Arduino in Education

A journey into STEAM
TRUSTED TEACHER - DEALER AT MOLLAN SQUARE

FIND THE BLUE BIKE!!
Interaction Design
IxD is a discipline looking at the interaction between [non] humans by means of digital artifacts [products and services].
People use platforms to learn and create things.
How replicable is this?
THE FIRST ARDUINO THING
What is Arduino?
```cpp
// The setup function runs once when you press reset or power the board.
void setup() {
  // Initialize digital pin LED_BUILTIN as an output.
  pinMode(LED_BUILTIN, OUTPUT);
}

// The loop function runs over and over again forever.
void loop() {
  digitalWrite(LED_BUILTIN, HIGH); // Turn the LED on (HIGH is the voltage level)
  delay(200); // Wait for a second

  digitalWrite(LED_BUILTIN, LOW); // Turn the LED off by making the voltage LOW
  delay(200); // Wait for a second
}
```
... the Arduino IDE is downloaded once every 2’5 seconds ...
... over 60,000,000 people visit the Arduino website yearly ...
THE KEY ASPECT?
Sorry
We're
OPEN
But we came to talk about ...
... pedagogical models (and reflections)

- Different ways of approaching technical materials in class.
- Mixing technology with other materials.
- Maximising outreach.
- Thinking about limitations.
The same way we were teaching, other teachers decided to use this platform for STEAM teaching.
STEAM: Science Technology, Engineering, Arts, and Math
2013 - 2019 SPAIN
//Declare the capacitive sensor:
CapacitiveSwitch sensor=CapacitiveSwitch(2,3);

void setup(){
    //initialize the capacitive sensor. Threshold is 400
    sensor.config(400);

    //initialize the servo motor
    pull.attach(9);
}

void loop(){
    if(sensor.getState()){ //If the capacitive sensor is touched, pull the servo
        pull.write(0);
    }
**BLOCK 1 - PROGRAMMING**

Get started and learn the basics of programming. Develop an interactive snake, a video game or a customized clock using the programming environment Processing.

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**BLOCK 2 - SPORTS**

Learn the basics of digital technologies to control digital actuators and read digital sensors. Build and play with small electronic games that simulate sports like basketball, fencing and pong among others.

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**BLOCK 3 - MAGIC**

Learn about the magic of analog signals and the serial port. Build projects that introduce sound and images that highlight analog signals.

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**BLOCK 4 - ROBOTS**

Learn the basics on how to control motors and sensors. Build different robots and add movement to them by using standard and continuous servos.
**CREATE/CAPTURE** What new data analytics can be derived from the hands-on learning of STEM subjects?

**ANALYZE/REASON** How can these data analytics be used to understand and support practice-based learning?

**VISUALIZE** How can we develop visualization tools that combine learning analytics data from rich multi-modal sensors and students self-documentation to provide meaningful information?
What I really wanna know is ...
What is the impact of the Arduino platform in teaching? Does it help students learn about embedded technology?
REPORTE SEMANA #19
No. 11 de 12
Capacitación de misión espacial del
23 al 26 de Mayo de 2022

DESCRIPCIÓN BREVE
Actividades desarrollados semanalmente para el proyecto:
Aguascalientes al espacio 2022.
The survey process.

- Teacher Education
- Student Education
- Project Building
- Report and Presentation

First student survey

Second student survey
Self-reported STEAM knowledge

**P-value <.01; ** P-value <.05
Test of STEAM competence

**P-value <.01; ** P-value <.05
List of open questions to consider

- Classes at multiple speeds
- Labs vs. personal kits: when and where?
- Kits vs. toolboxes: what is best?
- AI specific: dependency layers (C-NN-platforms)
- Guided vs. exploratory courses
- Expectations: And when novelty has wear off?
Let's wrap this up in style.
There will always be people looking into creative uses of technology.
ROBOTIC HANDS

JAKARTA LIGHT INSTALLATION
Thanks 🎓👩‍🎓 🇬🇷 for coming by!
Thanks 🎓🎓 for coming by!
Image Caption: Kelly Heaton, 2017. Left: “Donald Trump (The Big Hack).” Center: “Vladimir Putin (The Operational Amplifier).” Right: “Hillary Clinton (The Big Shock).” All works are oil on canvas, 18” x 18” x 1.5.”
Finally, a chirping cricket!
2-23-12

Notes: The cricket is so dependent on RC values, increasingly subtle and sensitive, that you can't get the same effect on the breadboard as off. Here is the basic idea which requires tweaking:

ADD'L notes: The piezo has a great ring and is tonally sensitive, more sensitive than the 8527. But it's loud. Try running the circuit @ 6V or even less.

[电路图]

Radio Shack piezo electric works best.

See 2 pages ahead.

Image caption above: Kelly Heaton, “Printed Circuit Bird (Peach Bird),” 2020. Custom analog electronics and printed circuit board with a clear solder mask, which makes the copper appear peach-colored. 7” x 9” x 1.5”

Image caption above: Kelly Heaton, “Big Pretty Bird,” 2019. Custom analog electronics and printed circuit board with green soldermask, white silkscreen, and ENIG plating. 18” x 24” x 1”

Image caption below: Kelly Heaton, Transparent Bird, 2019. Freeform analog electronics inside of laser cut and folded mylar. 5” x 8” x 3”
Image caption above: Kelly Heaton, “Sounds of Another Time (Rising Dragon),” 2021. Analog electronics, printed circuit boards, and silkscreen on fabric-covered panel. Unique series of 6 mixed media electronic artworks with one AP. 23.5” x 37.5 x 2”

Image caption below: Kelly Heaton, “The Tree of Life,” 2022. 13” x 9” x 1”. Artist’s proof for an edition not yet released
Arduino Uno

connected robots and other educational machines
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FIND THE BLUE BIKE!!
Workshop materials

- micro-servo motor working at 3V3
- green LED
- 2 x push-button or tactile switch
- 1 x joystick
- 1 x piezo buzzer
- USB cable to use between the Arduino board and a PC
- jumper wires
- breadboard
- crafting materials (cardboard, glue, paint, tape, scissors, etc)
Breadboard
LED (Light Emitting Diode)
- **Flat Edge** indicates the cathode.
- **Cathode (−)** is the short leg.
- **Anode (+)** is the long leg.
Resistors
Jumper Wires
Piezo electric / buzzer
Button
Potentiometers / Joysticks
Servo Motor
Arduino Board
USB Cable
→ Short pin to GND
→ Long one to pin 10
Connect your board to the PC
Open the Arduino IDE
Process

- Install the Arduino IDE 2.x.x
- Install the core for the Arduino Uno R4, which is quite new
- Try the different features of the board
- Connect external parts
- Build a small interactive machine
- [if there is time] Connect to the Arduino Cloud
1. Blink

➔ **Select your board**
Arduino Uno R4

➔ **Selecciona el puerto**
Tools > Port > Arduino Uno

➔ **Abre el ejemplo**
File > Examples > EduIntro > courseware > workshop_1h > Blink

➔ **Descarga el código a tu placa**
1. Blink

**RETO**
Modifica el programa para que parpadee más rápido / despacio

**OBJETIVOS**
- Encuentra y selecciona tu placa
- Abre ejemplos
- Descarga código a tu placa
- Modifica un programa
- Usa un LED
Desconecta la placa del ordenador
1. Blink

→ Añadamos un LED externo

→ Conectado al pin 10

→ Usando una resistencia en serie
1. Blink

RETO
Cambia el LED al pin 5

OBJETIVOS
➔ Tu primer circuito conectado a Arduino
➔ Use de una breadboard
➔ Uso de resistencias
➔ Uso de más pines en la placa
Desconecta la placa del ordenador
2. Hola Mundo!

→ Saluda a tu motor!

→ Prepara tu motor con uno de los apliques para que puedas ver como se mueve
2. Hola Mundo!

→ Conecta el motor a Arduino usando cables

Rojo > 5V  
Negro > GND  
Blanco > 10
2. Hola Mundo!

➔ Conecta la placa al ordenador

➔ Comprueba que placa y puerto estén bien seleccionados

➔ Abre el ejemplo
  File > Examples > EduIntro > courseware > workshop_1h > Servo
2. Hola Mundo!

RETO
Cuales son los mayores / menores valores que puedes usar para posicionar el motor?

OBJETIVOS
➔ Conecta un servo motor
➔ Programa un motor para que se mueva
➔ Combinando 3 de estos, podrías hacer un brazo robótico!
Desconecta la placa del ordenador
3. Melodía

➔ Conecta el piezo a tu placa

Rojo > 10
Negro > GND
3. Melodía

➔ Conecta la placa al ordenador

➔ Comprueba que placa y puerto estén bien seleccionados

➔ **Abre el ejemplo**

File > Examples > EduIntro > courseware > workshop_1h > Melody
3. Melodía

RETO
Modifica tu canción

OBJETIVOS
➔ Música!
➔ Piezo y melodías
➔ Colabora con otros y crea una orquesta!
Desconecta la placa del ordenador
4. Timbre

➔ Añade un botón a tu circuito

Rojo > 7  
Negro > GND
4. Timbre

- Conecta la placa a tu ordenador
- Comprueba que placa y puerto estén bien seleccionados
- **Abre el ejemplo**
  File > Examples > EduIntro > courseware > workshop_1h > MelodyButton
4. Timbre

OBJETIVOS

➔ Música!
➔ Piezo y melodías
➔ Uso de sensores
Desconecta la placa del ordenador
5. Señales analógicas

➔ Conecta el potenciómetro a tu placa

Rojo > 5V (3V3)
Negro > GND
Otro > Señal
5. Señales analógicas

➔ Conecta la placa al ordenador

➔ Comprueba que placa y puerto estén bien seleccionados

➔ **Abre el ejemplo**
  File > Examples > EduIntro > courseware > by_topic > Potentiometer
5. Señales analógicas

RETO
Prueba la función readStep(int steps) y explica cómo funciona. Conecta el LED a la placa para ver cómo cambia la intensidad.

OBJETIVOS
➔ Lee señales analógicas
➔ Conoce diferentes tipos de sensores analógicos
➔ Manda valores por el puerto serie
Desconecta la placa del ordenador