

Technology for Sensory Expansion

Clubes de Ciencia Mexico
Summer 2017



Clubes de Ciencia Mexico

WHAT DO WE DO?



We share science



**We build connections
between students
and young
scientists.**



**We design and
share online courses**

WHAT IS A SCIENCE CLUB?

It is a one-week workshop with hands-on activities where the students develop experiments, prototypes, and an excitement for cutting-edge science!

OUR MISSION



We seek to expand access to high quality science education and to inspire and mentor the future generations of scientists and innovators through international scientific networks.

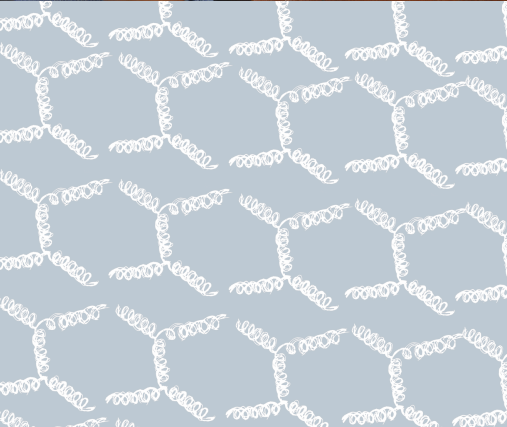
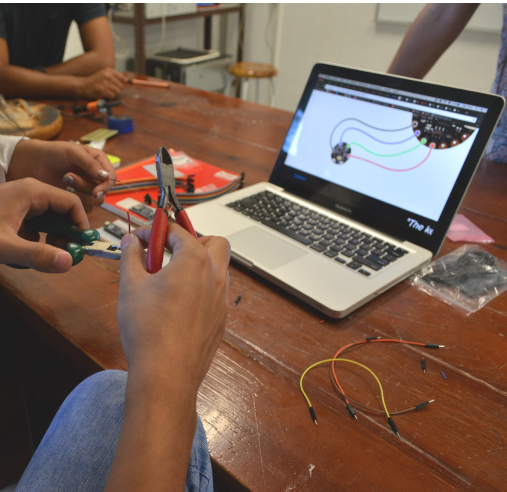
OUR APPROACH



- Recruit scientists
- Develop Science Clubs
- Identify and select students
- Partner with local Universities
- Engage public and private institutions as sponsors
- Build a network.

COURSE

TECHNOLOGY FOR SENSORY EXPANSION



Physics teaches us that there's a lot more "out there" than our senses pick up. Over time, people have learned to enhance their senses in many ways: microscopes, radios, telescopes, robots, etc. Modern technologies offer opportunities to perceive our world in new and exciting ways, and for creative sensory enhancement. For example, (normal) human color vision takes three averages over a small region of the electromagnetic spectrum, which is an infinite continuum. Through creative use of modern technology, we can make more of what's out there available. In this science club, students will learn basic programming skills and will build hardware devices using digital electronics and sensors to create both software and hardware devices that exemplify these possibilities.

Students in this club will construct both software and hardware projects that exemplify how through creative use of modern technology, we can sense more than our color vision allows us to. Basic ideas of Python and Arduino programming, image processing, and optoelectronic circuits will be involved in the projects.

For the course, we have prototyped a series of software and hardware devices and developed a workshop that has been replicated in various cities in four different countries under Clubes de Ciencias Mexico. One of the program's objective is to expand access to high-quality science education and to inspire and mentor the future generation of scientists in Mexico.

The course has been replicated in more than 10 occasions by different instructors:

- Clubes de Ciencia Mexico, Summer 2016 in four cities: Guanajuato, Merida, Ensenada, and Monterrey.
- Workshop at Arizona State University taught by Frank Wilczek, January 2017.
- Clubes de Ciencia Bolivia, January 2017, taught by Thomas Sanchez
- Clubes de Ciencia Paraguay, January 2017, taught by Thomas Sanchez.
- Clubes de Ciencia Mexico, Summer 2017 in four cities: Guanajuato, Xalapa, Ensenada; instructors trained by Thomas Sanchez.
- Clubes de Ciencia Peru 2017, taught by Thomas Sanchez.



Some of the topics covered in the course are the following:

- Human color perception
- Physics of light and sound
- Synesthesia
- Hyperspectral cameras
- Hyperspectral images
- Human senses
- Physical computing with Arduino
- Programming in Python

In this course, the students develop both software and hardware projects that exemplify the augmentation of human senses. The students will build from scratch two devices the iluminator and the synesthesia glove.

For example, common human color vision takes three averages over a small region of the electromagnetic spectrum, which is an infinite continuum. In order to make more of what's out there, students build a hardware device called the iluminator, which gives them precise temporal control of color illumination of objects of interest. They also built a Synesthesia Glove and explored how to combine the senses in order to acquire synesthetic experiences.

Each workshop is different and depending on the students' interest and their background, some of the topics will be explained in more detail than others. The course or the "club" is a week-long intensive class of eight hours each day taught by very enthusiast and motivated instructors.

The course was designed by the following researchers:

Frank Wilczek, ASU Physics Professor
Adrian Jinich, Harvard University
Thomas Sanchez Lengeling, Massachusetts Institute of Technology
Teresa Tamayo, Harvard University
Alexandro Munoz, University of Chicago Illinois

Recruitment

WANT TO TEACH A COURSE, DESIGNED BY THE PHYSICS NOBEL LAUREATE FRANK WILCZEK, IN MEXICO?



ASU and Clubes de Ciencia Mexico are looking for amazing graduate students who would like to deliver a course in human color perception, synesthesia, physics and programming. This course was designed by Frank Wilczek, ASU Physics Professor, and Physics Nobel Laureate (2004) along with graduate students at MIT, Harvard, and U. of Illinois.

Students will construct both software and hardware projects that exemplify how through creative use of modern technology, we can sense more than our color vision allows us to. Basic ideas of Python and Arduino programming, image processing, and optoelectronic circuits will be involved in the projects.

Travel expenses, accommodation, stipend, and workshop materials will be fully covered.

Dates: July 30 to August 5th OR August 6 - 12, 2017

Hours: 6 hours/day.

Location: in one of the following cities in Mexico;
Guanajuato, Mérida, Ensenada, Xalapa, Oaxaca, Chihuahua, Monterrey.

Instructors will take part in training course at ASU by one of Frank Wilczek collaborators (MIT Media Lab, Harvard University and University of Illinois). ASU instructor will be paired up with a Mexico-based graduate student.

More information:

Email: ajinich@fas.harvard.edu, thomassl@mit.edu



INSTRUCTORS RECRUITING STRATEGIES AT ASU



Technology for Sensory Expansion

Club especialmente diseñado por un
Premio Nobel - Frank Wilczek.

Tus ojos pueden ver gracias a tres canales de diversas
longitudes de onda:

Corta



Mediana



Larga



¡Otros animales perciben el color con más de tres canales!
¿Te gustaría ver los colores que ellos pueden ver?
¡Inscríbete a este Club!

**STUDENT RECRUITING STRATEGIES
IN SOCIAL MEDIA**

¿QUIÉN ES WILCZEK?



PREMIO NOBEL

DE FÍSICA 2004
POR DESCUBRIR
LA FUERZA QUE MANTIENE
A LA MATERIA CONECTADA.



PROFESOR EN 4 UNIVERSIDADES:



MIT, ARIZONA STATE UNIVERSITY,
UNIVERSITY OF STOCKHOLM Y
WILCZEK QUANTUM CENTER EN
SHANGHAI JIAO TONG UNIVERSITY.



LUGAR FAVORITO PARA LEER:
LA TINA DE SU BAÑO,
CON O SIN AGUA.

POETA FAVORITO:

SHAKESPEARE.



FRANK WILCZEK OPINA QUE:

"SI LOS PÁJAROS FUERAN FÍSICOS SERÍAN MEJORES QUE LOS HUMANOS,
YA QUE SU CAPACIDAD DE VOLAR LES PERMITIRÍA TENER UN SENTIDO INTUITIVO
SOBRE LA RELATIVIDAD."



EL CLUB **TECHNOLOGY
FOR SENSORY EXPANSION**
ESTÁ BASADO EN UN CAPÍTULO DE SU LIBRO
"A BEAUTIFUL QUESTION."



STUDENT RECRUITING STRATEGIES IN SOCIAL MEDIA



INSTRUCTORS

Technology for Sensory Expansion

GUANAJUATO

ASU GRADUATE STUDENT



MARISABEL RODRÍGUEZ

Marisabel Rodriguez is originally from Mexico City and completed her Bachelor's and Master's degree in Mathematics and Applied Mathematics, respectively, at the University of Texas-Pan American. She is currently a Ph.D. Candidate in Applied Mathematics at Arizona State University. Her research lies in the study of complex biological systems such as population dynamics (change of population size) of social insects influenced by phenomena of egg cannibalism and mechanisms that divide labor (foraging, brood care, task allocation by age). Moreover, this is also affected by the nutritional demand of a colony (inducing division of labor).

PH.D. CANDIDATE IN APPLIED MATHEMATICS

LOCAL INSTRUCTOR



HECTOR MANUEL LOPEZ DE LA CERDA RIOS

Hector Manuel is a native of San Juan del Rio, Mexico, a manufacturing city 3 hours from Mexico City. Through the help of others, he was able to obtain his bachelor's in Chemical Engineering from the National Autonomous University of Mexico (UNAM). Afterwards, he completed his master's in materials science and engineering during which he was able to collaborate with scientists from the Massachusetts Institute of Technology. He is a Fulbright-Garcia Robles scholarship recipient and preparing to apply for a Ph.D. in materials science and engineering at various US universities for fall 2019 enrollment.

NATIONAL AUTONOMOUS UNIVERSITY OF MEXICO (UNAM) CHEMICAL ENGINEERING

XALAPA

ASU GRADUATE STUDENT



KOMI MESSAN

Komi Messan is 5th year PhD candidate in the Applied Mathematics for Life and Social Sciences of Arizona State University working on mathematical ecological problems. Prior to starting the doctoral program, Komi obtained a Bachelor and Master of Science degrees in Applied Mathematics from North Carolina Agricultural and Technical State University. He has gained valuable experience in applied mathematics, ecology, research, and mentoring from academic setting and several internships. Komi has been developing mathematical models to study various ecological problems ranging from pest management to deleterious effects occurring from prey-predator host-parasite interactions. Mr. Messan interest is to work in an inclusive environment that fosters intellectual growth and he is very interested in sharing his scientific experiences as well as personal experiences in order to increase the research community.

PH.D. CANDIDATE IN APPLIED MATHEMATICS

LOCAL INSTRUCTOR



ERNESTO LADRÓN DE GUEVARA

During Ernesto professional training, he has participated in multidisciplinary workgroups that are theoretical, experimental and computational and as well research areas that include Immunology, Electrophysiology, Fluorescence Microscopy, Synthetic Biology. Part of Ernesto researcher has been developing technologies and techniques for "High Throughput Screening," which are compatible with all "-omics" techniques such as genomics, proteomics, and metabolomics. Moreover, he also has participated in the administration of computer systems of high performance and as well been part of organizing committees of national and international congresses and meetings.

NATIONAL AUTONOMOUS UNIVERSITY OF MEXICO (UNAM) STRUCTURAL BIOLOGY ENGINEERING

ENSENADA

ASU GRADUATE STUDENT



CODY PETRIE

Cody is a graduate student at ASU studying computational nuclear physics. He received his undergraduate degree from Brigham Young University in physics and a minor in astronomy. In addition to researching physics, he teaches science, and spends time with his family, he also likes outdoor activities, and occasionally plays with the amateur radio.

**PH.D. CANDIDATE IN COMPUTATIONAL
NUCLEAR PHYSICS**

LOCAL INSTRUCTOR



JESÚS DAVID ROJAS MÉNDEZ

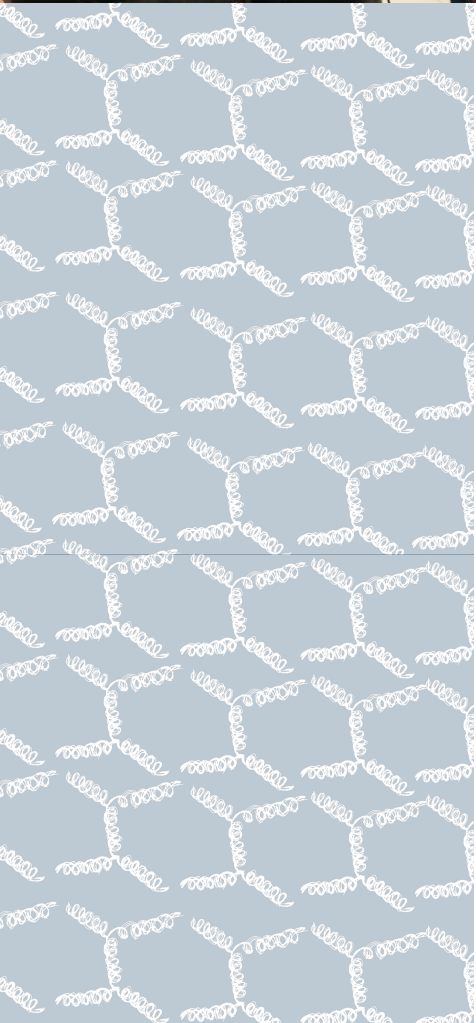
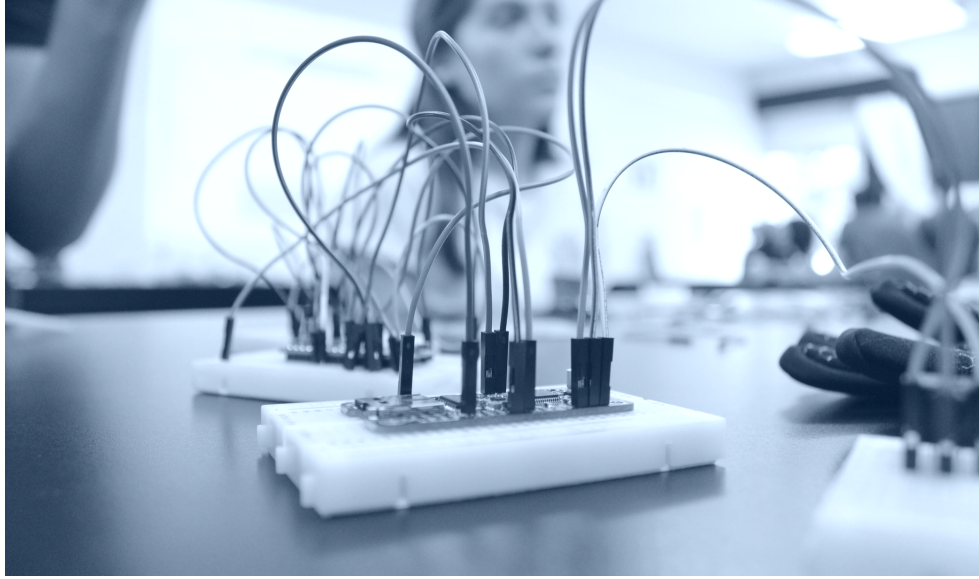
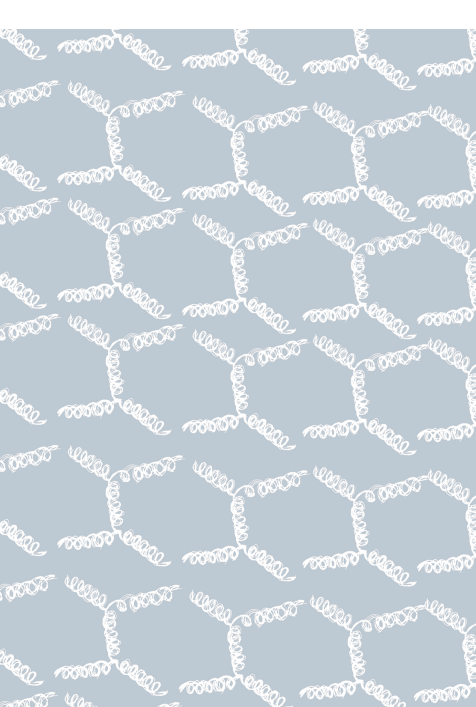
Jesús David is passionate about science outreach in Mexico and Astronomy. He is currently the president of the Astronomy association of Ensenada. And he is a student at the Autonomous University of Baja California, studying a bachelor degree in Nanotechnology engineering. He is also a research assistant at the Center for scientific research and high education at Ensenada (CICESE).

**NANOTECHNOLOGY ENGINEERING STUDENT AT
AUTONOMOUS UNIVERSITY OF BAJA CALIFORNIA**



TRAINING COURSE

Technology for Sensory Expansion



ASU Students participated in a two-day intensive course training program taught by Thomas Sanchez, Clubes de Ciencia Mexico Organizer, and MIT Media Lab Researcher. The course training included the following topics:

- Travel logistics from Arizona to Mexico.
- Different teaching methods (taught by Santiago Legaspi)
- Clubes de Ciencia Mexico program.
- Course theory.
- Course material: Software and Hardware.

In the training course, we prepared the students for their travel to each one of the cities in Mexico; Xalapa, Ensenada, and Guanajuato. We also presented to them all the information that they will need to know before traveling to Mexico. During the two days, the students learned the core ideas of the course as well as the course content both hardware and software. We reviewed the following topics: hyperspectral images in python, RGB color sensors, circuit design, educational materials, synesthesia hardware and software, and finally the illuminator concept and design. We also building and prototyped a small synesthesia device in python and in a circuit device.

Participants:

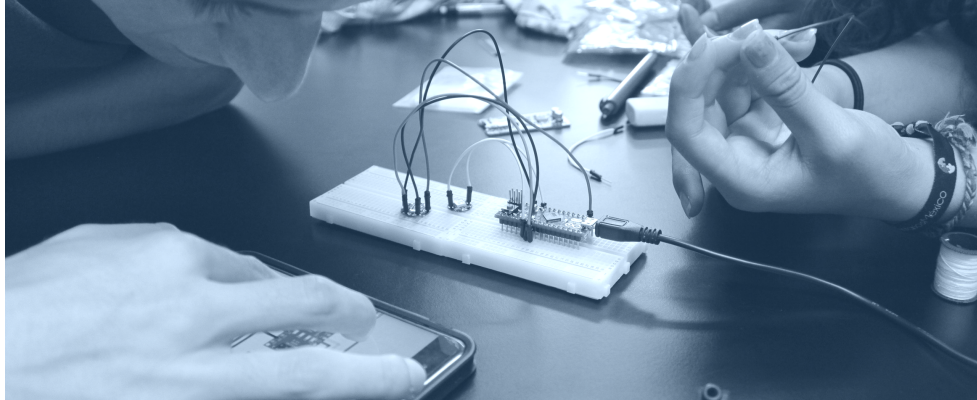
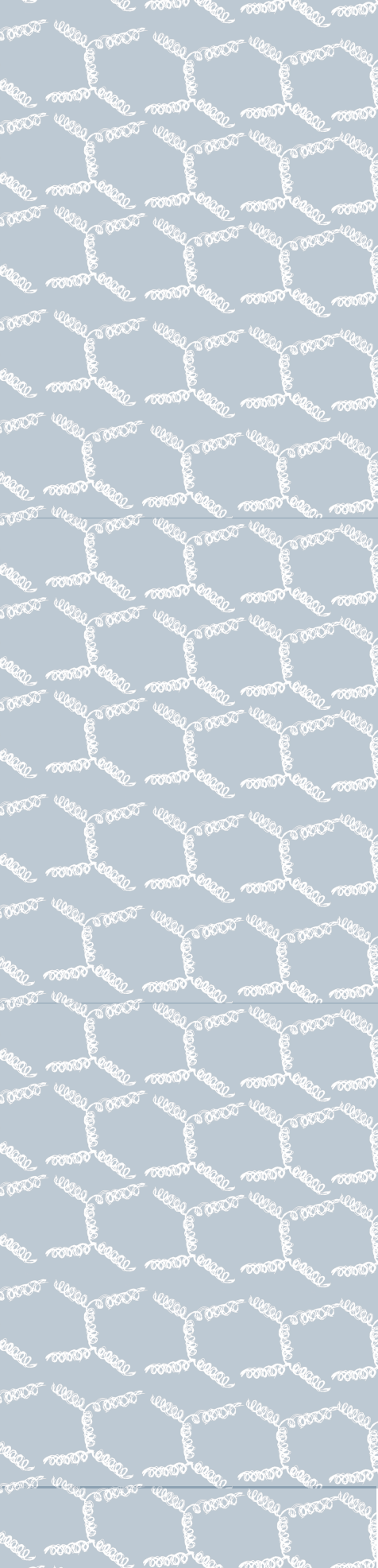
- Marisabel Rodríguez (ASU)
- Komi Messan (ASU)
- Cody Petrie (ASU)
- Thomas Sanchez engeling (MIT Media Lab)
- Santiago Martinez Legaspi (Rice University)

Friday, May 19
1:30pm - 6:00pm

Saturday, May 20
9:00am - 5:00pm

Location: ASU Physics Department.





TRAINING COURSE PROGRAM

Thomas Arrival	9:00 AM	
Arrival to ASU	12:00 PM	
Possible Lunch with Marisabel, Cody, Komi	12:00 PM	1:00 PM

Friday 19

Introduction to Clubes de Ciencia	1:30 PM	2:00 PM
Introduction to Wilczek Course	2:30 PM	3:00 PM
<i>Break</i>	3:00 PM	3:20 PM
Skype Call with the co-instructors	3:20 PM	4:00 PM
Course Materialas Overview	4:00 PM	5:00 PM
<i>Break</i>	5:00 PM	5:15 PM
Hardware Review	5:15 PM	6:00 PM

Saturday 20

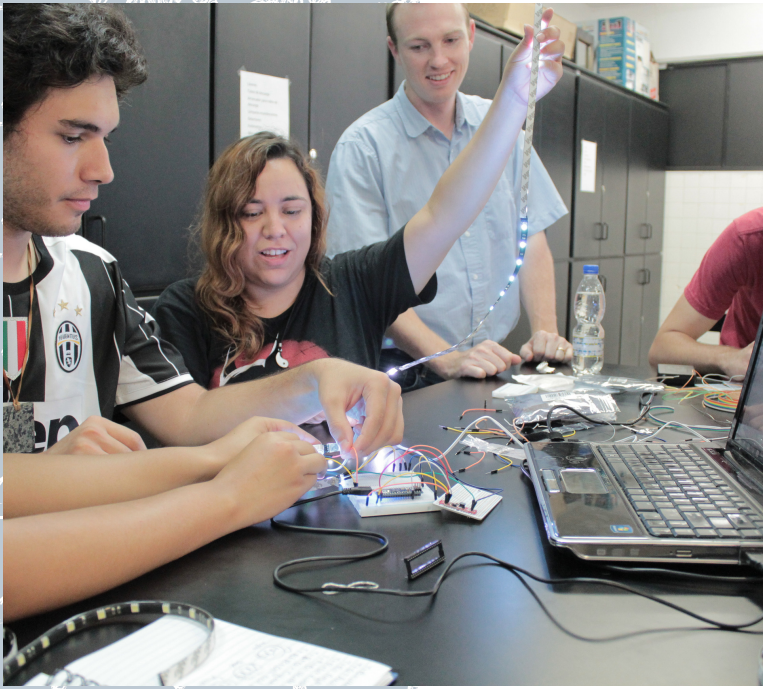
Course Overview	9:00 AM	10:30 AM
<i>Break</i>	10:30 AM	10:50 AM
Lab components and building	10:50 AM	12:00 PM
<i>Lunch</i>	12:00	1:00 PM
Building Components	1:00 PM	2:00 PM
Overview subjects	2:00 PM	3:00 PM
<i>Break</i>	3:00 PM	3:20 PM
Teaching techniques and Mexico	3:20 PM	4:00 PM
Final dicussion and extra time	4:00 PM	5:00 PM

CITIES

Technology for Sensory Expansion



ENSENADA



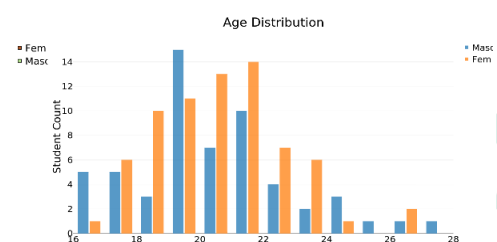
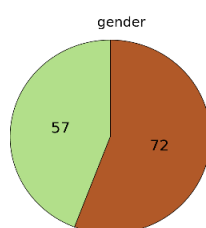
Ensenada is a coastal city in Mexico, the third-largest in Baja California. Ensenada is developing scientific research and natural science sectors, with particular focus in the marine sciences sectors. Ensenada is claimed to be the city with the highest number of scientists per capita in Latin America. The Center for Scientific Research and Higher Education of Ensenada (CICESE) researches Earth Sciences, Applied Physics, Oceanography, Communications and Experimental and Applied Biology. Further research is conducted on the campus of the Autonomous University of Baja California, Ensenada (UABC).



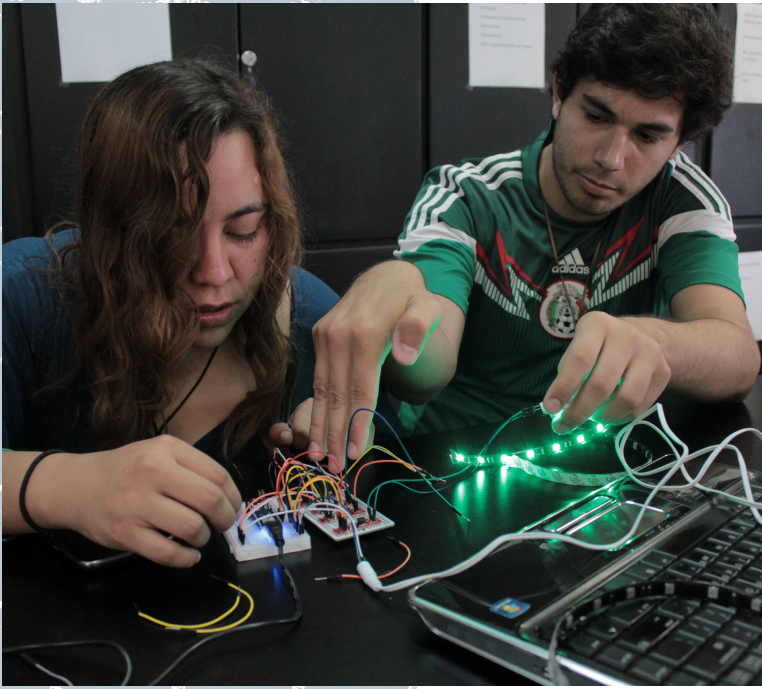
Ensenada is a great city, and we have partnered with some amazing people over there that believe, just like you, that science is something that must be shared. The host university for Clubes de Ciencia Mexico edition 2017 is the Autonomous University of Baja California, Ensenada (UABC). For this city, more than 200 students participated.

In Ensenada, eight workshops were taught from Bioinformatics, gene editing to climate change and conservation of coral reefs. Graduate students from Massachusetts Institute of Technology, Harvard University, Western State Colorado University, Stanford University, and Arizona State University participated in this edition.

The Technology for Sensory Expansion course in Ensenada has the following age distribution and gender percentage.



XALAPA



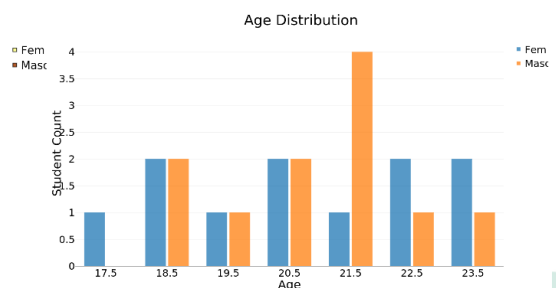
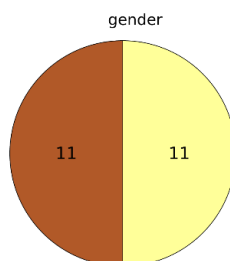
Xalapa is the capital city of the Mexican state of Veracruz. The city has several institutions of further education, and one of the most important is the Universidad Veracruzana which is also the most important in the state of Veracruz and attracts students not only from across Mexico but worldwide.

The Universidad Veracruzana is the host university for Clubes de Ciencia Mexico edition 2017.



In Xalapa, eight workshops were taught from Chemistry, gene editing to science education and Biomolecular medicine. Graduate students from Massachusetts Institute of Technology, Harvard University, University of Michigan, The Nature Conservancy, Stanford University and Rice University participated in this edition, and more than 200 students participated in this edition.

The Technology for Sensory Expansion course in Xalapa has the following age distribution and gender percentage.



GUANAJUATO



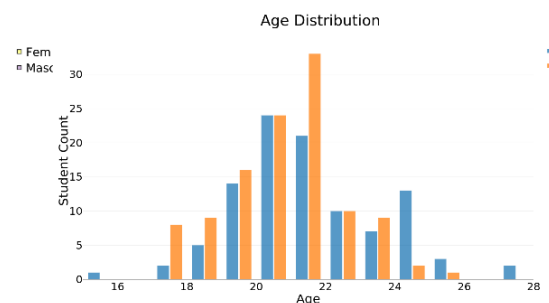
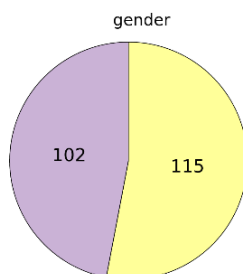
Guanajuato is a city and municipality in central Mexico and the capital of the state. Guanajuato host a large number of artistic and cultural events with artists invited from Mexico and other parts of the world.

Guanajuato ranks seventh in the country in the number of schools to population and sixth in teacher-student ratio. Institutions in the region includes Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM), Instituto Politécnico Nacional (IPN), Center for Research in Mathematics, (CIMAT).

In Guanajuato, eight workshops were taught from quantum computing, neuroscience, to design thinking and electronics. Graduate students and researchers from Massachusetts Institute of Technology, Harvard University, University of California San Francisco, University Of Tennessee, Boston University, and Rice University participated as instructors.



The Technology for Sensory Expansion course in Guanajuato has the following age distribution and gender percentage.





THANK YOU!

Technology for Sensory Expansion