LESSONS LEARNED

The creativity workshops and camps comprised a programme of fun hands-on activities for stimulating creative and critical thinking and included design and building activities. Puzzles, brainstorming, experimentation and object play were some of the techniques and tools used to stimulate out-side-the box thinking and brain development, which are crucial to inculcate creativity. These techniques and tools were well received by all participants.

There were several issues that challenged the project/project team in each country.

Barbados

Forces majeures in Barbados interrupted and hindered activities. Barbados was put on storm watch two days before the training workshop and camp, as Storm Chantal threatened destruction as it approached. Preparatory activities for the workshop and camp came to a halt as a result. The school to be used as the venue for the training workshop and camp was also a disaster shelter. Because of this the venue had to be changed on short notice. Training began as scheduled on the 10th July 2013 and facilitators made the best of venue and materials on hand.

In addition to this there was a delay with the Barbados Customs and Excise Department clearing materials sent from Trinidad for the workshop and camp. It has been our experience that packages normally take two days to be cleared, however in this instance it took two weeks. Some of the materials were needed for use in the workshop. The team was however able to source these materials from the Barbados National Council for Science and Technology which CCST partnered with to carry out the project in Barbados. The issue with customs was sorted and all materials were available for the pilot camp.

St. Vincent and the Grenadines

The workshop and camp was designed to accommodate a maximum of 25 persons each. Approximately 25 persons registered for both programs collectively. This was in part due to the workshop and camp clashing with other workshops being hosted at the same time. The majority of the persons present expressed interest in both workshops thus the overall structure was redone to accommodate this.

In addition to this, the two day camp had a late start. This was due to a miscommunication between the local organizers of Made in the Caribbean and the school hosting the camp
Despite these issues all workshop and camp content was delivered.

Tobago 2016

In Tobago, the main challenge was finalizing the timeline for training facilitators and carrying out the pilot camp. It was difficult to finalize a date that was suitable for all partners involved in the project. The schedule for activities were based on the availability of the facilitators who will be conducting the workshop and overseeing the camp in Tobago.

There was also some difficulty getting in contact with the schools in Tobago via telephone and email to promote the camp. The project coordinator was able to go directly to the schools to promote the camp and arouse the interest of students.

It is important to build a relationship with local organisations with similar interest who can offer support to help ensure the success of the project. We were able to get assistance from the Division of Education, Youth Affairs and Sport in Tobago.

A smaller group was targeted to ensure the quality of the camp. From our experience in hosting pilot camps, the ideal number of participants is twenty-five to thirty students. This way students get a greater level of practical experience for camp activities. Facilitators are able to work more closely with students to ensure all camp content is understood by students.

Countries that are already conducting national camps are best suited for sustainability of the project. It will be easier for these countries to take the training and implement it into their own national camps. In instances where the newly trained facilitators are teachers in their country, they have the ability and advantage of using the techniques taught in the workshops as pedagogical tools to enhance their own classroom delivery.

ADMINISTRATIVE CLOSURE

Barbados and St. Vincent and the Grenadines

At the end of the workshops and pilot camps held in each country the local organisations and newly trained facilitators were left with the relevant science kits, workbooks and manuals to replicate the camps.

Tobago

At the end of the pilot 3Dprinting camp the 3D printers and printing materials used were left with the facilitators. They will continue running camps based on 3Dprinting and innovation and invention. The facilitators came from two organizations Sankofa Consultants Ltd and I AM Legacy International. Both organizations specialize in carrying out STEM based programmes as well as assistance to support and promote entrepreneurs within Trinidad and Tobago.

PROJECT RESULTS

The main goal of Made in the Caribbean was to help develop the foundation knowledge, skills, attitudes and behaviours conducive to the development of a culture of science, technology, innovation and entrepreneurship in the region.

The project had two main objectives:

- To develop capacity in the teaching of creativity and innovation by means of providing curriculum, resource materials and basic training to a cadre of trainers/facilitators in Tobago.

- To enable students to develop skills in communication and teamwork among participants and; to grapple with and work together to find solutions to pressing issues in their local communities.

This project was intended to assist in promoting youth innovation and invention on a regional scale. It is also expected that it will encourage national governments, non-governmental organizations and other institutions to provide much needed investment in popularisation of science and innovation. Although it will take some time before the Caribbean region is to be known for its “knowledge” industries or research centres, stimulating young people to innovate and think creatively will ensure that they see the world in

non-conventional ways that will spur their entrepreneurial spirit and by extension the innovative capabilities of the region.

Initial Project Goals/ Objectives/ Deliverables	Project Outputs	Project Outcomes
To develop curricula and training materials produced to stimulate and develop mentors and camp counsellors and students' innovative potential at the workshops and camps.	Development of 3 sets of curricula and training materials to suit the three different thematic areas covered in the workshops and camps.	Curricula ad training materials developed that were able to stimulate and develop the creative and innovative capacities of camp and workshop participants.
To train a cadre of facilitators/mentors to lead camps for young inventors and innovators.	A total of 53 facilitators trained to lead and facilitate camps.	Participants of the "train the trainer" workshop now have the knowledge and skills to continue these camps in their country.
To pilot a Technopreneur-ship camp.	A total of 160 students in attendance at the Technopreneur-ship camp	Students who attended the camp were exposed to activities which allowed them to develop skills in communication and teamwork among their peers. The hands-on activities helped to stimulate students' creative and critical thinking. The camp also helped students to become more familiar with the concepts of innovation and invention and become more aware of the impact of science and technology on their daily lives.

PROJECT SCHEDULE

The planned project duration was May 2012 to May 2014 with an estimated start date of 2nd July, 2012. Made in the Caribbean was planned with the intention of covering one country in the first year and two countries in the second year. However the project activities began in 2013 in Barbados then St. Vincent and the Grenadines in 2014 and Tobago in 2016. Tobago could not be done in the same year as St. Vincent and the Grenadines as the relevant NIHERST staff and other resources were unavailable at that time. There were also no similar NIHERST projects held in Tobago in 2015 therefore Tobago was done in 2016.

The project dates for each country are listed below:

- Barbados 10th-12th & 15th-16th July 2013
- St. Vincent and the Grenadines 25th -29th August, 2014
- Tobago 10th-12th & 25th -26th June, 2016

APPENDIX

BARBADOS WORKSHOP CONTENT

DAY 1

Creativity & innovation

INVENTION -This is a device, process, or discovery that is new, useful and reflects creative ability or skill.

INNOVATION -This is not just an improvement on an existing device, but the actual use of the device to meet the needs of users.

Activities: Find an activity that Challenges the mind, makes persons think outside the box (Lateral Thinking)

- Logic puzzles
- Brain Teasers
- Riddles

These are a few activities that can get everyone thinking regardless of age or ability. When these two factors are taken into account additional activities may be added with various backgrounds

Creative thinking methods

There is a method in everything, even madness and understanding the creative thinking methods, processes, tools and techniques will always give one an advantage.

- *Synthetic*
- *Socratic*
- *Evaluative*

Tools & techniques

- Mind Mapping
- Brain Storming
- Brain Writing
- Morphological Box
- Provocation Technique
- Semantic Intuition
- Six Thinking Hats

- Stimulating Word Analysis
- TRIZ innovation Principles

Idea Evaluation & Assessment

Identify what characteristics you deem most important for your idea to be evaluated on at attach weightings (percentages %) to each feature noting the most important/crucial one and Assess your ideas. Some examples of features are.

- Cost of Production 10%
- Market Size 40%
- Availability of Resources 20%
- Time of delivery 10%
- Time to Produce Product 20%

Types of Learning

Understanding how you process information would have one better equipped at selecting a suitable Creative Method or Process.

- Auditory Learning
- Visual Learning
- Kinesthetic Learning

Determine your type of learning, by looking for or downloading any test online

Leadership

Entrepreneurs are Leaders and good Team Players.

Leadership Vs Manager – Roles and Responsibilities

Types of Leaders

- Laissez-Faire
- Autocratic
- Participative
- Transactional
- Transformational

Team vs. Group; what is the Difference?

Activities: Leadership/ Team Work Challenge (Time Limit)

- Assemble Puzzle
- Construct a Model
- Design Challenge

DAY 2

Idea generation & development

1. Using a Stimulant Develop your Ideas in Teams
2. Select Top Ideas

Evaluate Ideas, selecting Best Idea for Development

Introduction to Entrepreneurship

Opportunities

- Seek opportunities Identify Gaps/Problems
- SWOT Analysis

Activity – Identify opportunities in your school/community/country

Marketing & statistics

One must first identify their market; who would buy you product/service? One this is done you can approach you may start to organise your marketing Strategy using the 4 P's of Marketing.

One needs **Numbers** and **Facts** to back up **assumptions**; you cannot just assume you know the entire market. Some companies' most lucrative revenue stream is the Marketing and Statistical Data they process, sell and integrate in their Marketing Services, for example **Google** and **Facebook.**

Financing & funding

Such a topic requires and in depth volume of knowledge, understanding and practical application, which cannot be touched in any one workshop, with additional constrains depending on level of education and experience of the participants of the workshop. However a few simple terms and concepts can be explored and discussed.

- Startup Funds
- Working Capital
- Pay Back Period,
- Rate of Return

To develop a plan one needs a Balance sheet and must identify

- Expenses &Revenue Streams,
- Profits &losses
- Liabilities & Assets
- Miscellaneous Expenses & Contingencies

Finally one CANNOT forget about LAWS & TAXES:

- Income Tax
- Corporate Tax
- Health Surcharge Etc.

Where can one get funding?

- Personal Funds
- Loans, (Micro-Loans)
- Venture Capitalist
- Angel Investors
- Developmental Companies
- Government Aid/Grant

Activity – Estimate startup Funds for a Business and **working Capital** (don't forget to pay yourself)

Intellectual property & intellectual property rights

What is Intellectual Property?

"Intellectual property (or "IP" as it is often referred to) is the output of intellectual activity. IP is a form of property and as with any other form of property, it can be bought, sold or licensed. Under the terms of the convention establishing the World Intellectual Property Organisation (WIPO), intellectual property was defined as:-

"literary, artistic and scientific works, performances of performing artists, broadcasts, inventions in all fields of human endeavour, scientific discoveries, industrial designs, trademarks, service marks, commercial names and designations and all other rights resulting from intellectual activity in the industrial, scientific, literary and artistic fields."

"If intellectual property is the output of intellectual activity then "intellectual property rights" (often referred to as "IPRs") are the rights granted under the law to the owner of the intellectual property. The terms, intellectual property and intellectual property rights, are often used interchangeably. However, strictly speaking the term "intellectual property" defines the actual results of the intellectual endeavour, whilst the term "intellectual property rights" relates to the concept of legal protection and ownership which the law grants to the legal owner of the intellectual property".

There are six main types of intellectual property rights namely:

- Patents;
- Confidential information and know-how/trade secrets;
- Copyright;
- Trademarks;
- Design rights;
- Plant variety rights.

Certain types of IPRs can arise almost automatically; however, other forms only arise through a formal registration process. In addition, more than one form of IPR can apply to one creation.

Human resource & management

Organisational Structure of your business is important you must ask yourself:

- Who are the key players I need for my Management Team?
- Who are the key players I need for my Operations Team?
- What other Services to I require to run my business?

Activity – Map out or develop an Organisational Chart for a Business

TYPES OF BUSINESS STRUCTURES

SOLE PROPRIETOR - A sole proprietorship, also known as the sole trader or simply a proprietorship, is a type of business entity that is owned and run by one individual and in which there is no legal distinction between the owner and the business.

GENERAL PARTNERSHIP - In the commercial and legal parlance of most countries, a general partnership refers to an association of persons or an unincorporated company with the following major features:

- Created by agreement,
- Formed by two or more persons
- The owners are all personally liable for any legal actions and debts the company may face

It is a partnership in which partners share equally in both responsibility and liability

CORPORATION - A corporation is a separate legal entity that has been incorporated through a legislative or registration process established through legislation. Incorporated entities have legal rights and

Liabilities that are distinct from their employees and shareholders and may conduct business as either a profit seeking business or a non-profit seeking business.

LIMITED LIABILITY COMPANY (LLC) -A limited liability company (LLC) is a flexible form of enterprise that blends elements of partnership and corporate structures.

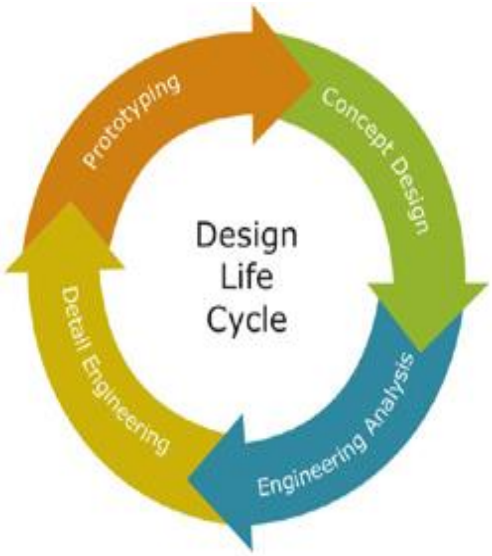
LIMITED PARTNERSHIP - A limited partnership is a form of partnership similar to a general partnership, except that in addition to one or more *general partners* (GPs), there are one or more *limited partners* (LPs). It is a partnership in which only one partner is required to be a general partner

LIMITED LIABILITY PARTNERSHIP - A limited liability partnership (LLP) is a partnership in which some or all partners (depending on the jurisdiction) have limited liabilities. It therefore exhibits elements of partnerships and corporations. In an LLP, one partner is not responsible or liable for another partner's misconduct or negligence.

PRODUCT DEVELOPMENT (R&D)

- INNOVATION, how to make your product better (cell phones and laptops always out dated)
- Research and Development into Technology, either yourself, outsourcing or reading up on what people are doing
- Continuous Market analysis and feed back
- Using end user for DEVELOPMENT

Engineering Design life Cycle



Activity - Techniques to Improve on Idea, develop Ideas Further, improve on Business

Incubators - a service that cannot be found any and everywhere but specialising in linking entrepreneurs with key resources and facilities, such as:

- Research
- Professional Assistance or guidance in a particular Field
- Prototype Development

Activity - ELEVATOR PITCH (Selling yourself and your Idea). Summarise your IDEA and Pitch to a Panel of Investors.

DAY 3

Successful companies

- Facebook
- Freelancer.com
- Google
- 3M

What can we learn from their success? How could we improve on their success?

Failed companies

- Pets.com
- Fresh Express
- Block Buster

Why Companies Fail?

- Sustainability vs. Profit Margin
- Customer value. Is it useful are substitutes out there?
- Market Attractiveness
- Technology/Idea Attractiveness
- Idea Protection
- Strategic Fit

Techno-preneurship Workshop

Techno – preneurship: the use of technology as a key element in the transformation of an entrepreneurial venture. Can techno-preneurship be taught, or can we only nurture and influence innate ability? This workshop contains engaging content and activities in three domains: Innovation, Invention and Entrepreneurship; with the entrepreneurial module being the most robust of the three. Depending on the background and level of the participants, the content focus and activities of the modules will be tailored to deliver the most impact for your particular context.
The following provides more insight on our offerings:

Innovation

Ideation

How does it all begin? What exactly is brainstorming? Participants will be taught brainstorming techniques and will be engaged in creative challenges such as generating ideas using inspiration from one's immediate surroundings.

Creation

The Ideation Framework: What happens after you have generated an idea? In this session, you will learn how to create follow through plans for original ideas and concepts.

Invention

Reverse Engineering I

Discover the power of inquiry. This module will help you to understand the interplay between technology, immediate surroundings, and powers of observation to discover alternative uses for, and ways to add value to everyday items.

Reverse Engineering II

Begin with the end in mind. This module takes a reverse approach to the invention processes, working backward from an end point allows participants to fully grasp the order and importance of the steps taken and the assumptions made to achieve the final product.

Entrepreneurship I - The Start-Up & the Pitch

You will be introduced to some key terms. What is entrepreneurship, the key differences between products vs. services, and commercialization vs. marketing? Also, we take a look at the reality of start-up initiatives: their successes and challenges and tips to have the best chance of surviving the first year of commercializing your idea.

Entrepreneurship II - The Plan

A solid business plan is one of the most important tools in the entrepreneurial toolkit. As you seek funding from investors or lending institutions, they expect to see your objectives, financial projections, and valuations in a clear, comprehensive and well thought out manner. A business plan is also a blueprint to help keep you on track as you build your new business.

Entrepreneurship III – The Presentation

Why should anyone want to buy what you are selling? Everyone thinks their product is the next best thing. You do not just have to sell your business idea, you need to sell yourself. The Presentation& Pitch is the final make or break stage before your business actually gets off the ground. You will learn how to communicate the value of your product/service in a concise and compelling way.

Activities

INNOVATION

IDEATION

- Riddles, Puzzles, presentation
- Build a Tower (Straw/foil/paper… *limit materials*)
- Build a Bridge (Straw/foil/paper… *limit materials*)
- Design your own game.

CREATION

- Build a Tower (Tallest Tower vs. Strongest Tower)… *Conditions of Build*
- Build a Bridge (Longest bridge vs. Strongest Bridge)… *Conditions of Build*
- Build a Car (Gravity Powered/ Wind Powered/ Motor powered)… *Conditions of Build*
- Design your own Game (Team vs Individual)… *Conditions of Design*
- Make your own JOURNAL… Pretend you are VP of R&D and have developed a popular device, how would it look?

INVENTION

REVERSE ENGINEERING I

- Observation, recording and Reporting
- Presentation
- Mystery Item Challenge
- Origami
- Make your own JOURNAL… *Scenario*

REVERSE ENGINEERING II

- Disassembly and Sketch I – common item e.g. Stapler
- Disassembly and Sketch I – not so common item
- Make your own JOURNAL… Pretend you are VP of R&D and have developed a popular device, how would it look?

ENTREPRENEURSHIP

ENTREPRENEURSHIP I - THE PITCH

- Pitch your Business Idea

ENTREPRENEURSHIP II – THE BUSINESS PLAN

- Develop your business plan

ENTREPRENEURSHIP III – THE PRESENTATION

- Develop and present your business plan

Robotics Workshop

NIHERST seeks to increase student interest and involvement in science, technology, engineering and mathematics (STEM) by engaging students in hands-on sustainable and affordable curriculum-based robotics engineering programs across Trinidad and Tobago.

As technology evolves ever more quickly in all aspects of modern living, it is important that the next generation know as much as possible about design, electronics, programming and integration in order to stay competitive. This is why robotics is becoming increasingly important at all levels of education.

Due to the dynamic nature of the topics being covered, the exact layout of each day may be changed to suit. However the central topics identified above for the morning and afternoon periods would be maintained.

Modules Overview

Booklet Name: ***Full Speed Ahead***

Introduction: Full Speed Ahead guides students step-by-step through the process of setting up the programming environment, programming the robot, and running the basic moving forward program.

Booklet Objectives:

- ❖ Open the Lego Mindstorms NXT Programming Software

- Write a program using the NXT Programming Software
- Program the robot to perform multiple actions in sequence
- Connect the robot to the computer and download programs to it
- Navigate and run programs on the NXT

Booklet Name: ***Wheels and Distance***

Introduction: Wheels and Distance Investigation involves students in an investigation of the relationship between wheel size and the distance the robot travels given a set number of wheel rotations.

Booklet Objectives:

- Follow directions to conduct a guided partial inquiry
- Calculate averages and circumferences
- Describe the relationship between diameter and circumference
- Describe the relationship between wheel size and distance traveled in a constant number of rotations
- Apply and describe the various points of experimental procedure:
    - Experimental hypothesis
    - Measurement technique
    - Multiple trials
- Describe and apply a self-formulated procedure for converting centimeters into wheel rotations
- Write a conclusion that summarizes the lessons learned in the investigation

Booklet Name: ***Right Face***

Introduction: Right Face Activity which guides students step-by-step through the process of building two different programs each of which produces a different type of turn.

Booklet Objectives:

- Program a robot to turn using the LEGO MINDSTORMS programming environment
- Connect the robot to the computer and download programs onto it
- Navigate to and run programs on the NXT
- Make the robot do both left and right turns, as well as one wheel ("swing") and in-place ("point") turns
-

Booklet Name: ***Measured Turns***

Introduction: Measured Turns Investigation, which involves students in an investigation of the relationship between robot geometry, motor degrees, and the amount the robot turns.

Booklet Objectives:

- Follow directions to conduct a guided partial inquiry
- Describe the shape traced by the robot as it swing turns
- Calculate the circumference of a circle
- Describe the relationship between robot's wheel-to-wheel distance, wheel size, motor rotations and amount the robot has turned.
- Apply and describe the various points of experimental procedure:
    - Experimental hypothesis
    - Measurement technique
- Measure and calculate elements of the robot geometry.
- Verify a procedure for converting motor rotations into amount the robot turned.

Booklet Name: ***Clap on Clap off***

Introduction: Clap On, Clap Off Activity, which introduces students to sensors, specifically the sound sensor. Students are led step-by-step through the process of finding a threshold, programming the robot, and running through several programs that rely on the sound sensor to control their robots behaviour.

Booklet Objectives:

- Program a robot using the LEGO MINDSTORMS programming environment to respond to environmental stimuli
- Collect and apply data from the Sound Sensor
- Calculate a threshold value

Booklet Name: ***Frequency and Amplitude***

Introduction: Frequency and Amplitude Exploration, which involves students in an investigation of the properties of a sound wave, and which properties of the sound wave that the sound sensor is able to distinguish.

Booklet Objectives:

- Follow directions to conduct a guided partial inquiry
- Learn about amplitude and frequency and units in which to measure them
- Apply and describe the various points of experimental procedure:
    - Measurement technique
    - Multiple trials
- Organize and analyze data collected through experimentation
- Write a conclusion that summarizes the lessons learned in the Exploration

Booklet Name: ***Obstacle Detection***

Introduction: Obstacle Detection Activity guides students step-by-step through the process of programming the robot to respond to two different types of sensory stimuli.

Booklet Objectives:

- Program a robot using the LEGO MINDSTORMS programming environment to respond to the Touch Sensor as well as the Ultrasonic Sensor
- Explain how the Ultrasonic Sensor works and what it can and cannot detect well
- Compare the differences in robot behavior using the two sensors, and make judgments as to
    - which is best in a given situation

Booklet Name: ***Get in Gear***

Introduction: Get in Gear Activity, which guides students step-by-step through the process of changing the robot's gears, running the basic moving-forward program and observing the differences created by the different gear ratios.

Booklet Objectives:

- Change the power level of the motors to speed up the robot
- Change the gear ratio on the robot and observe the effects on speed and power

Booklet Name: ***Gears and Speed***

Introduction: Gears and Speed Investigation, which involves students in a quantitative investigation of the relationship between gear ratio and robot speed.

Booklet Objective:

- Follow directions to conduct a guided partial inquiry
- Calculate averages, gear ratios, speeds
- Learn about speed and torque and units in which to measure them
- Compare two hypotheses that attempt to describe how gear ratio effects robot speed
- Use equations to make predictions about what will happen in future trials
- Take data to test two hypotheses against their predictions
- Apply and describe the various points of experimental procedure:
    - Experimental hypothesis
    - Measurement technique
    - Multiple trials
    - Organization of data

- Use data to validate one hypothesis and to invalidate another
- Write a conclusion that summarizes the lessons learned in the investigation

Activities

Project Name: Drag Race

Description:

For the Build Structure challenge, the participant will be required to design and construct a “wheel less” robotic vehicle using the Lego Mindstorm NXT 2.0 kits. The “wheel less” robotic vehicle will be required to outrun the opposing vehicle. The objective is to compete against the opposing team and cross the finish line first without the use of any circular parts inclusive of wheels especially. Because this challenge is primarily about the design of the robots body, the participant will be given a default program to run on their robots. The campers can request help from the facilitators to make any desired changes to the program.

Rules:

1. The participants are not allowed to use any circular parts, inclusive a wheel, in the construction of their robotic vehicle.
2. No two vehicles should reflect any similarity with another vehicle, (none should be identical), or both teams will face the penalty of disqualification.
3. If any part of the robot falls off within the duration of the competition, each team is allowed one team member to perform repairs with a 3 minute period.
4. A winner is only determined only, when the front, and no other part of, the robotic vehicle passes the finish line.
5. Gear can be used in the build of robot but cannot used as wheels.

Introduction to 3D Printing technology workshop outline

What is 3D printing? How does 3D printing work? What Can 3D Printing Do?

The use of 3D printing from hobbyists to schools & education programs over to the industry and the future in 3D printing.

In this course we will use two types of 3D printers:

1.) Fused deposition modelling (FDM)

2.) Stereolithography (SLA) based on Digital Light Processing (DLP)

Short introduction to the "basics" in Computer-Aided Design Software (CAD):

How to Choose CAD apps (applications).

During this course there is no need to learn specific CAD software, to be able to create 3D printable designs. More and more Open-Source CAD applications coming out, which take away the difficulties in designing & engineering.

Introduction to 3D Scanning applications: How to use a 3D Scanner (hardware). Participants will learn, how to use a 3D scanner and Open-Source scanner software, to create a bust or “mini-me” figure of themselves, to 3D print.

How to generate out of CAD data a 3D printable file:

1.) Repairing 3D files

2.) Slicing

3.) Generated support structure for 3D

How to set up and use a 3D printer:

1.) About the electronics

2.) Different type of plastic filament which could be used in a 3D printer

3.) Pros and cons in printing with a FDM 3D printer

4.) How to calibrate a 3D printer for the best print results

5.) Causes of print failure

6.) Basics knowledge how to repair and maintain a 3D printer.

How to create out of a 2D photo or drawing a 3D “Lithophanes” design

What is a Lithophane? To put it simply, it's a 3D print of a photo or drawing which uses the thickness of the print to show varying shades of grey when illuminated from behind.

Marketplaces to Share, Buy and Sell Designs for 3D Printing:

How to search: There are 3 "types" of marketplaces for 3D print files:

1) 3D printing services

2) Free sharing

3) Home 3D printing

Hybrid: some websites are offering download of the file and service 3D printing as well.

Meta search engines: they aggregate 3D files coming from multiple websites.

Group work for generating ideas

One group will search and download finished 3D printable designs and print them.

The second group using the 3D scanner, to create a bust or “mini-me” figure of themselves to 3D print.

The third group will utilize simple open-source CAD software for modelling their own ideas and printing them.

After each group achieved their goal, we will switch groups, this way they can start to explain their experience to the new groups like "Train the Trainer".

3D Printing camp outline

Day 1

Introduction to the 3D Printing technology:

What is 3D printing? How does 3D printing work? What Can 3D Printing Do?

The use of 3D printing from hobbyists to schools & education programs over to the industry and the future in 3D printing.

Short introduction = 15 min.

Introduction to 3D Scanning applications: How to use a 3D Scanner (hardware).

Students will learn, how to use a 3D scanner and Open-Source scanner software, to create a bust or "mini-me" figure of themselves, to 3D print.

2 Students from the audience = 30 min.

How to generate out of CAD data a 3D printable file:

1.) Repairing 3D files

2.) Slicing

3.) Generated support structure for 3D printing

Software demonstration = 20 min.

How to set up and use a 3D printer:

1.) Different types of plastic filament used in a 3D printer

2.) Pros and cons in printing with a FDM 3D printer

3.) Causes of print failure

1-2 printers are up and running, printing the 3D scans = 60 min.

Group activities with simple CAD app's

1.) Similar to MINECRAFT, building quickly via cubes
http://www.treebuild.com/playground/lubas/

2.) Sculpting like with clay
http://stephaneginier.com/sculptgl/

3.) 3D Slash, modeling made easy
https://www.3dslash.net/index.php

4.) **3DTin**. This is an in-browser tool that started out as a simple shape editor with specific blocks that you can duplicate and manipulate to make models. http://www.3dtin.com/#

Day 2

Marketplaces to Share, Buy and Sell Designs for 3D Printing

How to search. There are 3 "types" of marketplaces for 3D print files.

1) 3D printing services

2) Free sharing

3) Home 3D printing

Hybrid: some websites are offering downloads of the file and service 3D printing as well.

Meta search engines: they aggregate 3D files coming from multiple websites.

More demonstrations of 3D Printing

How a DLP Printer work.

1.) Stereolithography (SLA) based on Digital Light Processing (DLP)