

THE REPORT OF 4th ANNUAL S.T.E.M YOUTH BOOTCAMP

Girls and Boys in STEM for Sustainable
Development Goals

THEME: "Smart Agriculture: A tool to end hunger; achieve food security and improve nutrition"

**JAN
1st - 5th
2019**



Table of Contents

- 03** ABOUT BOOTCAMP
- 05** ORGANIZERS & INSTRUCTORS PROFILES
- 09** ASSISTANTS INSTRUCTORS
- 12** SPONSORS & SUPPORTERS
- 14** S.T.E.M ANGELS
- 16** SCHEDULE
- 17** Synopsis of the SYBC 4 Theme:
- 24** Roadmap Presentations
- 26** PARTICIPANTS INFORMATION

About BootCamp

DR. LWIDIKO E. MHAMILAWA Director – ProjeKt Inspire



STEM stands for Science, Technology, Engineering and Mathematics. The STEM Boot Camp is a sustainable project that aims at mainstreaming project based integrated learning to complement the formal secondary schools' science and mathematics curriculum.

Various studies indicate that students in Tanzania face challenges in applying the theoretical knowledge from school mainly due to lack of involvement in practical learning activities. In addition, the majority of students only study for examinations rather than to understand the context of the subject or particular topic which leads to poor applicability of their knowledge.

Realizing these challenges, the boot camp intended to create an opportunity for secondary school students of all levels across Tanzania mainland and Zanzibar to unleash their potential through involving them in hands-on science related activities as a way of improving their understanding of the subjects as well as improving their overall learning outcomes. This ultimately contributes to improving the quality of graduates from secondary schools, thus it contributes to improving the overall quality of education.

Moreover, the boot camp intended to

inspire the students to pursue STEM related career and use their skills, knowledge and creativity to solve socio-economic problems within the in the community, thus promoting sustainable development. With the overall theme "SMART AGRICULTURE", this boot camp aimed at making students realize the potential in agriculture and ways to use science and innovation to improve food security and nutrition, to end hunger and to promote sustainable agricultural for improved livelihoods.

Through the 4th boot camp, 67 secondary school students (28 girls and 39 boys) benefited from opportunities to learn about practical application of STEM that will contribute to achieving the sustainable development goals. Other learning activities included career development and growth, critical thinking in design management, effective communication and pitching, introduction to scientific literature review, as well as mentorship. In sum, the boot camp provided hands on experience to students as well as a comprehensive developmental program to prepare the youth for a competitive labor market in the STEM fields.

GOAL

To trigger students' participation in the STEM fields through giving them an opportunity to learn about various career paths and develop interest in the field, sparking their creativity and research skills thus leading to job creation and poverty alleviation in Tanzania.

Organizer's & Instructor's Profiles



MASOUD MNONJI Bootcamp Coordinator

Masoud Mnonji is currently pursuing his Master's degree in Project Planning and Management at the University of Dar es Salaam, Tanzania and a part of Projekt Inspire team working as Programme Officer. He received his first degree, Bachelor of Arts with Education from University of Dodoma, Tanzania in 2012.

Masoud has also attended several training and short term courses including Innovation Hub Managers Training offered by Tanzania Commission of Science and Technology; Monitoring and Evaluation Methodology and Data Analysis training offered by University of Dar es Salaam. Before joining Projekt Inspire team as Programme Officer, he worked on other education-related programs including teaching and running environmental programs.



AGNES MWANGOKA Communications and External Affairs Expert

Agnes Mwangoka is Tanzanian aged 27 holding a Master's degree in MSc. Social and Public Policy (Cardiff University), Post graduate Diploma in Management of Foreign Relations and Diplomacy (Center for Foreign Relations) and a bachelor degree in Political science and Public administration (University of Dar es Salaam). For almost six year she has been working in the field of communication, policy and External Relations with UN agencies such as UNHCR, International organizations such as HelpAge International.

She is also passionate in promoting youth affairs and echo their voices in different platforms to ensure they are heard and taken care of. Hence, she has dedicated most of her time in contributing to achieving youths aspired goals*



VANESSA CHILUNDA

Executive Secretary - ProjeKt Inspire

Vanessa Chilunda is a young Tanzanian student pursuing her PhD studies in Biomedical Sciences at Albert Einstein College of Medicine in New York. She graduated from St. Lawrence University, Canton, New York where she obtained her Bachelors of Science Degree in Biochemistry and Statistics under the UWC Davis Scholarship. She received her high school education from United World College of Southern Africa, Waterford Kamhlaba in Swaziland. Prior to that, she attended Marian Girls' Secondary School in Tanzania.

Vanessa enjoys sharing her experiences and knowledge amongst youth. This triggered her passion to offer inspiration and career coaching to youth in her community, and hence co-founded ProjeKt Inspire. Her passion in sciences and mathematics has allowed her to work closely with the ProjeKt Inspire's portal called Inspire STEM – Science, Technology, Engineering and Mathematics to advice and work with other youth to promote science and mathematics subjects to the local community in Tanzania. In this boot camp, she has closely worked with the organizing team to ensure that the class projects and curricula are in line with the theme and overall assistance in coordination.



MICHAEL EVARISTI MAGOTI

Science Class Instructor

Michael Evaristi Magoti is a young Tanzanian medical doctor, graduate from BadjiMokhtar University of Annaba - Algeria. He is passionate to inspire youths so that they can reach their potential especially in health and biological fields. He became a part of the inspire health leading team of projektinspire Tanzania upon his arrival from Algeria and was the Chemistry and Biology class instructor in 2018, ProjeKt Inspire STEM Youth Bootcamp. Participating in different Tv shows with channel ten and youtube channel "why online tz" and various expeditions to different secondary schools in Dar es salaam, training and educating youth to unveil their potentials.

Very much interested in Research and new therapeutical discoveries of Various Diseases affecting most Youth and children in Africa and the World in General, He is a Co-Ordinator of Africa-Neurogen Team in Africa, Rising awareness and Propagating the stem cell therapy in Africa. His hobbies are writing poems, playing Soccer and Drums.

HARVEY KADYANJI

Technology Class Instructor



Harvey Kadyanji is a remote software engineer for Edify Technologies with a primary focus on Frontend development. He graduated from Colorado College with a degree in Computer Science and has experience in robotics and embedded systems. In Projekt Inspire, he is the head of Consulting whereby he is responsible with aiding students grow their projects to attain technical and financial sustainability. In his spare time he loves to learn about emerging technologies, participate in hackathons and play squash.

TSITSI CHIGWERE

Science Instructor



Tsitsi chigwere is a young zambian who holds a bachelor's degree in microbiology from Badji Mokhtar university of Annaba – Algeria (and masters Of Cellular and Molecular Biology in progress). She attended her secondary education in zambia where she was a member of JETS club(junior engineers technicians and scientists).Tsitsi chigwere loves taking challenges,in secondary Schools, she was a co-founder of a business club and led a youth club that helped tackle challenges the youths face and how to resolve them. Her dedication to research and laboratory work made her do attachments in her free time at livingstone central hospital (zambia), Macha malaria research centre (zambia) and clinique aldjazaire (algeria) .

ADAM MARANJA

Mathematics Class Instructor



Adam is an experienced structural civil engineer with a wide range of skills in programming and entrepreneurial innovation. He is currently working on growing the Mhandisi Maridadi Group, an engineering start-up that offers a news platform on what is happening in the engineering world locally and internationally on www.mhandisimaridadi.com as well as producing mathematics tuition video content for secondary schools through the YouTube channel "MMG Tuition"

ANNA NIGISCSER

Invited Career guidance speaker



Anna Nigicscer is an advisor at Bjørknes University College in Norway. She holds an MSc in International Development Studies and a BA in International Relations. Anna is passionate about education development in East Africa, mostly focusing on the youth, providing career guidance and promoting youth entrepreneurship. She has field experience from several East African countries such as Uganda, Kenya and Tanzania doing research and working on a range of educational and community development projects. Now she is responsible for facilitating field trips and academic courses in Tanzania. She also initiated and organised a Career Guidance and Youth Entrepreneurship Conference in Tanga where the purpose was to support Tanzanian secondary school students in making informed and inner-motivated career choices that enable them to see themselves as change agents in their own society.

KAROLI FABIAN

Engineering Instructor & Curriculum Coordinator



Karoli Fabian, a young geoscientist, graduate at university of Dar es Salaam (BSc with Geology, 2014) Currently working as GIS analyst and farm technologist at green agriculture and environment ltd, collecting and analyses all GIS data for the case of monitoring and managing crops at the farm.

Apart from being GIS analyst, also known as a GIS and Database specialist, has acquired competency in geographical information system in any sector and geology field, through using knowledge of geology, GIS and computer programming skills, I am capable in collecting and interpreting geographical data for specific purposes. Development specialist with experience in designing interfaces, managing, and providing support to project teams, I specialize in designing survey instruments using ODK and GPS as well as data cleaning, analysis and reporting using GIS software including commercial and free package and advanced features in Microsoft Excel.

Assistant Instructors



ISAYA IPYANA Biology Group Assistant Instructor

Issaya has earned a Certificate of Secondary Education and Advanced Certificate of secondary Education at PUGU HIGH SCHOOL majored PCB (Physics, Chemistry and Biology) as well as gained a certificate of achievement and Recognition in the STEM (Science, Technology, Engineering and Mathematics) Boot Camps. Being a hardworking and well rounded educator Issaya utilizes his extensive experience, collaborative nature and innovative skills he works closely as programs assistant with Projekt Inspire's portal called RISING STEAM STARS a Program for Pre primary and Primary schools students.



GRACIOUS FANUEL Engineering Group Assistant Instructor

Gracious fanuel, a technological innovator from Kilimanjaro region in Tanzania acquired his high school education in Physics Chemistry and Mathematics at Ilboru high school. In the second S.T.E.M youth bootcamp he managed to successfully invent a humanoid robot with different capabilities and won an extraordinary certificate and had national and international recognition where by he got a grand innovation award from Africa Moja youth society and Innovation in action.



PRAISE DANIEL MATHEW Assistant Instructor Science Class.

Praise Daniel Mathew is currently pursuing his Diploma in Medical Laboratory at KicCHAS in Tanzania, Praise is a positive thinker, God fearer, inspiration speaker and a decent young man who has passion in revolving Africa into a great continent. Praise has participated in various conference, programmes and competition nationally, however he also participate the 3 SYBC and manage to be the 1st winner of the competition with project titled "Environment conservation and health entreatment through avocado seeds". He is committed to teamwork, social-economic activates. additionally he a children, youth, girls and women activist. He is the founder and C.E.O of Inspire Afrika a non government organization that serves the African community



GIBSON KAWAGO

Assistant Instructor - Technology Class

Gibson is an electrical and electronics enthusiast who has been using local and advanced technologies in solving problems in societies. As a young, sheer willed, focused man with various technological innovations, he has been focusing on villages and rural areas where he had experienced hardships and problems in his childhood`s life, and took this as a motivation towards his goals.

He is currently an Electrical Engineering student at Dar Es Salaam Institute of Technology and an Innovator and instructor at ProjeKt Inspire.

He has been working with ProjeKt Inspire since March 2016 with over Two years experience in teaching STEM Education to children, and preparing STEM based experiments and curriculums.

Gibson has succeeded to come up with several innovations.

He made a solar mobile charger in 2016 that could charge mobile phones, which became number one product in his own village at Iringa.

He made a card controlled solar water pump that could pump and deliver water from wells with a card as a security control which was installed at Bagamoyo.

He also has designed a card access control for rental houses that allows only allowed personnel to access the common gate. This system has really helped people from key losses and replication which increased theft cases.

“The road makes the road to the man who knows where he is going”



ELIZABETH J. MWANG'ONDA

Assistant Instructor - Engineering class.

Elizabeth James Mwang'onda is Young Tanzanian girl she is pursuing her diploma in Water and Sanitation engineering. Being a versatile student she was awarded a certificate of achievements in Physics and Mathematics at Bwiru girls high school. Due to her collaborative and cooperative nature she is now assistant instructor of their Engineering Class.



MADAM SYLVIA G. RUAMBO

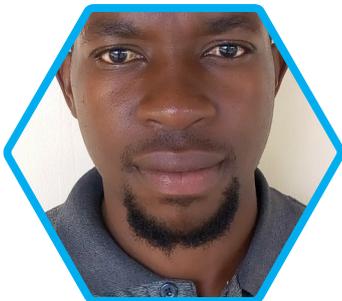
Matron

Sylvia is a special educationist who holds a Masters degree in Education Management and Planning (MEMP) and a Bachelor of education special needs (BEdSN). Sylvia has been a Projekt Inspire STEM Boot Camp matron since its onset and is currently working with Share Tanzania, a Non Governmental Organization that deals with vulnerable children in Kilimanjaro.

Sylvia is a child advocacy who speaks out in the best interests of children, especially vulnerable children. She was nominated as a top 10 influential teachers in Tanzania and became No. 1 best care giver 2018 (UNESCO & HIMT Awards).

Sylvia is also an environmental activist. She became the 2nd winner in the Quarry Life Award 2018 through her project "Bringing Life to Quarry Biodiversity, Connecting Quarry, Schools and Community to Nature". She believes that when young people learn science, they can use their skills and knowledge to address the agricultural challenges. This is possible when they are actively engaged in STEM, under Projekt Inspire, a home for innovation and creativity!

As a feminist, Sylvia believes that when female students are empowered, in STEM, their overall performance in STEM will be improved. PI empowers female students. PI, a mile stone towards Tanzania's industrial economy!



OLIVER KATEMBO

Patron

He is a graduate of Bachelor of Arts With Education (Geography) Obtained from St. Augustine University of Tanzania. He is currently a teacher at Mwabaluhi Secondary School teaching Geography and helping in English Department.

He is an Environmental activist acting as a regional coordinator Roots & Shoots and helping Children in Pastoralist Communities to Discover their potentials as future leaders.

His aspiration to the community goes hand in hand through nature conservation and Conservation. He believes towards sustainable Environment for all living Creatures.*

Sponsors & Supporters

- British High Commission
- HDIF (Human Development Innovation Fund)
- St. Joseph University in Tanzania (SJUIT)
- NABAKI Afrika
- Africa Proper Education Network (APE)
- Lahmeyer
- Ifakara Health Institute (IHI)



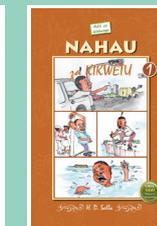
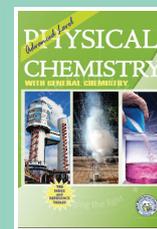
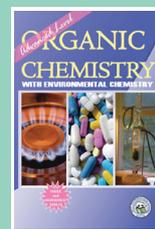
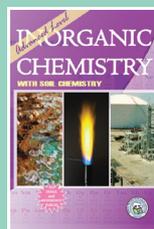
CLASSES





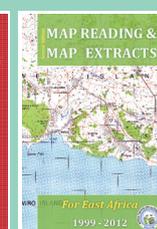
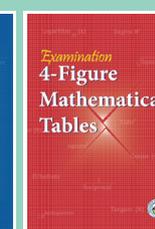
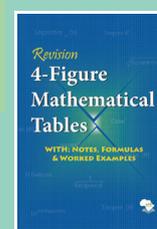
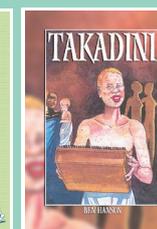
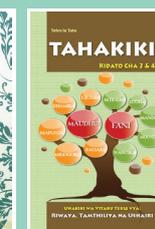
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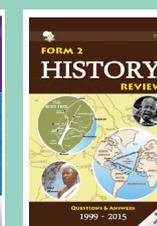
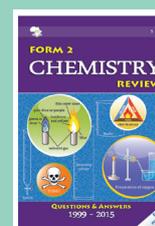
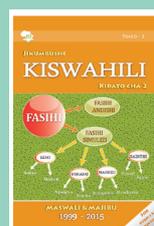
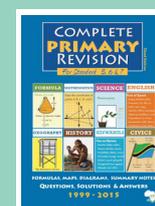
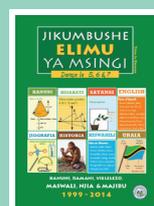


Our Publications

To date, we have published 72 books and co-published over 10 books. Together, our publications range from revision books to Kiswahili literature books which have for the past ten years, supported over 10 million students across East Africa.

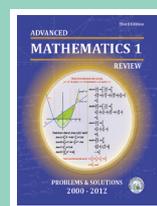
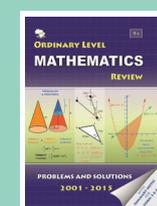
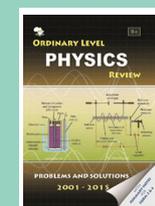
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S.T.E.M Angels



Dr. Madoka Ohashi

Obstetrics and gynecology specialist from Tokyo, Japan who has been a STEM angel for ProjeKt Inspire since the beginning.



Ms. Jody Davis

Ms. Jody Davis - Aeronautic Engineer at NASA Goddard Washington DC. She conducted a crowdfunding to support STEM Bootcamp Participant from remote areas.



Edify Technologies

Edify Technologies develops music applications with the mission to give every kid in the world a chance to make their own music



Social Action Trust Fund (SATF)

Social Action Trust Fund (SATF) is registered under the Trustee's Incorporation Ordinance. The Trust commenced its activities in April 1998. SATF is dedicated to supporting Most Vulnerable Children(MVC) and to address the impact resulted by HIV and AIDS and poverty in Tanzania. This is achieved through provision of grants to NGOs, FBOs and CBOs registered in Tanzania.

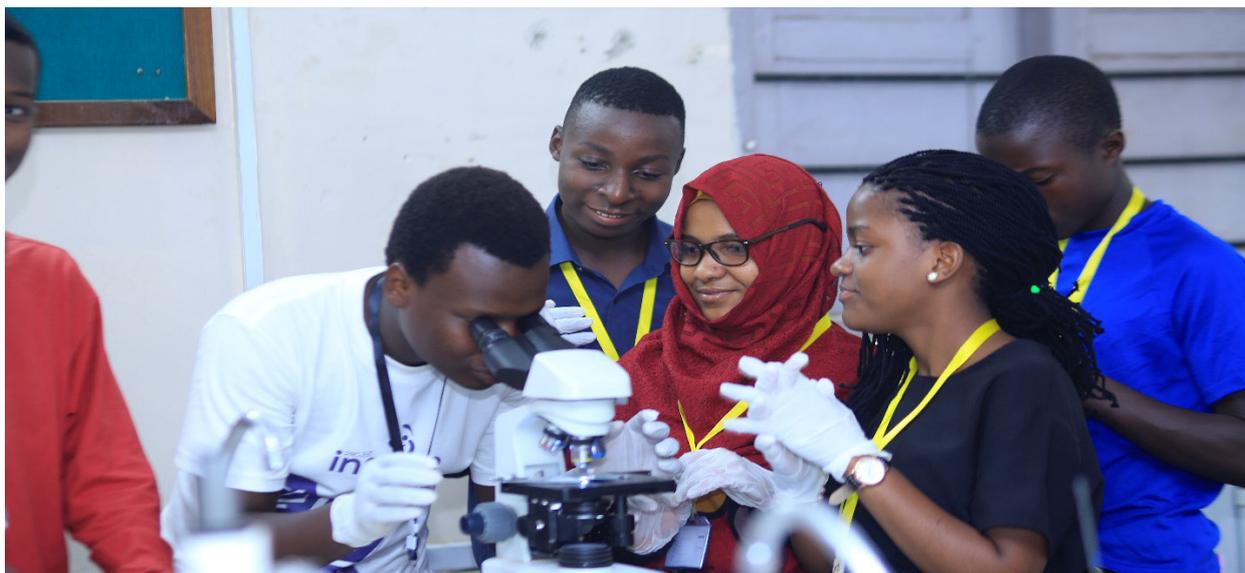
Summary of Activities

Farming is all about decisions, and improving the quality of the information available can make a big difference not just to the yield but, crucially, to the profitability. Decision support is the theme of Smart Agriculture, which is the use of technology in agriculture with the aim of improving yield, efficiency, and profitability.

All STEM projects worked with different elements of this theme by involving students in hand-on learning activities. In the followings, STEM class activities and results are summarized.

A

SCIENCE GROUP PROJECT: ANALYSIS OF CHEMICAL, BIOLOGICAL AND PHYSICAL PROPERTIES OF SOIL.



OBJECTIVES

- Introducing students to field and laboratory scientific research methods in soil field.
- Apply Science knowledge in assessing soil contents and make connections between the acquired theories from school to practice.
- Conduct field studies and collect Soil samples to prepare and perform physical, chemical and biological testing of the soil samples from various location
- Comparative analysis of Soil's data available from readings to what obtained in our practical and conclude the difference from our hypothesis.

ACTIVITIES

Field activities

Students will observe the area of interest to analyze the physical aspect of the soil ,the moisture content ,the types of plants that are grown in the area and the appearance of the leaves and the thickness of the stems. The students will collect the soil and leaf samples for analysis in the laboratory.

Laboratory activities

The science class will examine physical and chemical composition of the soil. They will analyze the ionization in the soil, the cations exchange capacity in different soil samples, the physical appearance of the plants in relation to its chemical content and with that conclude on the healthiness of the soil.

Observes different worms and other living microscopic organism found in the soil which plays a role in the fertility of the soil.

Microscopic observation of different plant parts and biological flows of nutrients (ions) from roots to leaves.

Data analysis

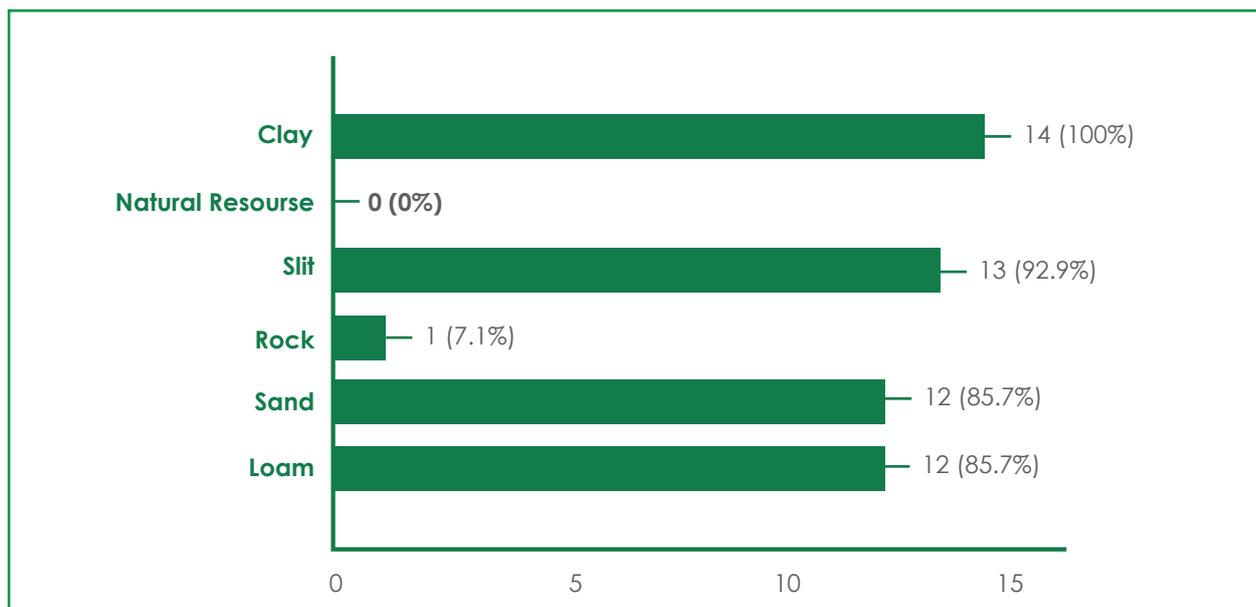
Based on the data collected, students will have a chance to perform statistical analysis of their data to determine if the data support their hypothesis, expectations and the actual states of both microscopic and naked eye made observations and if not, then commenting on suit.

They will also be required to use available literature to explain the data trends they observe.

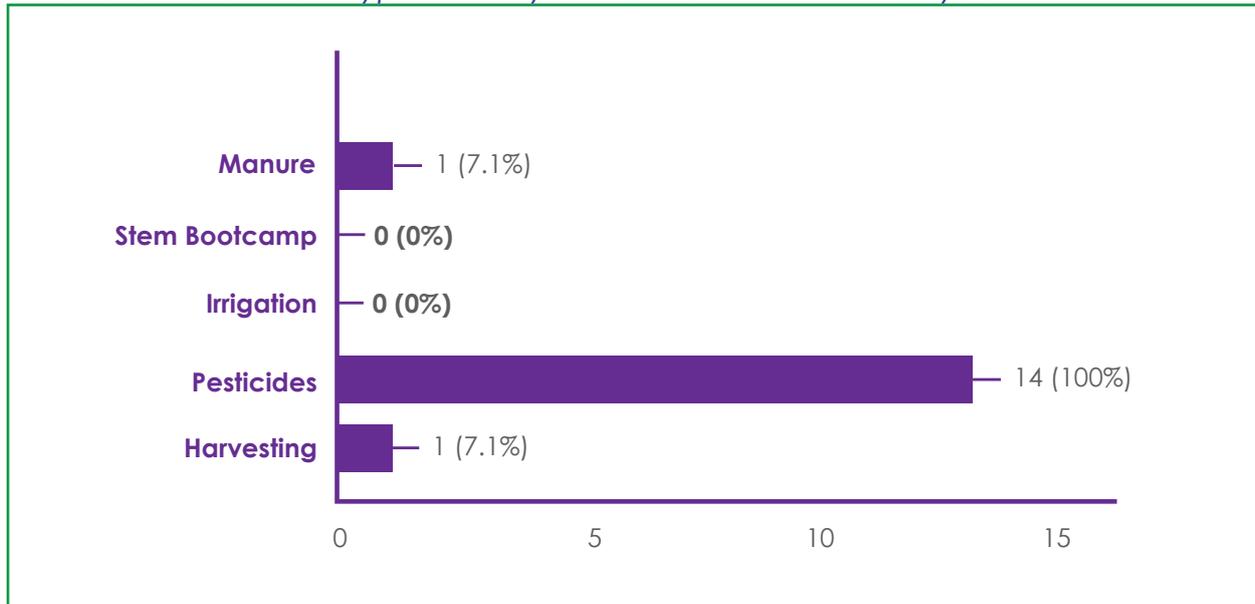
Results

Evaluation data

Majority of students were able to understand and distinguish different types of soil for agricultural practices.

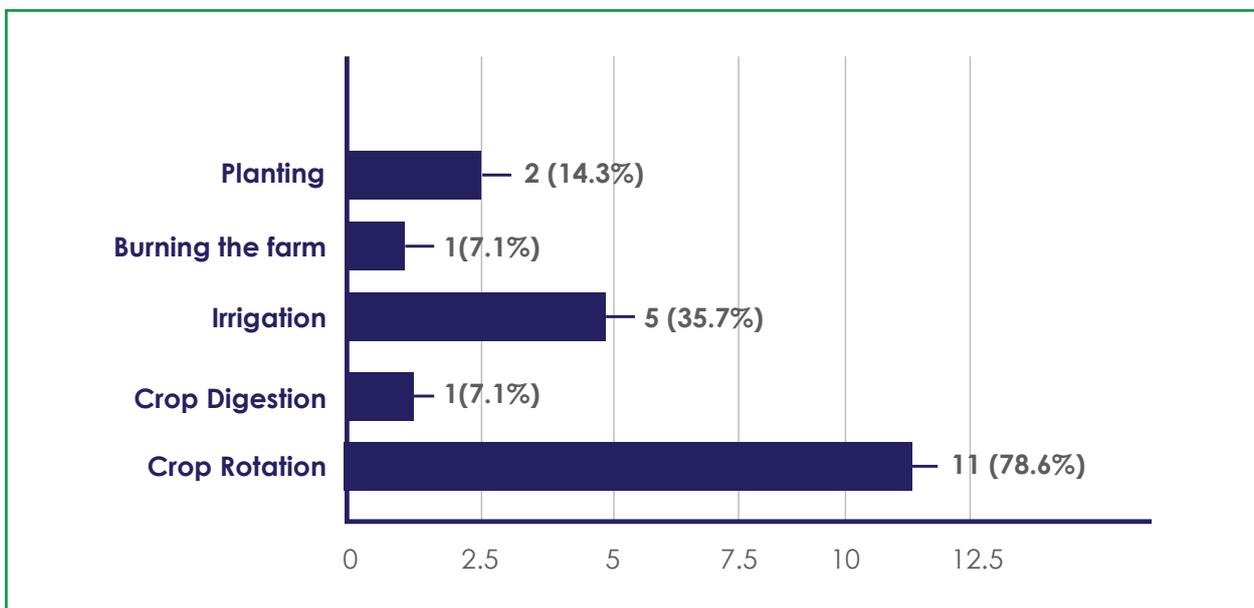


What are the different types of soil you know of? Tick the ones you know.



How to eliminate harmful organisms from the soil by ... (tick the correct ones)

In total of 14 responses, 100% were correctly responded although few responded to other incorrectly.



Preservation of necessary living organisms in the soil.

About 78.6% of students were able to understand ways of preserving soil organisms. Generally, 93% of students were very satisfied with the science class.

B

TECHNOLOGY GROUP PROJECT: AUTOMATION OF IRRIGATION SYSTEM

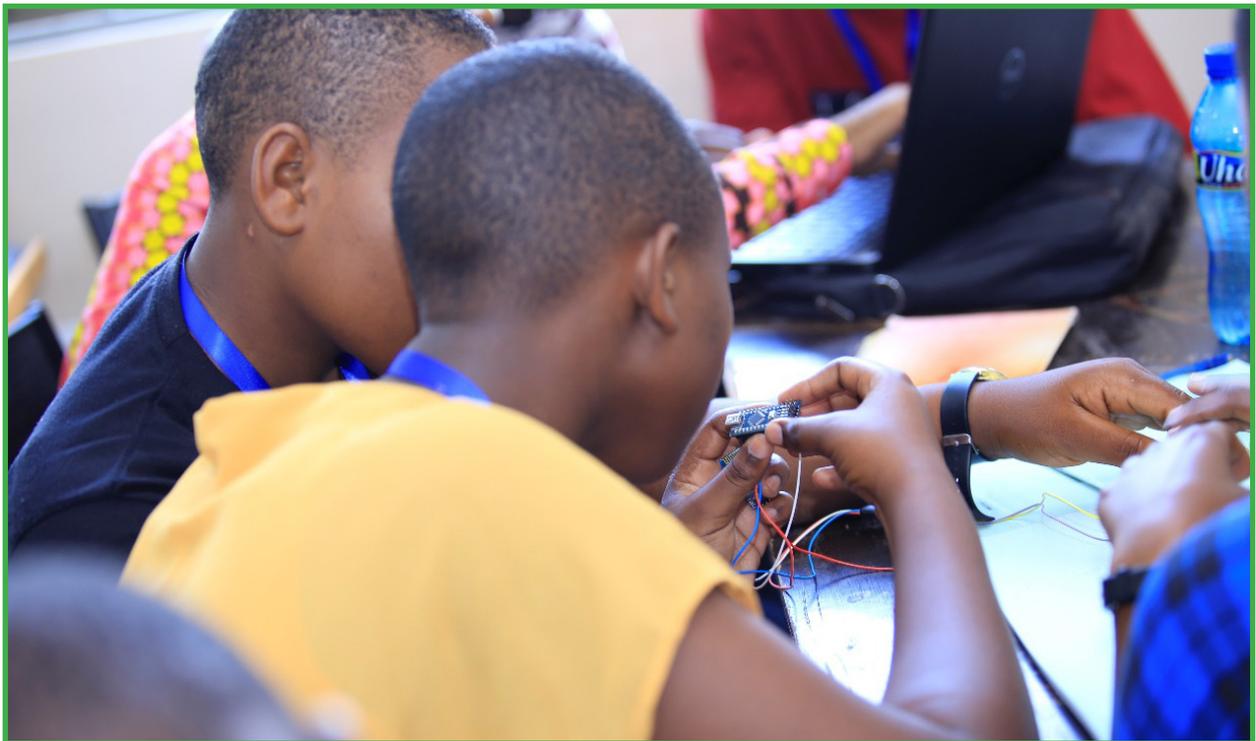
OBJECTIVES:

- Students learn about android app development using emerging technologies (React Native)
- Student learn about the application of Arduino and how it interfaces with sensors
- Student learn on how they can interface the Bluetooth sensor and Arduino micro-controller
- Demonstrate to students on how they can interface the Arduino to the Android App.
- Students are introduced to NodeJS server platform to collect and store the data for future analysis

ACTIVITIES

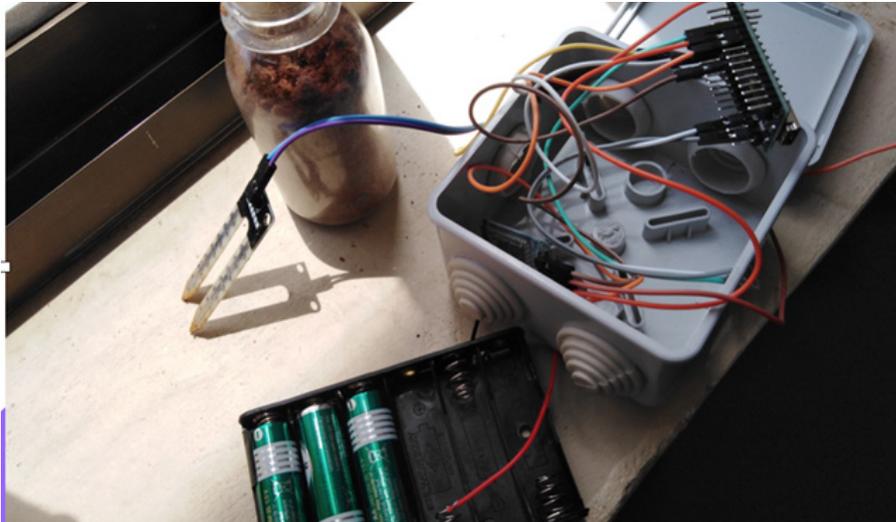
In technology class, the students were divided into 3 groups depending on their existing level of understanding of computers, arduino and programming. The 3 groups were the Sensor group (8 students), App group (6 students) and server group (3 students). 2 students were then chosen to act as overseers of the learning and development of the projects, and also as links between the 3 groups.

In the sensor group, students learnt about the Arduino, what its function is, how it can be interfaced with a soil moisture sensor and a Bluetooth module, and how to code the program to run it. In the app group, the students were expected to have some basic experience with programming and they learnt about designing a user interface, setting up react native environment, creating a basic app with clickable buttons and finally receiving data using the in-built bluetooth module. In addition, students were tasked with designing and drawing out a User Interface and were taught on how to install the react native environment in a windows computer. Lastly, they came up with android app that read and display values from a paired bluetooth device and send data to a server address. The server group were taught on how to install the necessary tools. Again, there was a field visit where the sensor group was able to integrate the soil moisture sensor with a solar water pump that was designed by engineering class then taught on how to receive data and partially store it in the application for future consumption. Finally, the sensor was then packaged into an IP67 casing.



RESULTS

We had a very diverse group of students with 5 students who had not interacted with technology before and 11 students who were very comfortable with technology. Hence, the grouping was great since every person got an opportunity to learn something new.

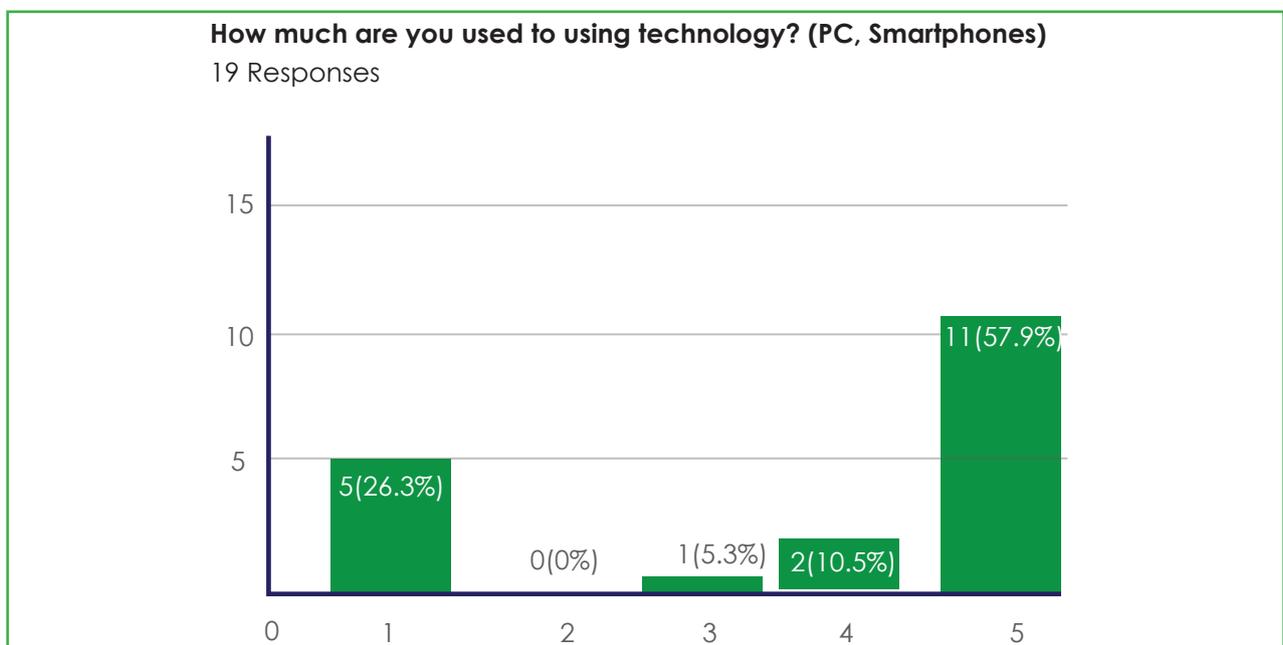


The soil moisture sensor



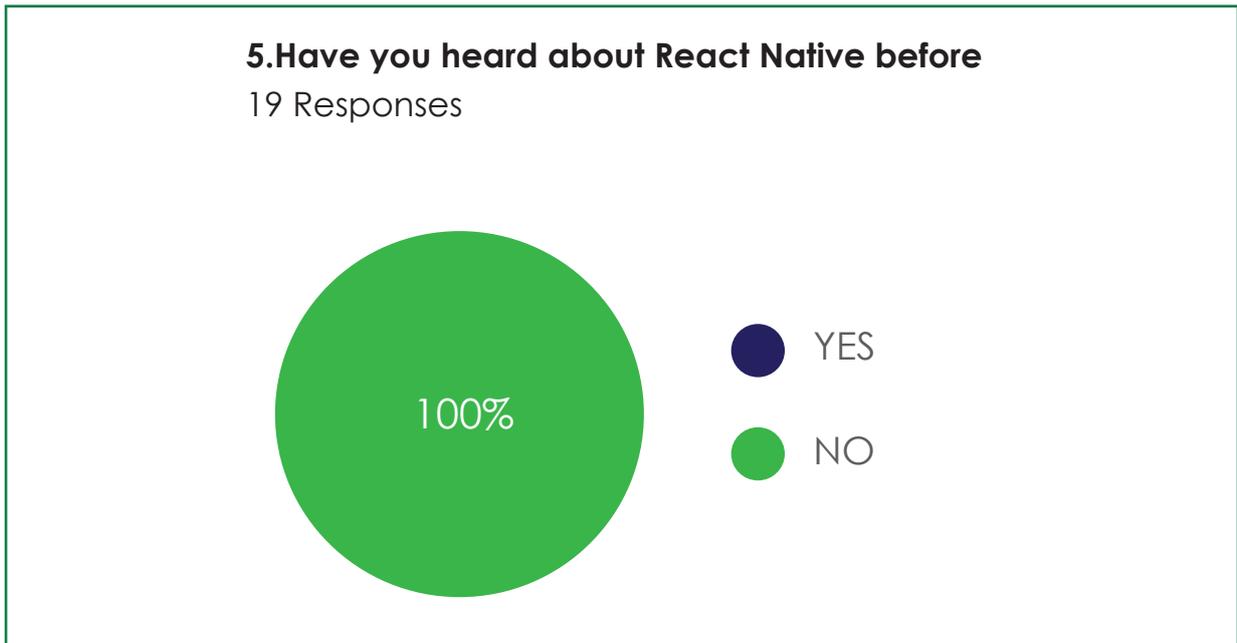
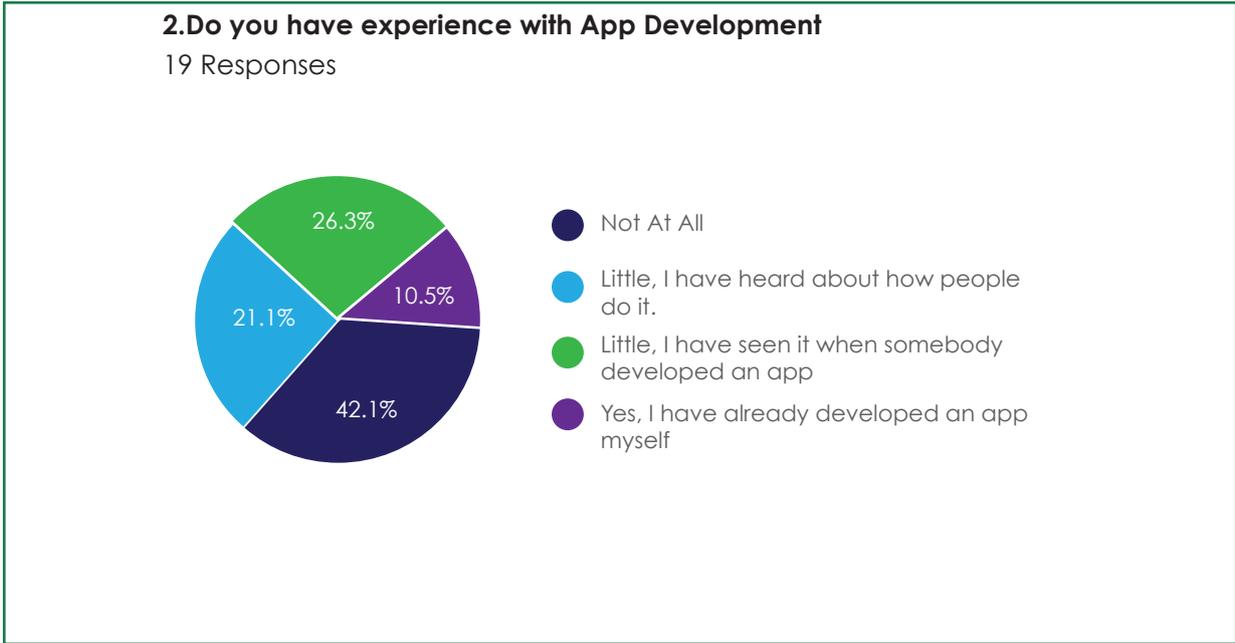
The android app

EVALUATION DATA



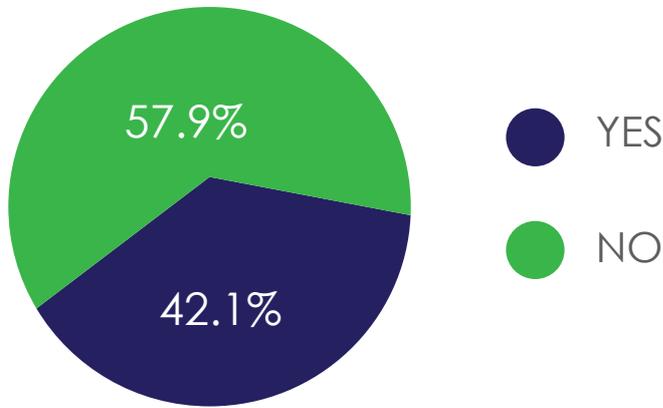
In the class only 2 people had created an app prior, with the majority having little to no experience. Although only 8 students immersed themselves in the app creation process, everyone in the class had witnessed how the app development process worked.

Hence moving the 63.2% of students to the yellow bracket of the graph below.



None of the students had heard about React Native before the boot camp, however on the end line evaluation, 90% of the responses correctly identified the steps needed to create a React Native based application. Before the boot camp 57.9% didn't know about the Arduino microcontroller, 63.6% of responses taken from the sensor group were able to correctly identify steps of making the Arduino soil moisture sensor. Most of students in this group had this class as their first time interacting with an Arduino.

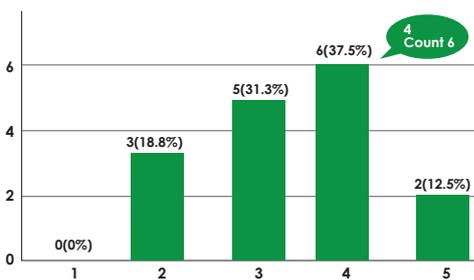
6.HAVE you had experience with an Arduino before the bootcamp
19 Responses



Students found the class to be moderately demanding and difficult regardless of the new concepts that were introduced to them in a short period of time. The overall satisfaction rate was high with challenges pointed out generally towards the little time we had to cover the concepts which brings up the usual debate on how to balance utility vs wow factor vs diversity of past experience among students.

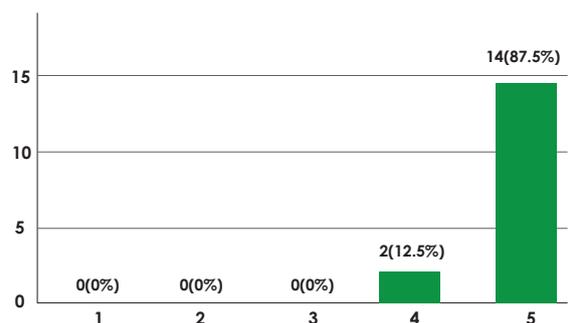
10.All in all, how difficult/demanding did you find the class

16 Responses



11.All in all, how did you like the Class

16 Responses



OBJECTIVES

- Students develop a basic, practical understanding of irrigation concepts, techniques, and its applications.
- Students learn how to calculate water efficiency on the field
- Students learn how to create an Automated irrigation system

ACTIVITIES

The students were introduced to irrigation farming systems through the aid of videos and photographs displayed on a PowerPoint model, they could see what exactly was happening in the sites and how exactly irrigation is done in farms. Thereafter, they provided with all materials and equipment for irrigation pump to correctly function. With the help of instructors, students were successfully able to assemble the solar powered water pump and integrated with the sensors (soil moisture) which programmed from the technology class for automation irrigation system based on water content required by a plant in the soil.

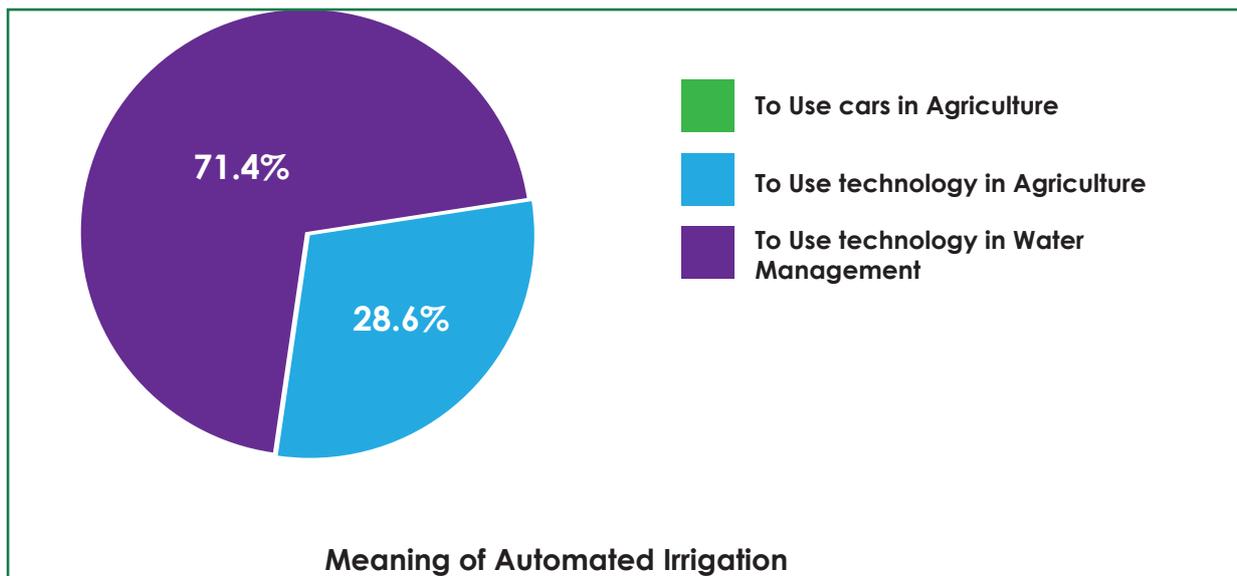




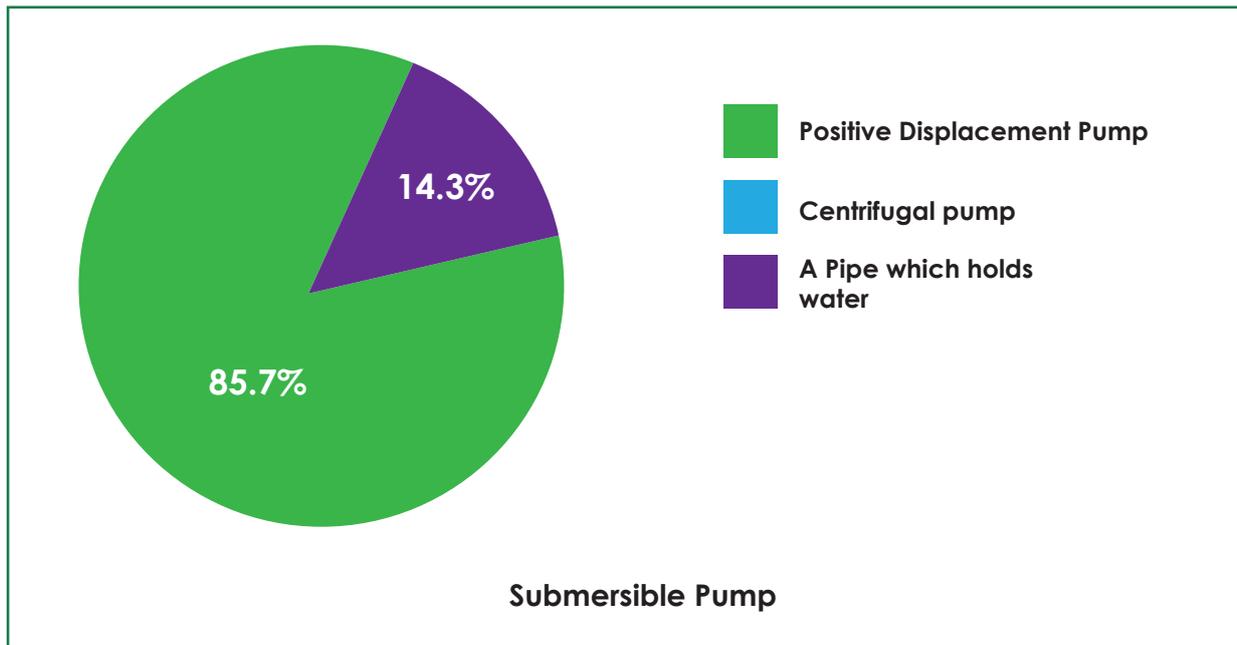
RESULTS

At the end of the training sessions of the boot camp students were able to build an automated solar powered water pump, the system which is very practical to them, many of them promised to go and try implementing at home whenever possible.

EVALUATION DATA



After the camp, more than 71% of participants were able to navigate meanings of automation in irrigation agriculture.



About 86% of students were able to understand the equipment and assembly of machines for irrigation systems.

D

ENGINEERING CLASS (B) PROJECT: OIL AND IRRIGATION MAPPING AND MANAGEMENT INTRODUCTION

INTRODUCTION

Introduction to the agricultural mapping that is day by day becoming crucial for monitoring and management of soil and irrigation of farmlands. 10 student attended this class analyzing soil data combined with historical farming practices in determining what the best crops to plant, are where they should go, and how to maintain soil nutrient levels to best benefit the plants. This class were able to develop the analyzed maps for future agriculture decision used by the farmer, agriculture officers, researcher, scientist and governments.

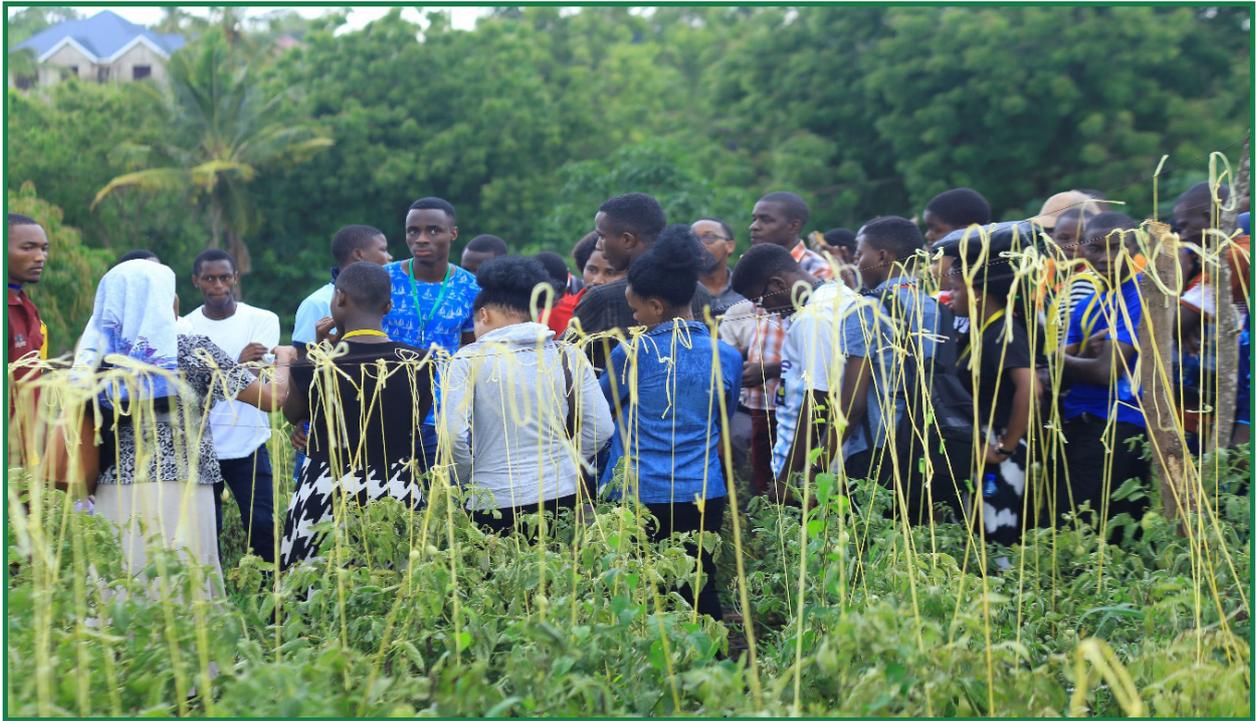
OBJECTIVES

- Students develop a basic, practical understanding of GIS concepts, techniques, and real-world applications.
- Students learn how to collect data using GPS
- Students learn how to analyze and visualize soil data with the aid of GIS techniques

ACTIVITIES

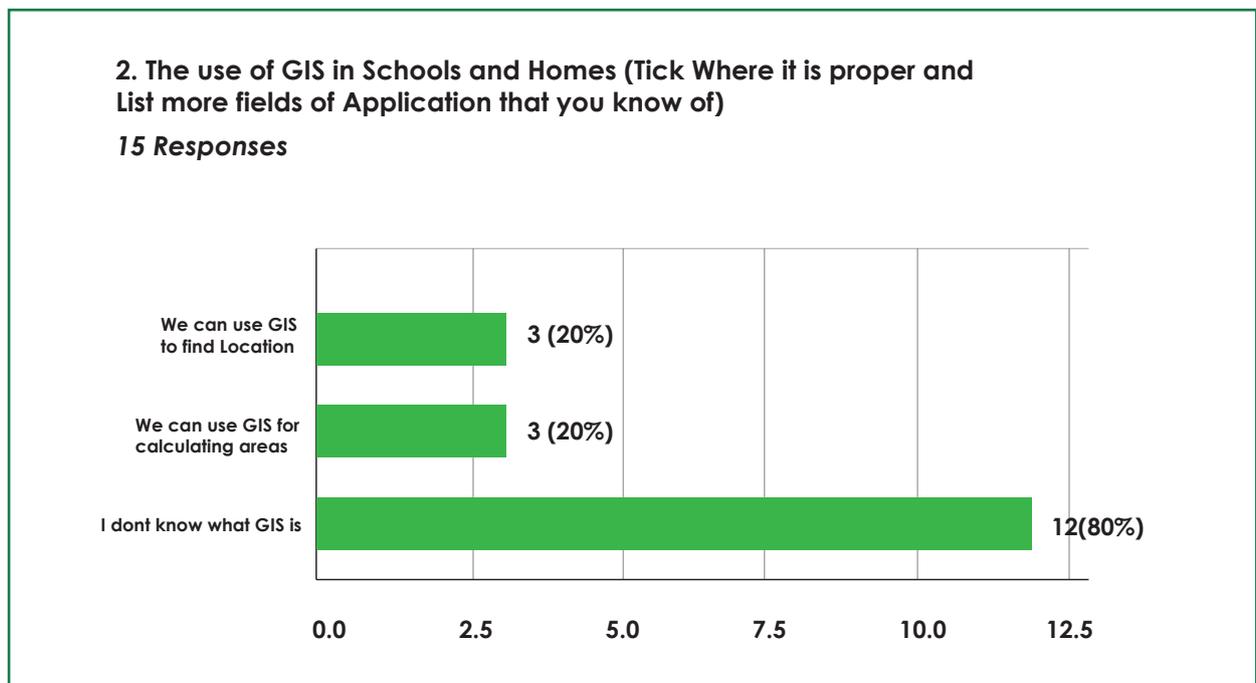
Class activities included students introduced to GIS and its application in agriculture as well as mapping concepts and simple soil analysis mapping using QGIS 3.2.3 desktop application. Students collected field data by using GPSmap 62s (GARMIN). During fieldwork, students managed to identify and record smart farms location (Longitude and Latitude) used in training by using Geographical Position System devices called GPS map 62s (GARMIN). They also took soil sample and other climate and demographic information that were used for geospatial analysis at the computer lab. Finally, during computer laboratory activities, students were taught the use of QGIS 3.2.3 desktop application and they were able to analyze the collected data and created final maps.



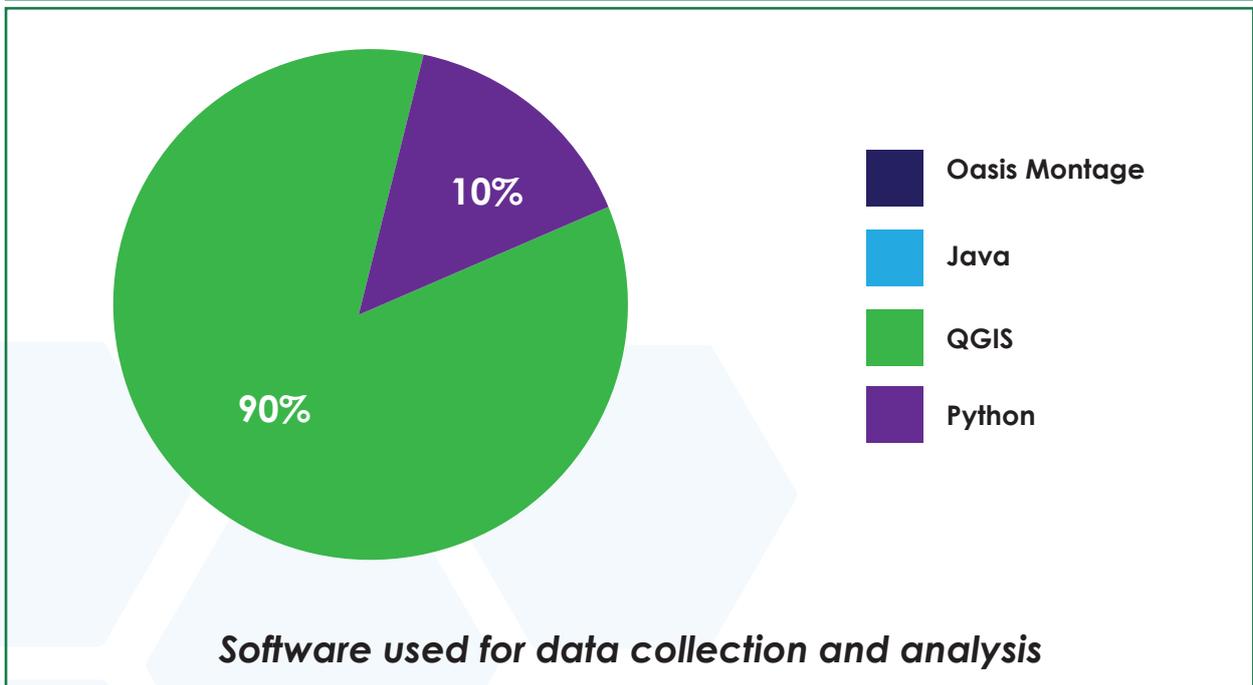
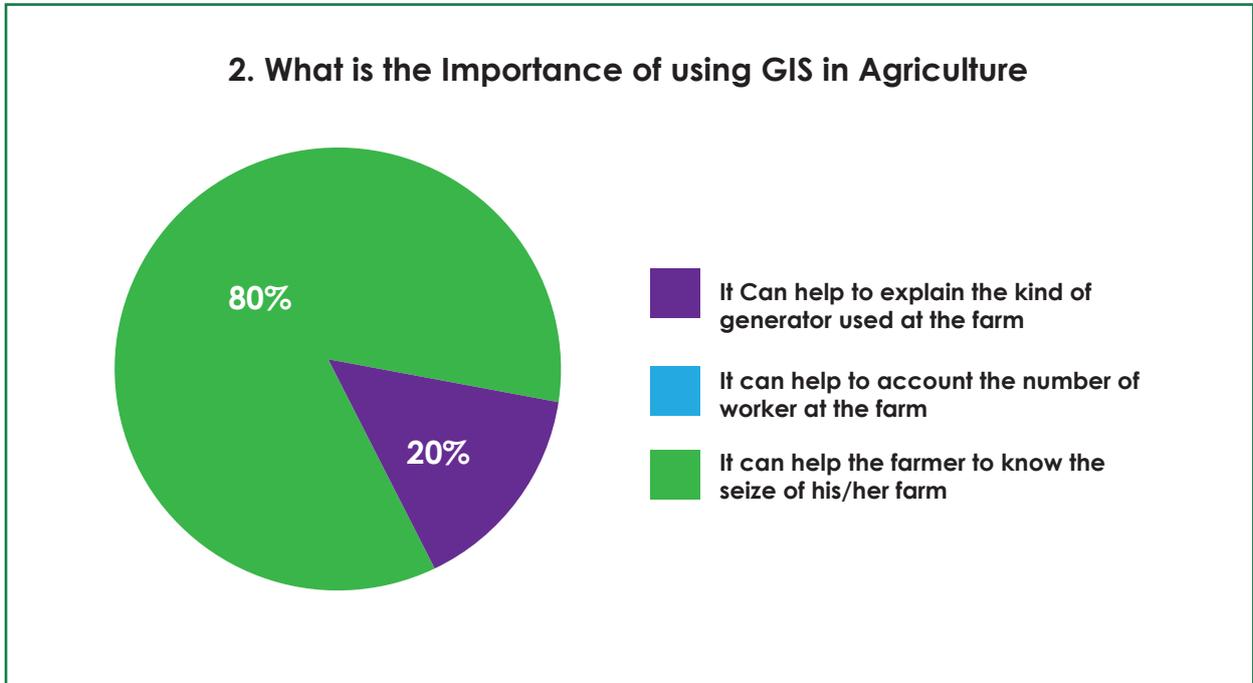


RESULTS

Before the boot camp, 80% of students did not have any previous experience with GIS. Only few could answer the question on its use.



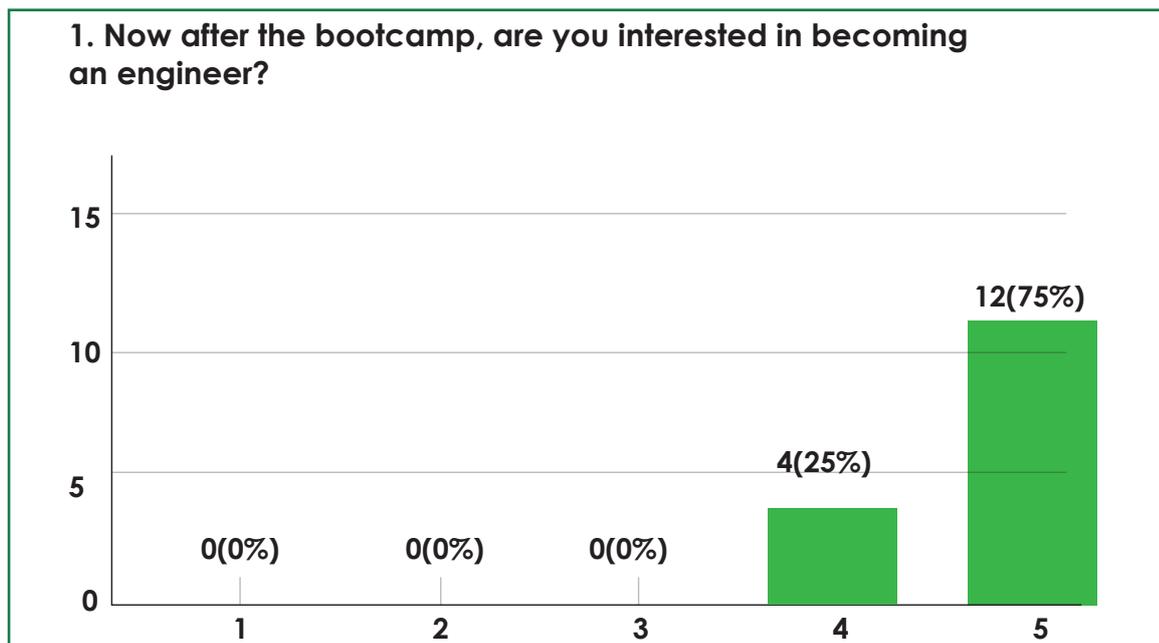
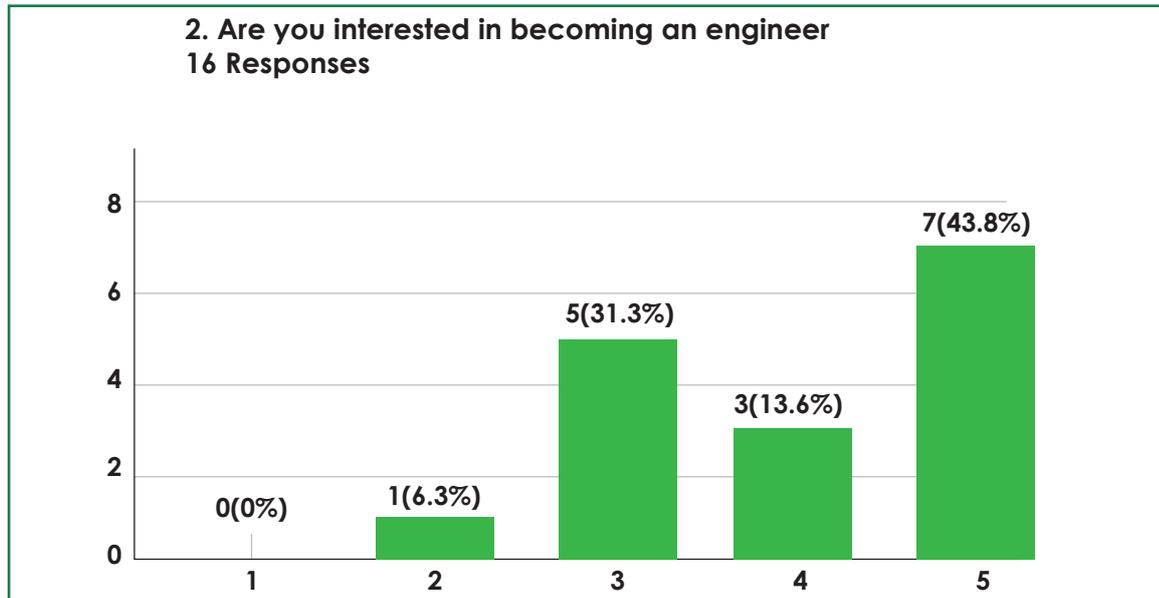
In comparison, by the end of the boot camp, all students could explain at least one way of using GIS in schools and homes, and a third of them could list even several applications. 80% of the student responded correctly to the question about the importance of using GIS in agriculture.



90% of Class B students were able to identify the software used for data collection and analysis. After participating at the class, 80% of students showed high interest in learning more about GIS in the future.

EVALUATION DATA

Engineering classes lead to increased interest in engineering as a potential career.



Interest in engineering before and after the boot camp.
In sum, 93% of the participants were very satisfied with the engineering class.

INTRODUCTION

The mathematics class is one of the integral part of the theme in the boot camp, where they dealt with data analysis of the soil properties that was experimented by the science class. The objective of this class is to make the students understand the basics of statistics and create a mathematical model for any two soil related parameters that will be measured from the science class. This was meant to be a statistical graphing activity where students gain understanding of data collection and presentation techniques and how an equation can be used to accurately predict the behavior of a physical property.

OBJECTIVES:

- Students should understand the meaning of statistics and its application.
- Students should be able to collect and present data using any of the data presentation techniques (graphical and tabular)
- Students should understand the meaning of a linear regression model and how to create it.
- Students should practice and understand one statistics software (r-studio).
- To inspire students find mathematics interesting, easy and fun.

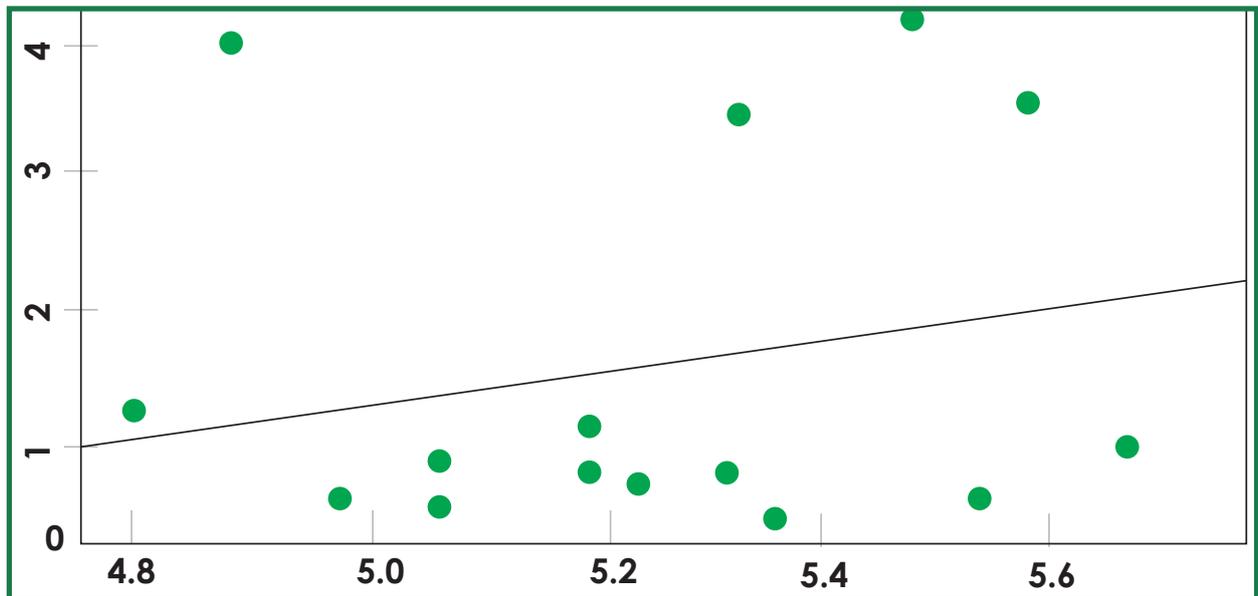
ACTIVITIES

Students were first introduced to statistic and its applications. Then students learnt about measures of central tendencies, measures of variability and an introduction to correlation and regression analysis. Thereafter, they had field visit to the greenhouse and smart farms where they deal with horticulture. The objective of the field visit to get a feel and knowledge of how modern agriculture is done, as well as to observe the scientific activities done by the other classes since they were to use the data from the science experiments for analysis. Furthermore, students learnt correlation and linear regression. Then they practiced some examples and later learnt to use r-studio software repeating similar examples as exercises. Lastly, final analysis and creation of linear regression model was completed relating to Magnesium element to soil pH.



RESULTS

The end results for the class was to produce a regression model showing the linear relationship between Magnesium element content in the soil and the respective pH levels. This model would suggest the strength of the relationship as well as help in forecasting the element content in the surrounding areas for future farming. The following are the scatterplot, correlation coefficient and the linear regression model of the two said parameters.



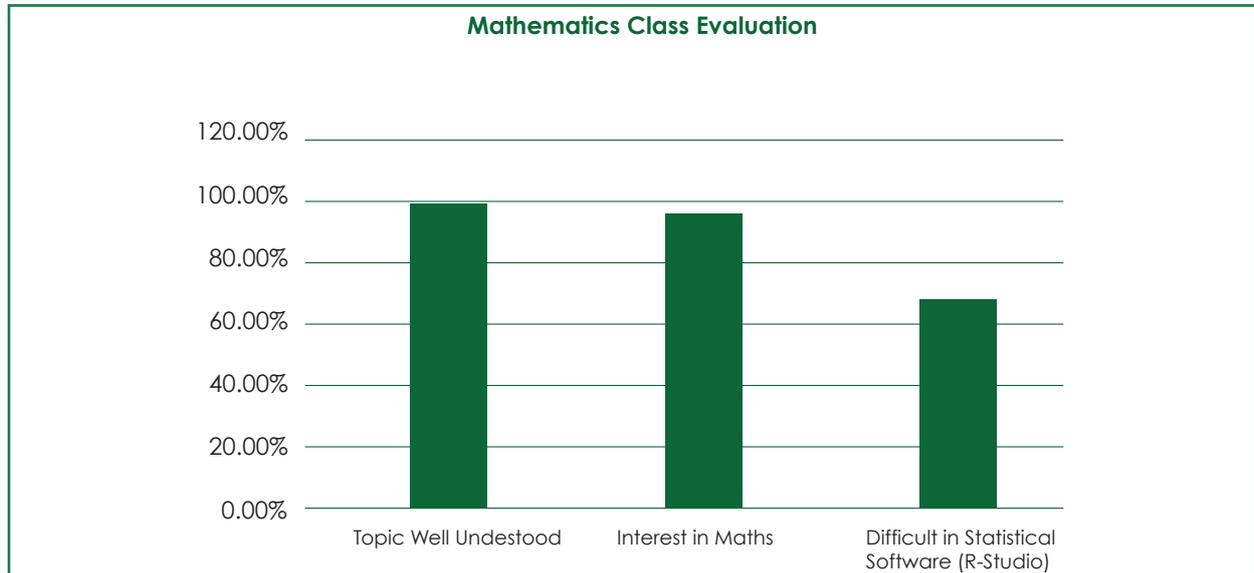
Correlation coefficient = 0.178

(An indication of a weak relationship as it approaches 0)

Linear model: $Mg = 1.15pH - 4.417$

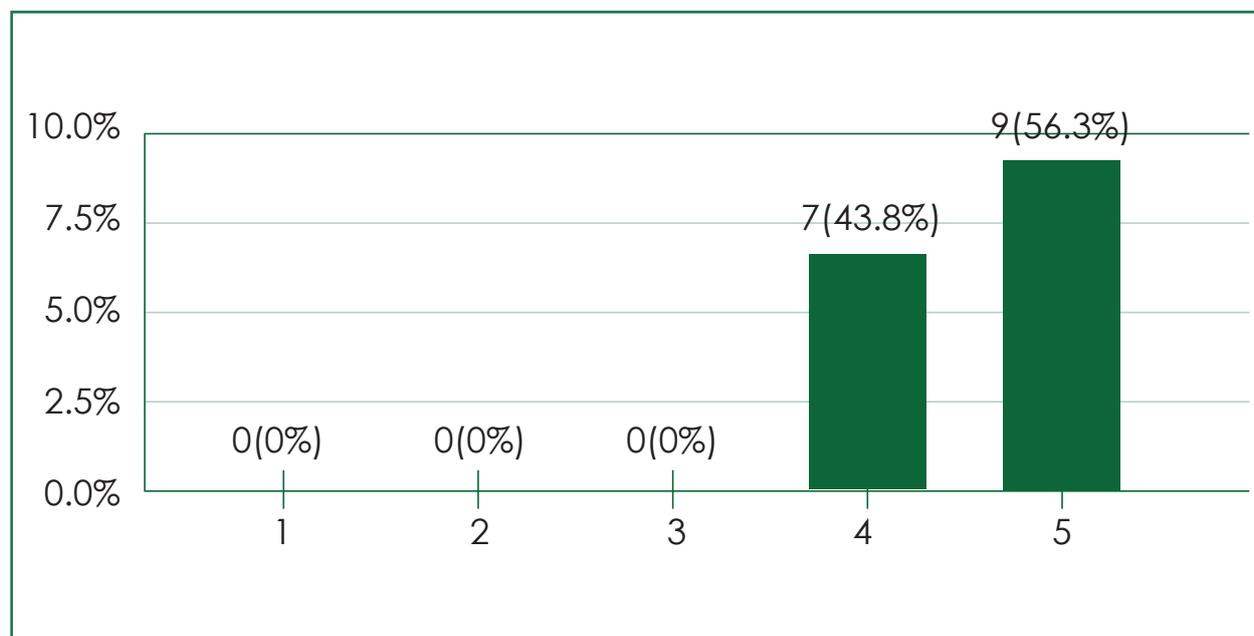
EVALUATION DATA

Two evaluation surveys were conducted, a baseline and an endline, to measure if the objectives were for the class met.



The above data has been derived from all 18 students for Mathematics class.

At the end of the boot camp, 100% of students answered correctly questions about the meaning and use of statistics, compared to 87% before the boot camp. The majority of students showed also good understanding of data collection methods and the meaning of linear regression model. Students also report that they think statistics will be quite useful for them in the future.



Useful do you think the statistics software will be for you in the future

By the end of the boot camp, 94% of student report increased interest in mathematics.

F

LIFE SKILLS TRAINING SESSIONS: CAREER GUIDANCE, DESIGN THINKING, PITCHING AND PUBLIC SPEAKING

INTRODUCTION TO CAREER GUIDANCE AND INSPIRATIONAL SPEECHES

One of the objectives of the boot camp was to support the students in making informed career choices and to broaden their perspectives of what is possible to achieve especially in STEM related fields. At this boot camp, we had several young professionals from aerospace engineering, architectural science, civil engineering who came to inspire the students and share their own career related experiences. One of the speakers was Moses Browne Mwakyanjala who is a young Tanzanian space engineer currently pursuing his PhD in Sweden. He gave an introduction to space science and its potential for future space scientist and he inspired students to explore the diversity of opportunities within space engineering. He also shared his practical experiences with the students on which steps to take to reach their dreams and how to strive for excellence in their studies. Others speakers were two young ladies from Nabaki Afrika who inspired and motivated the students. Ms. Khadija who is a landscape architect and Ms. Beatrice who is a civil engineer spoke especially to girls and encouraged them to not look at the challenges in front of them, but to dare to aspire for different careers in STEM related fields. Both Ms. Khadija and Ms. Beatrice shared personal experiences on how they managed to pursue their career dreams in a male dominated field like engineering and how girls can make a difference in these fields.

RESULTS

Inspirational speeches supported the students in making their own career plans that will help them to reach their dreams. For this purpose, students were introduced to a strength-based career-planning tool called the Roadmap that helps them in identifying their dreams, their strength that they can build on, the milestones and the smaller steps leading to their dreams. During the roadmap sessions, the students were challenged to think holistically about their future, to realize the community challenges surrounding them and to see how they can contribute to solving these challenges, especially with the use of STEM. Students were engaged in group discussions, got guidance from the mentors and boot camp instructors, and by the end of the career guidance sessions, all students have developed their own roadmaps with specific and practical steps leading towards their dreams.



DESIGN THINKING, PITCHING AND PUBLIC SPEAKING

The boot camp intended also to equip students with life skills that are necessary for not only dreaming big, but also realizing these dreams, especially realizing their innovations for the benefit of the community. Firstly, students were introduced to design thinking, a process of developing meaningful ideas into real projects that aim to solve pressing problems in the society. Students learned about the importance of empathizing with the community first, then defining the problem, then generating ideas to solve the problem, prototyping and then testing. This session intended to improve their problem solving and creative thinking skills.



Secondly, students needed also to develop essential skills to communicate these ideas in a constructive and meaningful way that would convince investors to support them in realizing these ideas. The idea pitch workshop included the elements of designing a powerful presentation of their innovative ideas focusing on not only the product itself, but its financial plan to ensure sustainable success.





Finally, students took part in a public speaking training session where they learnt how to use the desired oral and body language to present their ideas in an understandable and convincing way. During this participatory session, students worked in pairs and practiced their short pitch several times in 1 minute where they also received direct feedback from their peers on different aspects of verbal and non-verbal communication. These sessions highly contributed to the development of students' communication skills and improved their self-confidence in speaking in front of people, which they greatly benefited from when preparing for the individual project presentations during the camp.

INDIVIDUAL INNOVATIVE PROJECTS

INTRODUCTION

Promoting the development of innovative ideas in STEM to solve community challenges was one of the priorities of this boot camp as well. Students got the opportunity to present their individual projects that they had developed before the boot camp. The individual projects competition aimed at recognizing the potential innovations that the students developed and to help them to get to the next stage to realize their innovations.

SUMMARY ACTIVITIES

Innovative projects were divided into two categories, pilot and scale up. Pilot projects refer to innovations that are at the idea phase and have not been tested yet, or their functionality have not yet been proved, but the idea shows great potential. Scale up projects refer to projects the functionality of which have already been tested by the students before presenting them at the boot camp. In total, 30 students presented their innovations in front of the panel. The judges (both internal and external) assessed the innovations and their potential in improving livelihoods and promoting sustainable development. The judges also got the chance to ask questions from the presenters to probe their ideas and get more clarification, then the judges gave constructive feedback to each presenter on what they can do to improve their innovative projects. Finally, the judges announced the winners of the idea pitch competition and the winner, the first and second runner up were then rewarded at the closing ceremony.

S/N	Full Name	Project Title	Level
1	Ojung'u Jackson	Human Waste Hair Recycling	Prototype
2	Hardness M Range	Ngozi Mosquito Net	Prototype
3	Boris Massesa	Phone Detector's For Secondary Schools	Prototype
4	Erick Sabato	Simple And Affordable Method Of Maize Cultivation	Prototype
5	Innocent Revocatus		
6	Neema Festo Magesa	Science Takers Energizer	Prototype
7	Shaymaa M. Abas	Smart Aquaponics System	Prototype
8	Sharifa H. Hamad	Rain Alarm	Prototype

9	Mulhat Hakim Mambo	Rice Harvester Machine	Prototype
10	Irene Joseph Katete	HIV Prevention	Prototype
11	Johari Salum Kassele	A Hydrogen Gas Stove	Prototype
12	Michael E. Nandi	The GPS Device To Rescue People With Albinism	Prototype
13	Gasiano Dominick	Poultry Liquid Injection Organic Fertilizer	Prototype
14	Said Hozza	Little Base Transcoder Station	Prototype
15	Neyman		
16	Jackson Egidius	Stem Club Aoo And Qr-Code Ids	Prototype
17	Joshua B.	Home Auto-Alert security System	Prototype
18	Samwel P.		
19	Rose J. Rwegasira	A Toxic Gas Detector	Prototype
20	Justine Bahati	Charcoal Refrigerator	Prototype
21	Hamisu Zubeir Hassan	Extraction Of Natural Pesticide From Lantana Camera	Prototype
22	Khudhayma Haji Hussein	Polyhouse And Drip Irrigation	Prototype
23	Zuhura Suleiman Abdallah	Smart Aeroponic System	Prototype
24	Alan Deusdedith	Environmental Simulation (Es)	Prototype
25	Clever A. Mwakipesile	How To Keep Chicken	Prototype
26	Mussa Charles	Myssa Home Assistance Artificial Intelligence	Prototype
27	Aidan Baraka Kamalang'ombe	Eco-Friendly Garden For Waste Control	Pilot
28	Neema Mwanayo	Women Empowerment	Pilot
29	Anne-Marie Malekela	Paper Collector Machine	Pilot
30	Philemon Amani	Noise Detector	Pilot
31	Essau Mukono	Bio Fuel Production for sustainable energy, environment conservation and agriculture merit	Pilot





RESULTS/WINNERS

The best prototype (scale up) projects:

In this category, the winner was Boris Massesa with a project titled phone detectors for secondary school students' technology. He was followed by the first runner-up, Justine Bahati whose project titled charcoal refrigerator and the second runner-up was Mussa Charles with project titled Myssa home assistance artificial intelligence.

THE BEST PILOT PROJECTS:

The winner in this category was Anne-Marie Malekela with a project titled paper collectormachine, followed by the first runner-up Philemon Amani who presented noise detector project. Finally, the second runner-up was Aidan Baraka Kamalang'ombe with a project titled Eco-friendly garden for waste control.

SCIENCE SLAMS COMPETITION

Science slam is science competition where young scientists explain a research project in a format that is easy to follow. The aim of the slam in the boot camp is to encourage the rising scientist in Tanzania to be aware of recent science discoveries, and be able to communicate that knowledge to their peers. The important aspect of the competition is not only the presenting the scientific outcome of their work but also to explain it in an understandable, entertaining and concise way. Students' task at the competition was presenting STEM innovation done by one of the Nobel Laureates who has been awarded the Nobel Prize in the Past 10 years.



SCIENCE SLAMS' WINNERS

The best presenter for science slams competition were Ojung'u Jackson Lizer who presented paper on the discovery of cryo-electron microscopy by Jacques Dubochet, Joachim Frank and Richard Henderson. Then, he was followed by second winner Neema Mwanayo who presented the discovery of antibody diversity generation initiated by Susumu Tonegawa. The third best in this competition was Sharifa Haji Adam who presented on the structure and function of Ribosome, a discovery done by Venkatraman Ramakrishnan.



CLOSING CEREMONY

The official closing ceremony of the 4th annual STEM boot camp was held on Friday, January 04th, 2019. For this ceremony, sponsors, supporters, representatives of government institutions and special guests were invited to celebrate the achievements of this event. Firstly, the Programme Coordinator, Mr. Masoud Mnonji provided opening remarks which was then followed by a welcome note from Chairperson of ProjekT Inspire Board of Advisory, Prof. Burton Mwamila. Later, the chief guest of honor, Mr. Marc Thayre, Head of Political, Press and Public Affairs, British High Commission, on behalf of Hon. Sarah Cooke, British High Commissioner to Tanzania, addressed the audience with encouraging words to the youth.

In addition, we had the honor of receiving representatives from various organizations such as Human Development Innovation Funds (HDIF), St. Joseph University in Tanzania, Tanzania Institute of Education (TIE), Nabaki Afrika, Social Action Trust Fund (SATF), UNESCO NATCOM, Edify technologies, Women in Agribusiness in Sub Saharan Africa Alliance, Tanzania Chapter as well as media representatives including ITV/ Radio One, the Citizens, Azam Tv, Majira Newspaper, Wapo Radio, Uhuru newspaper, Tanzania Daima, Upendo Fm, Tumaini Tv/Radio, as well as Dar Mpya blogspot. During this ceremony, students in each STEM class got the chance to present what they have learnt during the boot camp. Students were also awarded based on presentation of their own individual projects and science slams. Finally, all students were awarded certificates of participation by chief guest of honor and other respected guests.





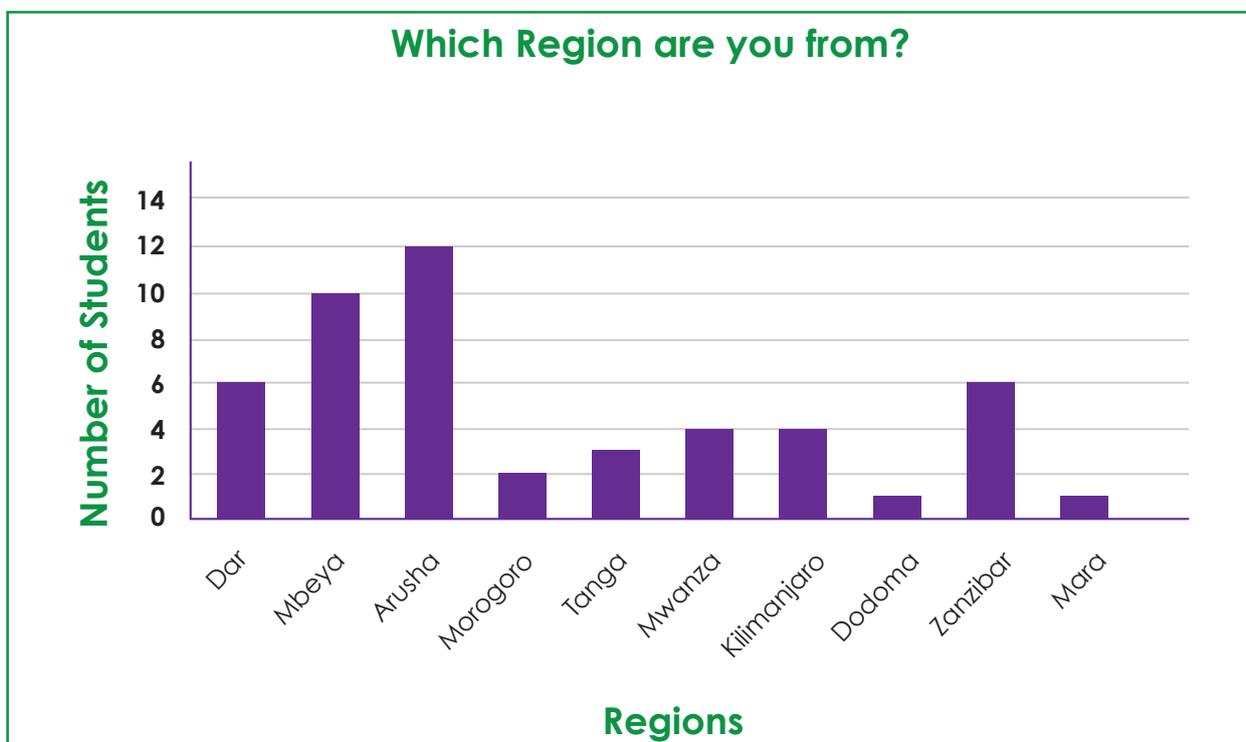
Summary of Baseline & End-line Evaluation Results

EVALUATION PURPOSE AND METHODS

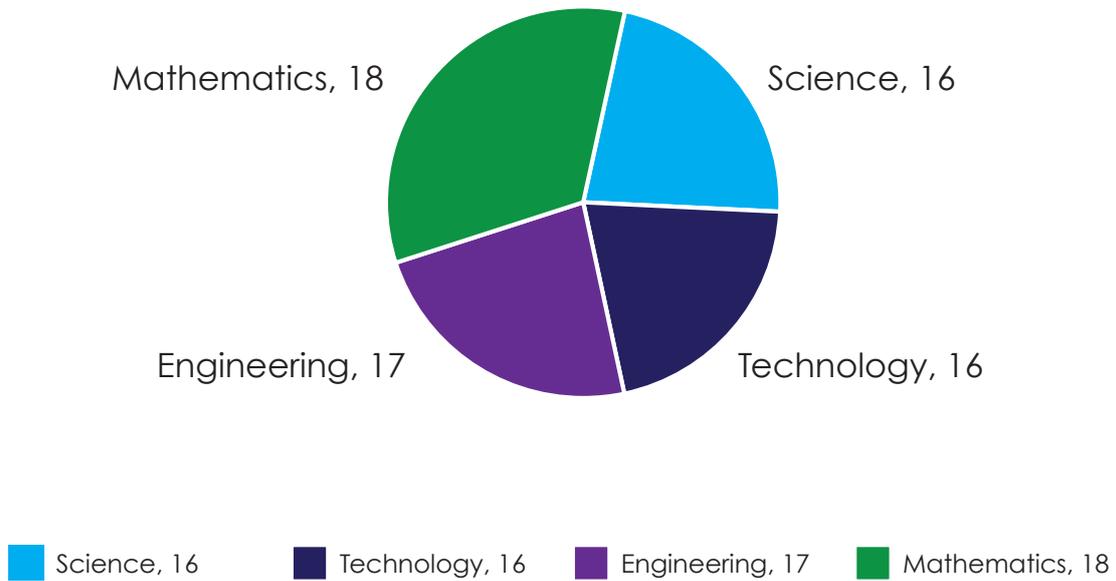
Students' learning and the overall success of the boot camp was assessed by participants completing a baseline and an end-line questionnaire. Quantitative and qualitative questions were then analysed and compared. Results are as follows.

STUDENT DEMOGRAPHICS

67 students attended the boot camp, 39 boys and 29 girls. Their age ranges between 15 to 21 years, 67% of them were between 18 and 21 years. 84% of students attend government schools and 16% private schools. Participants come from 10 different regions in Tanzania.



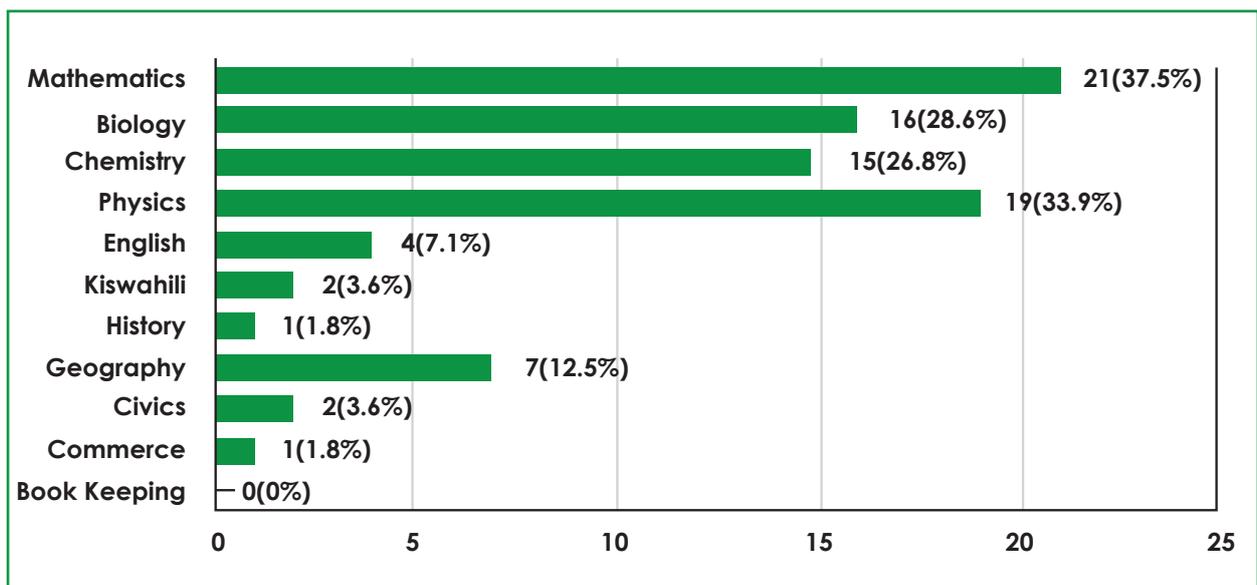
Number of Students attending STEM Classes



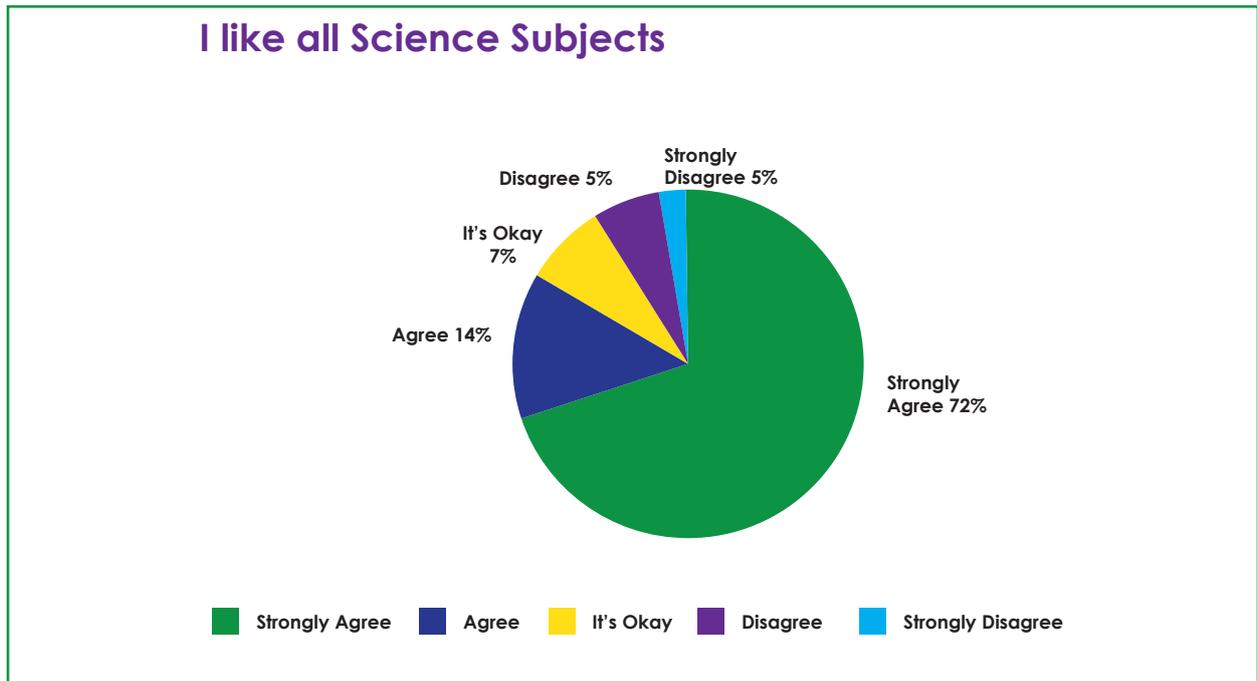
Out of 67 participants, 54 completed the baseline and 49 completed the end-line questionnaire due to technical challenges. Thus, findings cannot be generalized to the whole population of participants.

STUDENTS' INITIAL INTEREST AND MOTIVATION

Valuable information on students' initial interest and motivations showed a relatively high interest in science subjects.

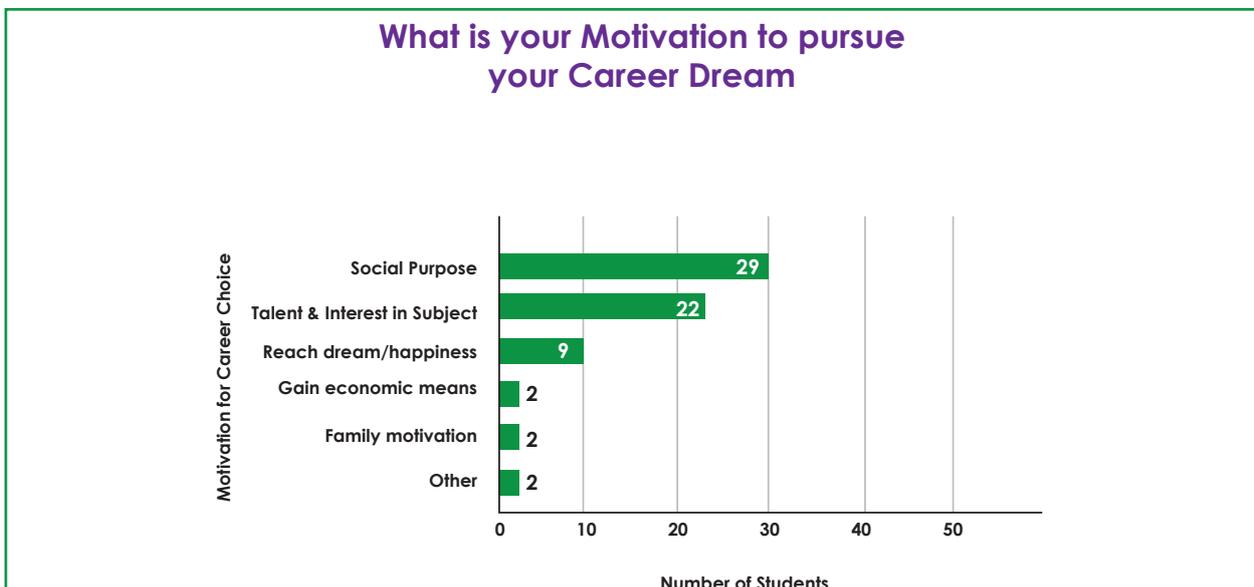


In total, 86% like all science subjects.

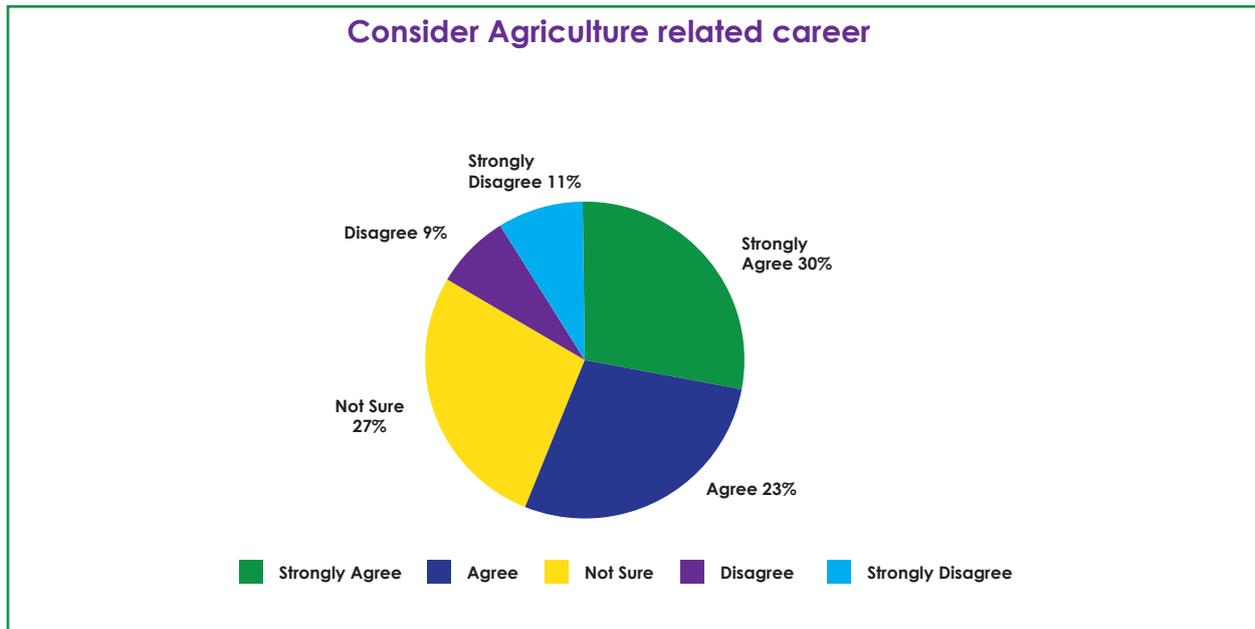


Regarding desired future career, 35% of participants had a quite specific idea (e.g. biomedical engineer, UX designer) showing a greater career awareness, while 65% have a more general idea about what they want to become (engineer, medical personnel). 75% of respondents wish to pursue a STEM related career reflecting the high interest in science subjects. About 20% of the respondents were interested in starting their own business or project.

Regarding students' motivation in future career, the majority of respondents (54%) show relatively high social awareness wishing to solve community challenges and promote development in Tanzania. Apart from having a social purpose, students often choose their career based on their talent and interest in specific subjects, such as science subjects.

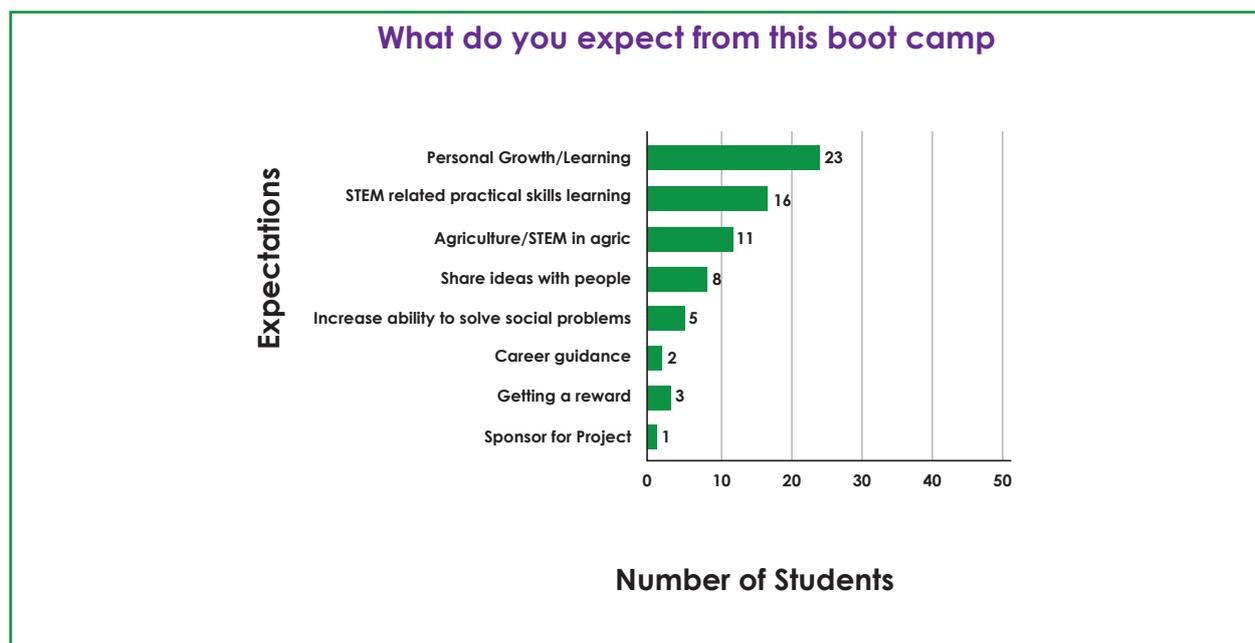


Before the boot camp, 53% of respondents showed positive attitude towards a career in agriculture



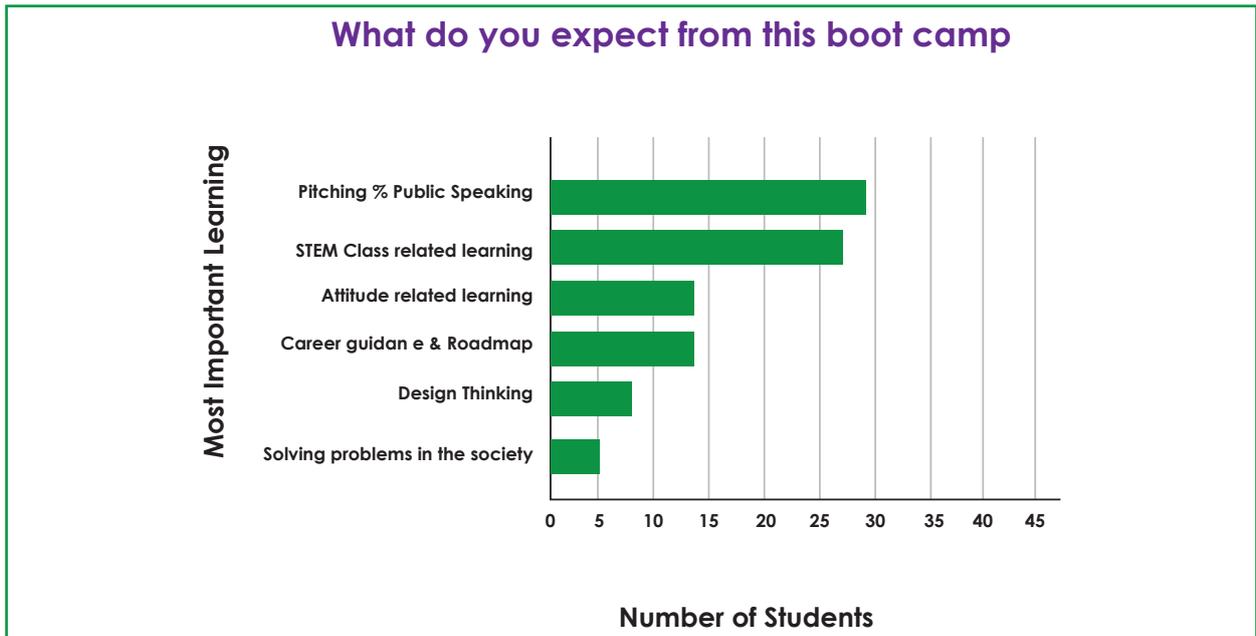
The baseline survey also showed that students' primary motivation for attending the boot camp was meeting people and sharing ideas as well as learning new skills both related to personal development and STEM specific practical skills.

Regarding key expectations for the boot camp, 43% of respondents mentioned learning new skills and knowledge for personal development, and 30% of students specifically mentioned STEM class related learning.

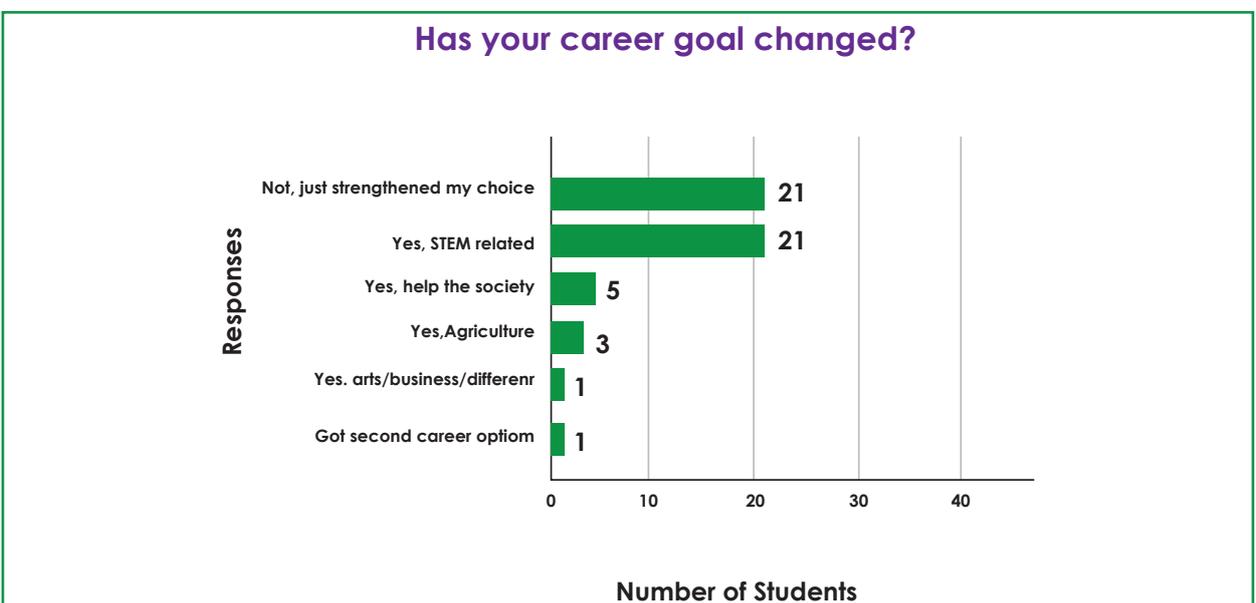


STUDENTS' LEARNING AND EXPERIENCE

The majority of respondents (59%) reported learning connected to life skills such as pitching, public speaking, presentation and communication skills as their key learning experience. STEM class related learning (e.g. soil science, coding) was mentioned by 53% of students. In addition, 29% of respondents reported that they got career advice and to have learnt not to give up, to believe in themselves and have good self-confidence when thinking about their future (attitude related learning). These results fairly reflect the priorities of the boot camp.

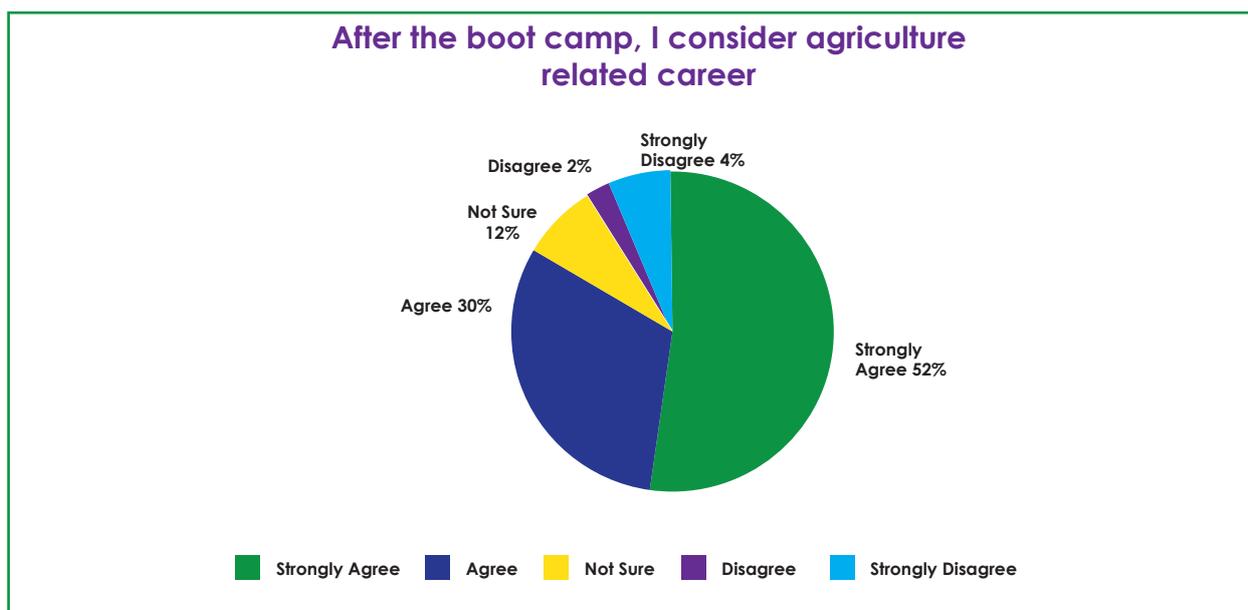


When it comes to steps in career development, a bit less than half of the students (43%) kept their original career dream, while a bit more than half of the students (57% in total) were inspired to change their career dreams (especially within STEM) as a result of the career guidance sessions.



“Yes now I want to be an engineer because I have been taught ways to follow to achieve my dream and I have seen girls like me who made it” (Female participant, 18-21, Dar)
“No, it didn't change but it has been strongly developed because it made me know the techniques on how to reach my dreams” (Female, 15-17, Arusha)

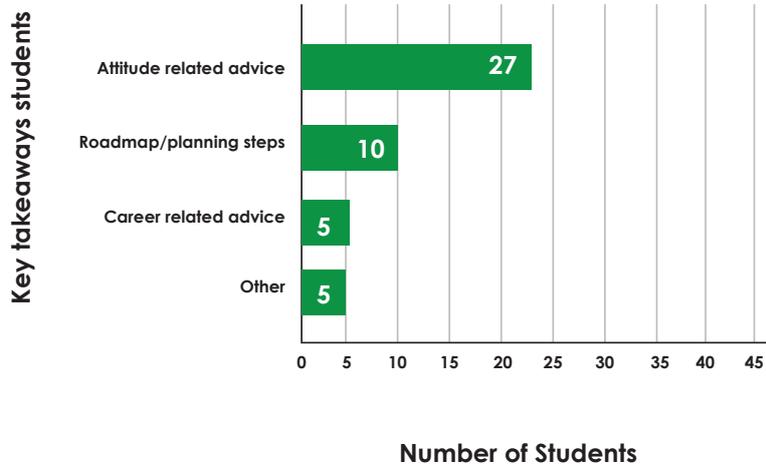
82% of respondents show interest in potentially pursuing an agriculture related career in the future, which is a significant improvement compared to the baseline results.



After the boot camp, 100% of respondents could imagine starting their own project, business or organisation. This is a significant improvement compared to only 20% of students thinking about entrepreneurship as an option in their future career before the boot camp.

From the career guidance sessions, the majority of respondents (55%) reported to have learnt about the way of thinking or positive attitude they should have to reach their goals. In addition, key learning by 20% of respondents was connected to using the roadmap as a tool to plan their future career.

New ideas during career guidance sessions/ inspirational speeches



"I got a lot of ideas... that I should write down my dream... there is power in noting your dream and what steps to take in order to achieve that" (Female, 18-21, Morogoro)

"I got to understand that you can become anything you wish to be as long as you have passion with what you do." (Male, 15-17, Arusha)

"... I have learnt that girls have the skills and ability to perform as well as boys..." (Male, 18-21)

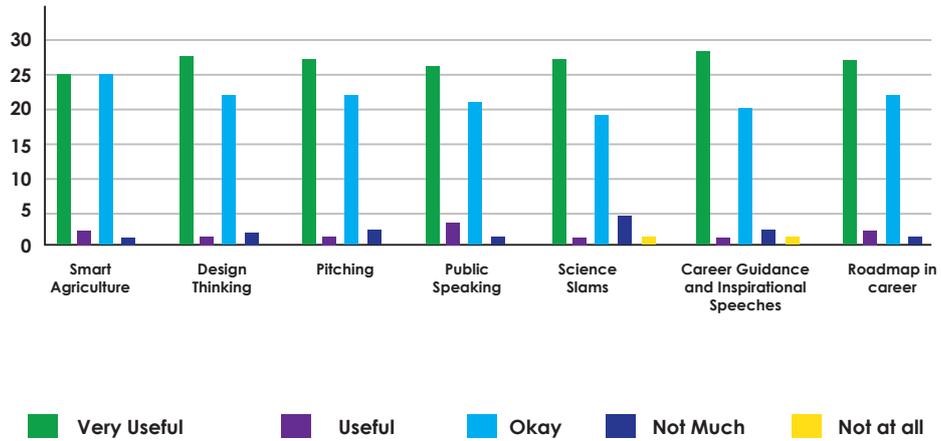
One of the intended outcomes of the career guidance sessions was to make sure that students are not only inspired, but aware of the specific steps they need to take that will help them to reach their goals. About half of the students (51%) had now a somewhat clear idea on what specific steps they'll take to reach their goals (e.g. finish up internship applications, study computer languages), and half of them (49%) have more general or partially specific steps (e.g. study hard, going to university etc.).

"The steps I want to take: 1. Making sure I complete my A-level studies with good performance 2. Saving money for a project that I want to start 3. Looking for a permanent mentor to guide me to ensure my success"(Male, 18-21, Mbeya)

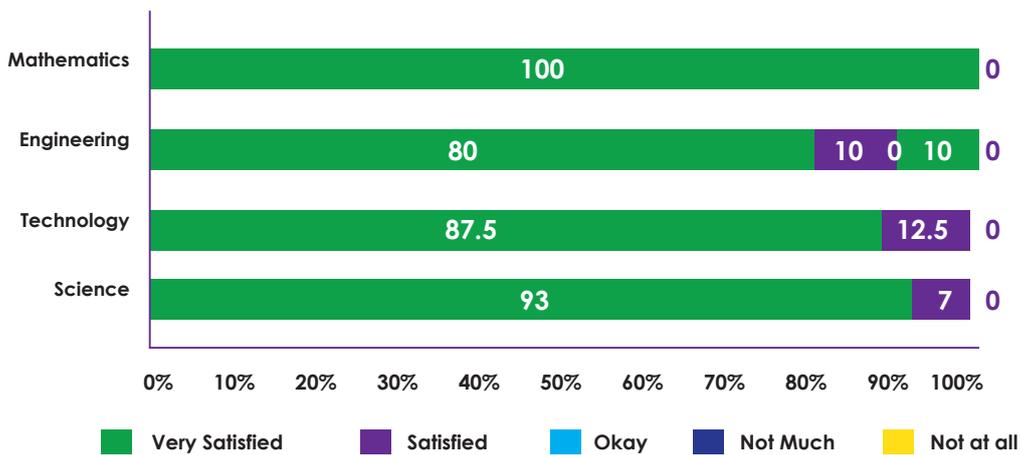
All in all, 100% of participants responded very positively ("yes sure") when asked if participants feel they can achieve their dreams.

When evaluating the usefulness of the sessions, students were generally positive to all sessions.

Usefulness of Sessions

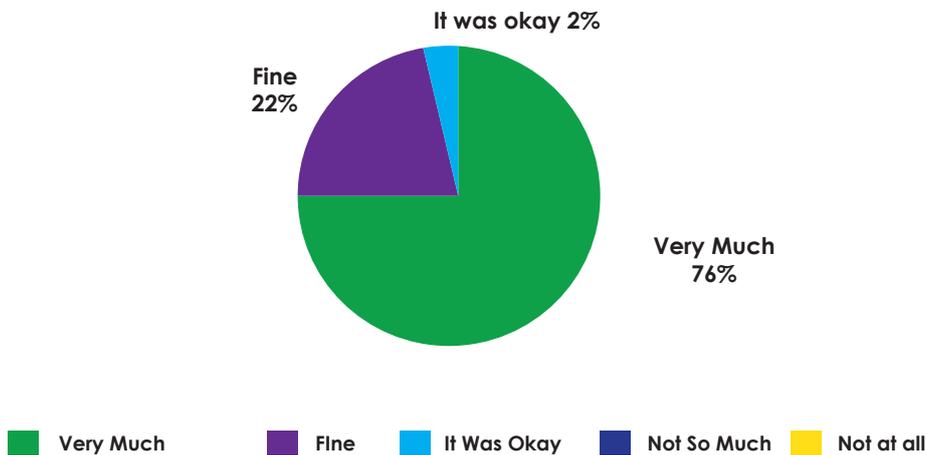


Overall satisfactions with STEM classes

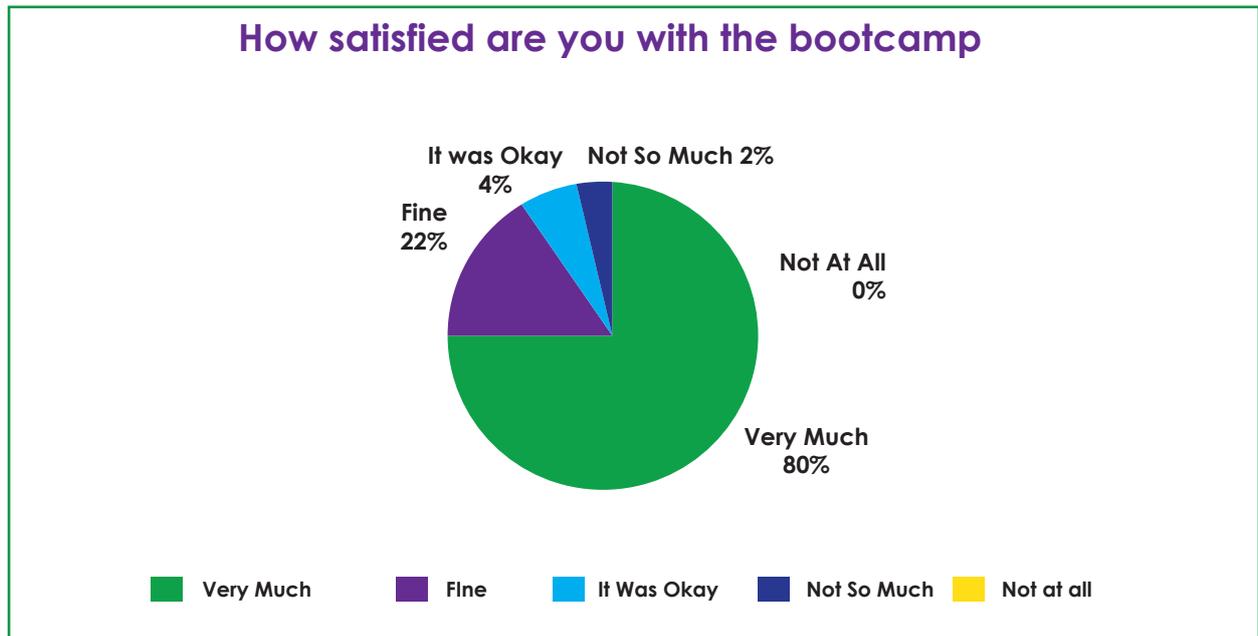


All in all, 98% of the respondents felt that the boot camp fulfilled their expectations.

How much did the bootcamp fulfill your expectations



Similarly, the vast majority of respondents 94% were satisfied or very satisfied with the boot camp as a whole.



KEY SUCCESS OF THE BOOT CAMP

- Exposure to STEM related hands-on projects where students gained valuable knowledge and developed practical skills
- Boot camp activates inspired and strengthened the majority of students to pursue STEM related careers
- Increased interest in pursuing agriculture related career (54% growth in interest as an immediate result of the boot camp)
- Increased interest in entrepreneurship and innovation among students (100% of respondents could imagine starting own projects, business or organisation)
- Key learning from career guidance and inspirational speeches connected to developing a positive attitude regarding the future (100% of students feel they can achieve their dreams)
- Majority of students showed awareness about the specific steps they need to take to achieve their career dreams
- High participation during science slaps and individual project presentations
- Majority of students reported to have gained essential life skills such as presentation and communication skills
- Majority of boot camp objectives were met which shows the overall success of the boot camp. Overall student satisfaction also supports this (94% satisfied or very satisfied)

REPORTING AGAINST INDICATORS OF SUCCESS

Objectives	Indicators	Results
<p>Outcomes</p> <p>Increase interest and active participation among students in STEM (especially in agriculture) and innovation activities and students consider opportunities within STEM as potential career path</p>	65% of students consider a career in STEM	Baseline: 70% wishes STEM related career End-line: 43% kept original career dream, 57% got new ideas
	60% of participants show positive attitude towards a potential career in agriculture	Baseline: 53% positive attitude End-line: 82% positive attitude Total: 82% positive attitude Total improvement: 54%
	80% of students are satisfied or very satisfied with the boot camp as a whole	80% very satisfied, 14% satisfied Total: 94%
	80% of students report that the boot camp fulfilled their expectations	76% completely agree, 22% agree Total: 98% report expectations fulfilled well
<p>Outputs</p> <p>1. Girls and boys develop a strength-based way of thinking about their future and their role in contributing to community development (especially by using STEM innovations)</p>	1.1 By the end of the boot camp, 50% of students report to have learnt about the mind-set/ attitude necessary to succeed in the future	55% report attitude related advice / learning
	1.2 By the end of the boot camp, 80% of students feel they can achieve their dreams in the future	100% Yes sure!
<p>2. Students aware of a wide range of career opportunities available within their field of interest (STEM, especially agriculture) and they know which steps to take to reach their goals</p>	2.1 By the end of the boot camp, 80% of students report that the career guidance sessions and the roadmap sessions were useful in planning their career	Career guidance: 54% strongly agree, 2% agree Roadmap: 52% strongly agree, 4% agree
	2.2 80% of students can list 3 specific things they will do in the next weeks/ months to achieve their career goals	51% specific steps 49% general / partially specific steps
	2.3 80% of students develop draft career plan (roadmap) by the end of the boot camp	100% yes (all did at the end of the career guidance session)

3. Students able to use theoretical STEM knowledge from school in practice to solve community challenges (especially in the agricultural sector)	3.1 STEM class related success criteria (different for each STEM class)	(see STEM class evaluation reports)
	3.2 80% of students liked the STEM class	Science: 93% very much, 7% good Technology: 88% very much, 12% good Engineering: 94% very much Mathematics: 100% very much
	3.3 80% think the STEM class information taught was beneficial	62% completely agree, 14% agree Total: 86% positive attitude
4. Students present individual project ideas and prototypes within STEM thus improving their creative problem solving and presentation skills	4.1 At the boot camp, 50% of students present individual projects	45% (30 out of 67 students presented)
5. Students receive guidance on how to develop an idea to solve community challenges and pitching a business idea	5.1 50% of students can imagine starting a business after the entrepreneurship session	100% YES
6. Students have increased capacity to understand STEM research and can present scientific innovations in an understandable way	6.1 At the boot camp, 80% of students present their Nobel Laureate's innovations in an understandable manner	100% yes (67 out of 67 students presented)
7. Students develop life skills that will make them succeed in their future career (especially within STEM fields)	7.1 By the end of the boot camp, 50% of participants report that they have learnt necessary life skills	67% consider pitching and public speaking among the most important learning experiences



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