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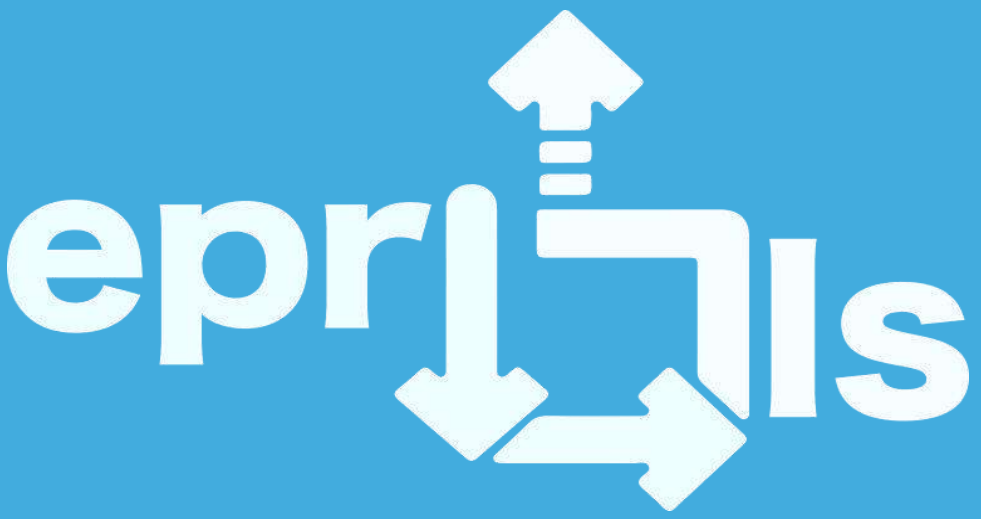

Best practices in educational robotics and programming

according to the national curricula for secondary education (ISCED 2-3) of Portugal, Poland, Turkey and Italy

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Índex

Introduction 6
Methodology 7
1 -Title: Activity – Traffic light 8
2 - Title: CREATION OF A MULTICOLORED LAMP 11
3 - Títles: CHALLENGES FOR THE IMPLEMENTATION OF EPR@LC 13
4 - Título: CHALLENGES FOR THE IMPLEMENTATION OF EPR@LC 14
5- Learning Scenario for Module 1 - Computer Architecture 15
6- Title: SIMULATION IN THE TINKERCAD APPLICATION 17
7- Title: Calculation of the area of a square 20
8- Title: Pedestrian traffic light with button requesting passage 23
9- Title: CHALLENGES FOR THE IMPLEMENTATION OF EPR@LC 27
10- Title: Traffic light simulator 29
11- Title: Intelligent Lighting 32
12- Title: Text message display on LCD display 16*2 35
13- Title Addressed area: Arduino 39
14- Title: Using Arduino and Sensors – “First steps with Arduino” 42
15- Title: TINKERCAD | ELECTRONIC CIRCUITS 43
16- Title - Simulate Temperature Sensor 45
17- Addressed area: Arduino, Tinkercad; 48
18- Title: Arduino – Knight Rider Simulator (Leds blink sequentially and with reverse) 52
19- Title: Programming a Sound Traffic Light 55
20- Title: Sound Distance Sensor 59
21- Title: Let's Create Our Circuit! 62
24- Addressed area: Arduino - even odd 69
25- Title: How to obtain and interpret the position-time graph of a person's rectilinear movement 73
Geometry 78
26- Theme: Geometry 78
27- Title: Arduino application and temperature and humidity sensors for measurements in a hydroponic garden 84
28- Addressed area: Tinkercad and placa Micro:bit 88
29- Title: “Discovering Prime Numbers” – presentation and visualization of text message 90
30- Subject: Create and Test a Learning Scenario 95
31- Title: Simulate Temperature Sensor 98
32- Title: Application Development for Braille Learning using Arduino. 101
33- Area addressed: 3D editing software (tinkercad) 108
34- Title: INTERACTION WITH ARDUINO – LCD (Liquid Crystal Display) 110
35- Title: Traffic light for vehicles and pedestrians 112
3D Printing 114
36- Addressed area: Arduino, Tinkercad and 3D printing 114
38- Title: 3D replicas of tourist attractions in English-speaking countries 125
39- Subject: Create and Test a Learning Scenario 127
40- Area addressed: 3D Modeling and Printing 132
41- Title: The Tangram 144
42- Subject: Programming and Information Systems 149
43- Title: 3D Modeling - Autodesk Inventor 151
44- Title: Design Emoji 153
Virtual Reality 158
45- Title: my bedroom - Mein Zimmer 158
46- Title: Virtual Exhibition "Verbal Violence Against Women" 162
47- Title: historical figure 166
48- Title: the virtual philosophy 171

49- Title: Virtual Reality (VR) to promote tourist itineraries 178
50- Title: Familiarization with Virtual Reality (VR) 181
51- Title: CHALLENGES FOR THE IMPLEMENTATION OF EPR@LC “logo magnet in 3D” 183
52- Title: 3D Printing - Prusa Slicer 185
53- Title: Virtual reality in the promotion of educational centers 187
54- Title: Advanced Use of Arduino 189
55- Title: Make the name of your school in Braille 192
56- Title: Make your own stationery 198
57- Title / Addressed area: 3D Modeling and Printing 210
58- Title: Automatic lighting system with Arduino and sensors 214
59- Title: Illuminated dividers 217
60- Title : CHALLENGES FOR THE IMPLEMENTATION OF EPR@LC “traffic light - 3leds” 219
61- Title: - Simulating a car's parking sensors. 222
Reflection and evaluation 226

Introduction

Materials were developed, courses were given face to face, first hand to teachers who were the engine of this internal motivation in each member country for training in digital technologies.
After the trust of the first line teachers, we proceed to the dissemination of the course to other teachers of all disciplinary areas in each country.
The contents and support of materials and tutorials were developed by experts from each country and with the collaboration of ANPRI, National Association of Computer Teachers.
During the training, doubts were raised and good practices were proposed by all course participants in different countries.
Therefore, we compiled the best 60 good practices resulting from this contribution over the big number of training sessions.

Some of these good practices were presented in Barreiro during the conference, where the results of the same were presented and recommendations were made to be disseminated. The concrete examples of good practices illustrated at the conference were applied to physics, chemistry and biology using temperature and humidity sensors applied to a hydroponics system created at Secundária Augusto Cabrita.

Another practical example is 3D printing with arduino, allowing an innovative way to learn braille code for the blind in a simple, intuitive and fast way.
These are just two examples of many included in this compilation of examples.

These examples range from the use of arduino and sensors applied to geometry and calculation, such as linear equations in terms of calculation and graphic visualization, or in simpler examples in the detection of even/odd numbers and prime numbers for the motivation of beginning students.

The use of arduino and sensors to create a toy or its application to geometric solids, were also applied in other devices such as microbits.

The use of the arduino, sensors, controllers and other electronic devices in the PAP - Proof of professional aptitude, in professional computer science and electronics and automation courses, in other cases its application in robotics clubs, are examples of research and learning in many subjects by our students from different levels of education with the support of their teachers.

In the area of 3D printing, in addition to applications to history subjects with the modeling and printing of different historical monuments, it allows to know these monuments in detail, in addition to enhancing many other knowledge in this process.

The creation of a tangram by creating the pieces using 3D printing, which comprises several stages, after creating the design, modeling it until printing it, allowing students to create the pieces from scratch, planning all the tasks.

Using tinkercad was a great help for those who don't have other more complex design software and it allows you to make your 3D drawings easily.

Poland used 3D drawings, modeling and printing in its actions, which they applied to many different objects, including key rings with the school logo. Turkey used 3D design and printing technology to create and produce imojis or to create a game.

The use of tinkercad was also very important for those who did not have electrotechnical equipment such as arduino boards, controllers and sensors, being able to do the exercises and obtain the desired results.
So everyone could do the activities they proposed, with the support of their teachers and tutorials to learn any content of any subject.

Some teachers and students explored the environment of the Italian virtual reality platform Edmondo.
Italy, which uses the Edmondo Italian platform to create its virtual classroom environments, was widely used during the pandemic and continues to be widely used today at different levels of education.

In the Italian examples we illustrate here, they are examples linked to virtual reality using artsteps which is now also widely used in Italy for its ease and quick learning. Here, the use of artsteps and voki to create different virtual environments, such as the presentation of a philosopher, were exemplified here in an exhibition show. Or even the use of 123apps for voice recording and the use of artsteps was applied to learning the German language.

Methodology

All participants were asked to select the best practices with the digital tools proposed to them by the countries involved in this European programme.

Thus, Polish, Italian and Turkish colleagues were asked to identify 4 good practices each and we share in this compilation of good practices, the remaining good practices were selected from the training carried out in portugal

In this selection we tried to include the most innovative practices and the initiation and familiarization practices for Basic Education students who started to explore digital tools and software.

This balance between both resulted in the present selection
and in some cases presented, a reflection and greater detail of the learning methodology was made including surveys to students and their self-assessment.

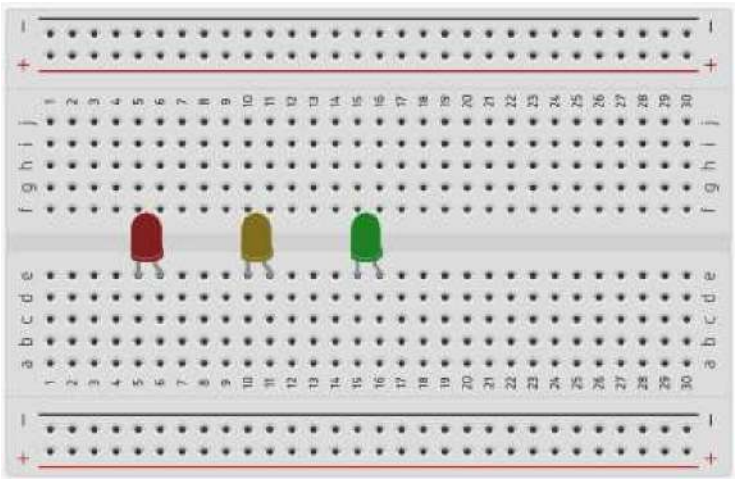
1 -Title: Activity – Traffic light

Objectives of the Activity: The objective is to create a program that shows the sequence of lights similar to a traffic light.
The sequence should be as follows: Green – Yellow – Red

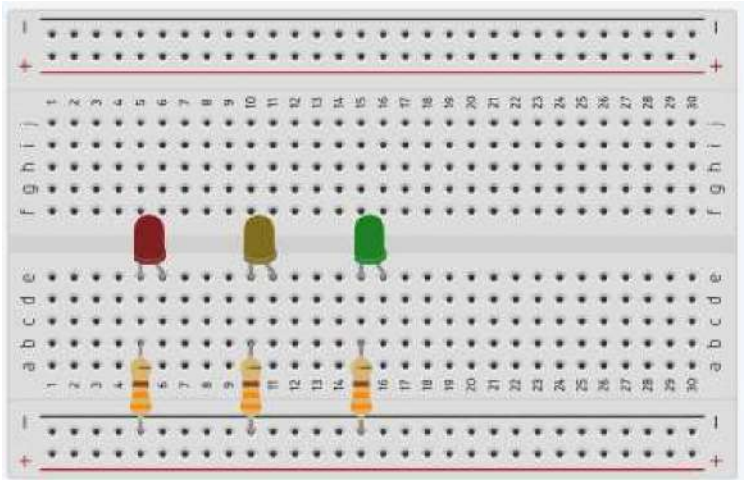
Resources:
Breadboard, arduino, jumper cables, 3 LEDs (1 red, 1 yellow, 1 green), 3 resistors of 220 ohms.

Make the connections as shown in the following figure:

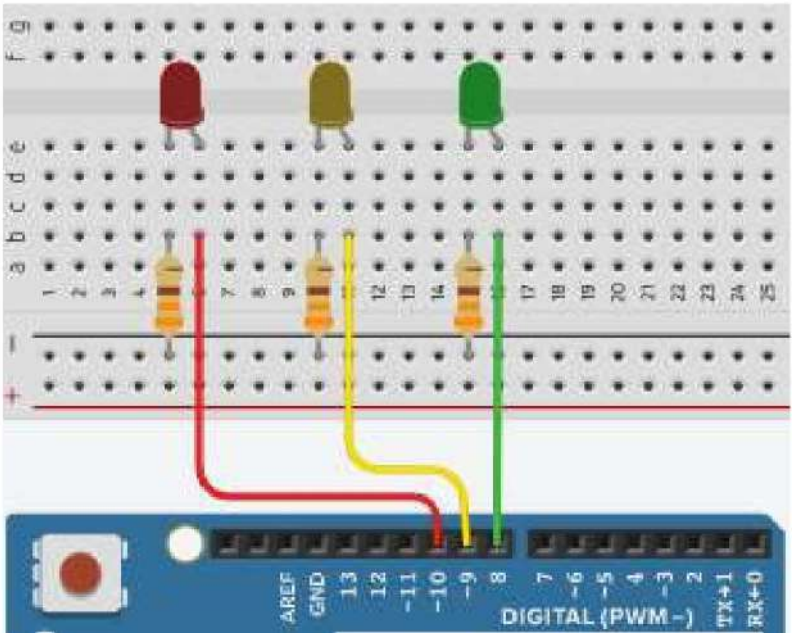
The **red led** will be connected to column 5 (smaller leg) and column 6 (bigger leg), the **yellow led** will be connected to column 10 (smaller leg) and column 11 (bigger leg) and the **green led** will be connected to column 15 (smaller leg) and column 16 (larger leg).



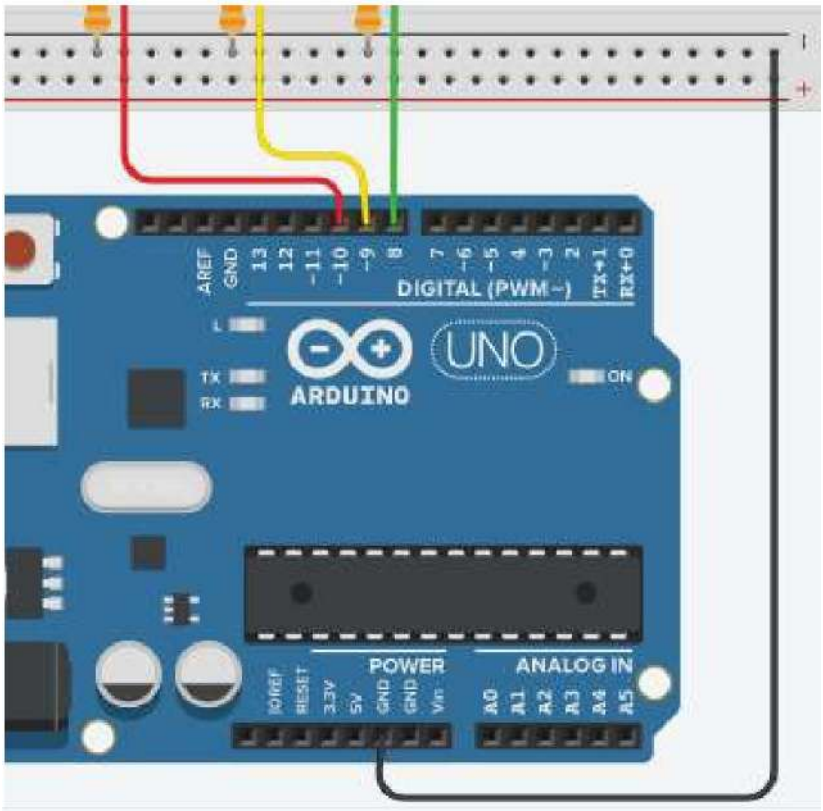
Connect one leg of each of the resistors in columns 5, 10, and 15 and the other leg to the negative line of your breadbard.



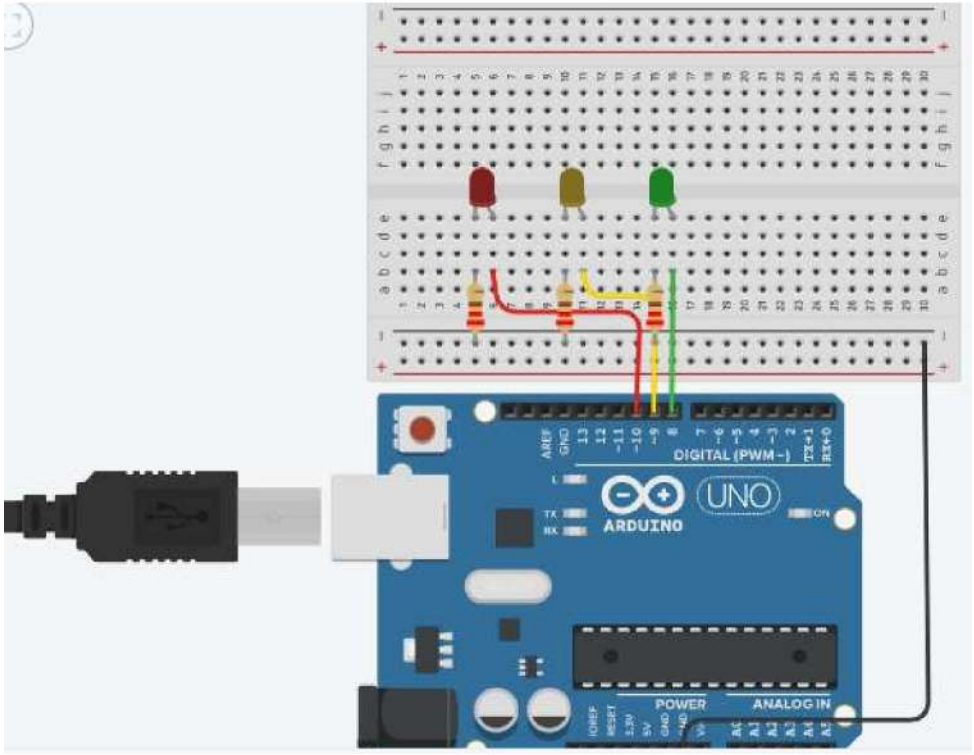
Connect jumper wires to columns 6, 11 and 16 of the breadboard.
Using the colors of the jumper wires as in the example below, connect the **red wire** to digital pin 10 of the arduino, the **yellow** wire to digital pin 9 of the arduino and the **green** wire to digital pin 8 of the arduino.



Connect the **black** jumper wire to the digital GND pin on the arduino.



The final circuit should look similar to the image below:



Program the Arduino:

Program the Arduino: It should simulate a traffic light. The red and green LEDs should have a duration of 4 seconds and yellow only 2.
The sequence should be as follows: Green – Yellow – Red

Texto

1 (Arduino Uno R3)

```
1  void setup() {
2  pinMode(8,OUTPUT); //define o pino 8 como saída
3  pinMode(9,OUTPUT); //define o pino 9 como saída
4  pinMode(10,OUTPUT); //define o pino 10 como saída
5  }
6  void loop() {
7  //Controle do led verde
8  digitalWrite(8,HIGH); //acende o led
9  delay(5000); //espera 5 segundos
10 digitalWrite(8,LOW); //apaga o led
11 //Controle do led amarelo
12 digitalWrite(9,HIGH); //acende o led
13 delay(2000); //espera 2 segundos
14 digitalWrite(9,LOW); //apaga o led
15 //Controle do led vermelho
16 digitalWrite(10,HIGH); //acende o led
17 delay(5000); //espera 5 segundos
18 digitalWrite(10,LOW); //apaga o led
19 }
```

2 - Title: CREATION OF A MULTICOLORED LAMP

Addressed area: Electric circuits

Subject: Deepening knowledge of electronics and its components

Context: It is intended that students deepen their knowledge of electronics and its components, through the creation of various electrical circuits and introduction of new components, such as the capacitor and the transistor, creating a multicolored lamp, with regulation of the intensity of the three primary colors of light (red, blue and green).

Objectives:

Develop technical skills in the area of electronics, through the identification of components, their functions and their application in circuits;

- Develop the ability to solve problems, through the creation of original and creative solutions;
- Promote the use of digital tools for sharing information and knowledge;
- Promoting creativity, through the creation of a chain;
- Evaluate the impact of the decisions taken;
- Promote the development of creative solutions;
- Promoting adaptability to new situations;
- Develop technical skills in the area of electronics, through the identification of components, their functions and their application in circuits;
- Develop the ability to solve problems, through the creation of original and creative solutions;
- Promote the use of digital tools for sharing information and knowledge;
- Promoting creativity, through the creation of a chain;
- Evaluate the impact of the decisions taken;
- Promote the development of creative solutions;
- Promoting adaptability to new situations;

Narrative

ACTIVITIES	MOTIVATION	TASKS	DURATION
Students know and identify the different electronic components from diagrams provided by teachers	-Acquire knowledge about the use of arduino as well as potential typologies projects -Acquire circuit building and programming skills -Acquire knowledge about programming - Develop autonomy	-Design and program the circuit using the Arduino and the remaining components. -Test the circuit and make any corrections and/or changes and/or alterations according to the intended purpose	**50 minutes**
Students build more complex electrical circuits from schematics provided by teachers			**50 minutes**
Pupils build a lamp, being able to give light of different colors! Students learn to adjust the brightness of the Red, Green and Blue LEDs Construction of a lampshade for the lamp started in the previous class. Adjustment of the brightness of the LEDs, in order to create new colors			**50 minutes**
Pupils build a lamp, being able to give light of different colors! Students learn to adjust the brightness of the Red, Green and Blue LEDs Construction of a lampshade for the lamp started in the previous class. Adjustment of the brightness of the LEDs, in order to create new colors			**50 minutes**

Reflection and evaluation:

This scenario intends to promote collaborative and experiential learning and to develop technical and behavioral/social skills. Using technology as a means of development Conducting a quiz through Kahoot! to review acquired knowledge.

Resources:

Computers with Internet access, Tinkercad, Arduino IDE, Arduino Kit.

3 - Títles: CHALLENGES FOR THE IMPLEMENTATION OF EPR@LC

Addressed area: Arduino and Tinkercad

Subject: Getting to know Tinkercad and Arduino

Context: In this class, it is intended that the students of a 9th grade class have their first contact with Arduino and Tinkercad, establishing relationships with the demonstration of the use of robots by the Robotics Club of grouping carried out in the 2nd trimester of the school year. Students must perform two activities proposed in Tinkercad: the first following the teacher's demonstration and the second following a circuit and provided code. Students should conclude by evaluating the activity on a form.

Objectives: Create, apply and evaluate a circuit and code with Arduino in Tinkercad.

NARRATIVA

ACTIVITIES	MOTIVATION	TASKS	DURATION
presentation of the origin and constituent elements of an arduino demonstration of the use of the tinkercad platform and the arduino participation in a class on tinkercad assembly of components in tinkercad and its programming	acquire knowledge of robotics: ● know what free hardware is ● know what arduino is ● know what is the tinkercad simulation platform ● draw and code a circuit reflect on learning	watch the presentation sign up for tinkercad and proposed classroom follow the demonstration of how to turn on a led, elaborating the circuit and the programming code develop the circuit and programming code on how to connect 3 leds following a guide	**100 minutes**
class evaluation	reflect on learning	answer a form	

Reflection and evaluation:

Reflect and evaluate the activities carried out in a form, mentioning your personal opinion.

Resources:

Theoretical material about Arduino and Tinkercad

Tinkercad

4 - Título: CHALLENGES FOR THE IMPLEMENTATION OF EPR@LC

Adressed Area: Arduino and Tinkercad

Subject: Led controled by a potentiometer

Context: Using the arduino, the led and the potentiometer, through the arduino IDE, students acquire skills in the area of programming and logic circuits.

Objectives: Know the arduino board, understand how the analog and digital ports work and program the arduino using the arduino IDE.

Create a logic circuit, with a LED, a potentiometer, an arduino, a breadboard, jumpers and resistors, programming it logically so that a blinking LED controlled by the potentiometer works.

NARRATIVE

ACTIVITIES	MOTIVATION	TASKS	DURATION
Arduino Uno Introduction	Acquire knowledge about Arduino	Internet Information Search	**50 minutos**
show projects developed with the arduino board	Acquire some knowledge about the Capabilities of the arduino and its use	Reading some information about the arduino board and searching the internet	**50 minutos**
Conhecer alguns componentes (LEDs, resistências, potenciómetro, etc.)	Understand how to include them in the circuit	Carry out the first assembly (Les flashing/potentiometer)	**50 minutos**
Knowing some components (LEDs, resistors, potentiometer, etc.) Program the circuit of the first assembly so that the red LED turns on and off second by second. Increase or decrease the speed of the LED using the potentiometer	Understand how to create a circuit using arduino and other components or in Tinkercad online	Create a project with the working circuit	**50 minutos**

Reflection and evaluation:

It will be proposed to students to create a circuit that controls a led through a potentiometer.

The work must be developed in pairs using the Arduino IDE to program the circuit.

Resources: Computer; Breadboard; arduino board; Led; Resistance; Jumpers; Arduino IDE.

5- Learning Scenario for Module 1 - Computer Architecture

Title: Introduction to Tinkercad and Circuit Creation

Addressed area: Computer architecture

Subject: Creating and Testing Circuits with the Help of Programming

Context: In this module, it is intended that students understand and experiment with circuits based on programming.
Through a virtual environment, students access an Arduino board, making access to electronics easier, cheaper and more flexible.

Objectives:
- Develop 1 basic project with Arduino, using TinkerCad, assembling the circuit and its programming
- Present the automatically generated code in the project
- Minimize costs and risks of damage to hardware through the use of simulators before students come into contact with the physical board.

NARRATIVE

ACTIVITIES	MOTIVATION	TASKS	DURATION
Enter the Tinkercad platform - Presentation of platform features	online platform -Virtual environment	-Log in/Register -Understand how the platform works	30 minutes
- Execute the worksheet circuit to later physically implement it on the arduino board	-Create circuits without having to use physical components	- Select/drag the components to be used (Arduino, Resistor, LED, Connection wires) - Run the circuits (When turning on the board, the LES should flash and stay on for 6 seconds and then turn off)	30 minutes

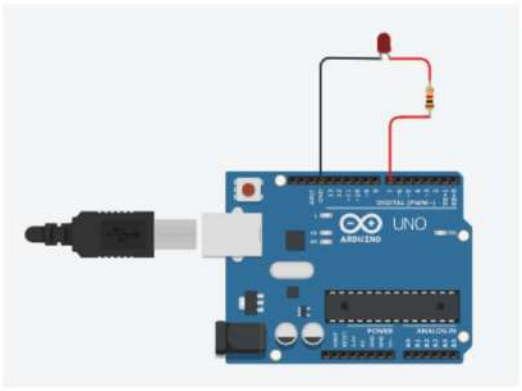
Reflection and evaluation:

Carrying out an exercise in Tinkercad

The proposed project aims to point out the possible qualitative gains in the process of learning algorithms when using a ludic, simple and flexible method, different from the one traditionally used by teachers.
For this, a project will be developed that will serve as a basis for the proposal to use Arduino in the classroom, in such a way that it can raise the level of motivation and satisfaction of students.
When carrying out the project, students simulate a circuit, being able to redo the same project as many times as necessary and the teacher can stimulate new challenges and concepts of Physics and programming.
This type of software should be part of every teacher's and student's daily life, because by adding this technology to the context of classes, a new process is created, more dynamic and active in the execution of tasks. The student becomes more dynamic and becomes his own teacher, where instructions can be repeated countless times.

Resources:

- Computer
- Tinkercad software
- Work sheet
- Carry out the following circuit: When turning on the board, the LED should flash and remain on for 6 seconds and then turn off)



```
// C++ code
//
void setup()
{
  pinMode(7, OUTPUT);
}

void loop()
{
  digitalWrite(7, HIGH);
  delay(6000); // Wait for 6000 millisecond(s)
  digitalWrite(7, LOW);
  delay(6000); // Wait for 6000 millisecond(s)
}
```

6- Title: SIMULATION IN THE TINKERCAD APPLICATION

Addressed area: Arduino

Subject: Simulation of Moving Characters on an LCD

Context: The projects carried out on the Tinkercad platform, namely the circuits (Arduino) lead students to acquire knowledge of electronics and programming. In terms of electronics, students experiment with connections (to the Arduino board), sensors, among other components, in relation to programming (Arduino ID), students begin to learn the C/C++ language.

Objectives: Set a character set in motion.

NARRATIVE

ACTIVITIES	MOTIVATION	TASKS	DURATION
Presentation of the Tinkercad platform and Arduino	Acquire knowledge of the Arduino board	Assembly of simple projects in the application	**5 hours**
Assembly of components in Tinkercad	Understanding Tinkercad features Simulate different projects	Create a project with the working circuit	**100 minutes**

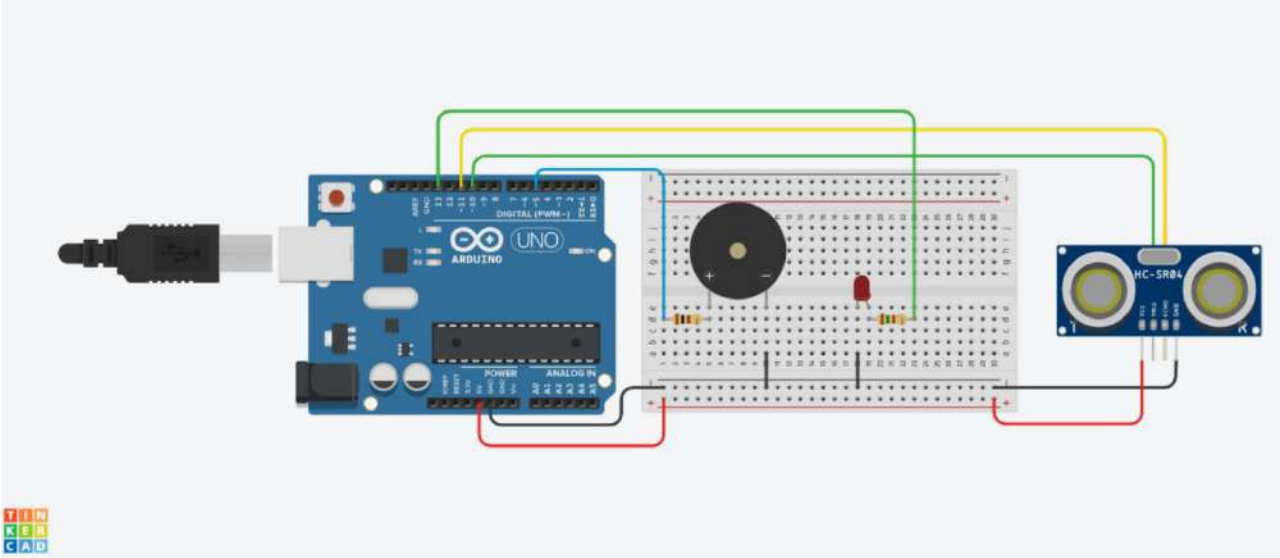
Reflection and evaluation:

Students will be challenged to create different circuits to solve problems. Students in the programming and robotics club must measure their success based on how the circuit works.

They must collaborate with each other, programming their own ideas.

Materials used in Tinkercad:

- ✓ 2 resistor;
- ✓ Distance sensor;
- ✓ Buzzer;



Code:

```
int Distancia = 0;
long readUltrasonicDistance(int triggerPin, int echoPin)
{
pinMode(triggerPin, OUTPUT); // Clear the trigger
digitalWrite(triggerPin, LOW);
delayMicroseconds(2);
// Sets the trigger pin to HIGH state for 10 microseconds
digitalWrite(triggerPin, HIGH);
delayMicroseconds(10);
digitalWrite(triggerPin, LOW);
pinMode(echoPin, INPUT);
// Reads the echo pin, and returns the sound wave travel time in microseconds
return pulseIn(echoPin, HIGH);
}
void setup()
{
pinMode(13, OUTPUT);
pinMode(5, OUTPUT);
}
void loop()
{
Distancia = 0.01723 * readUltrasonicDistance(10, 11);
```

```
if (Distancia <= 50) {
digitalWrite(13, HIGH);
digitalWrite(5, HIGH);
delay(1000); // Wait for 1000 millisecond(s)
digitalWrite(5, LOW);
delay(1000); // Wait for 1000 millisecond(s)
} else {
digitalWrite(13, LOW);
digitalWrite(5, LOW);
}
}
```

7- Title: Calculation of the area of a square

Addressed area: Arduino

Subject: Create and Test a Learning Scenario

Context: The projects that students carry out on the Tinkercad platform allow them to acquire knowledge in electronics and programming, especially in the context of Arduino circuits. In what it refers to electronics, students can experiment with different types of connections to the Arduino board and learn how to use different components including sensors, LCD display. With regard to programming, when using Arduino, students have also the opportunity to familiarize yourself with the C/C++ language.

Objetives: Calculate an area.

NARRATIVE

ACTIVITIES	MOTIVATION	TASKS	DURATION
Presentation of the Tinkercad platform and Arduino	Acquire knowledge of the Arduino board. Understand the features of Tinkercad. simulate different projects	Assembly of simple projects in the application...	**2 hours**
Assembly of components in Tinkercad		Create a project with the circuit running; Student Assessment and Perceptions; Teacher's reflection	**6 hours**

Reflection and evaluation:

Students in the class will be encouraged to create different circuits to solve specific real-life problems. To evaluate the success of their creations, they will have to base themselves on the functioning of the circuits and collaborate with each other, sharing and programming their own ideas.

Materials used:

Proceed to assemble the circuit in figure 1, considering the needed sources:

- ✓ Arduino UNO with USB cable;
- ✓ Mounting plate;
- ✓ 16x2 LCD display;
- ✓ 2 resistors of 1 KΩ;
- ✓ Connection cables.

Implementation:

Learning scenario model to be implemented:

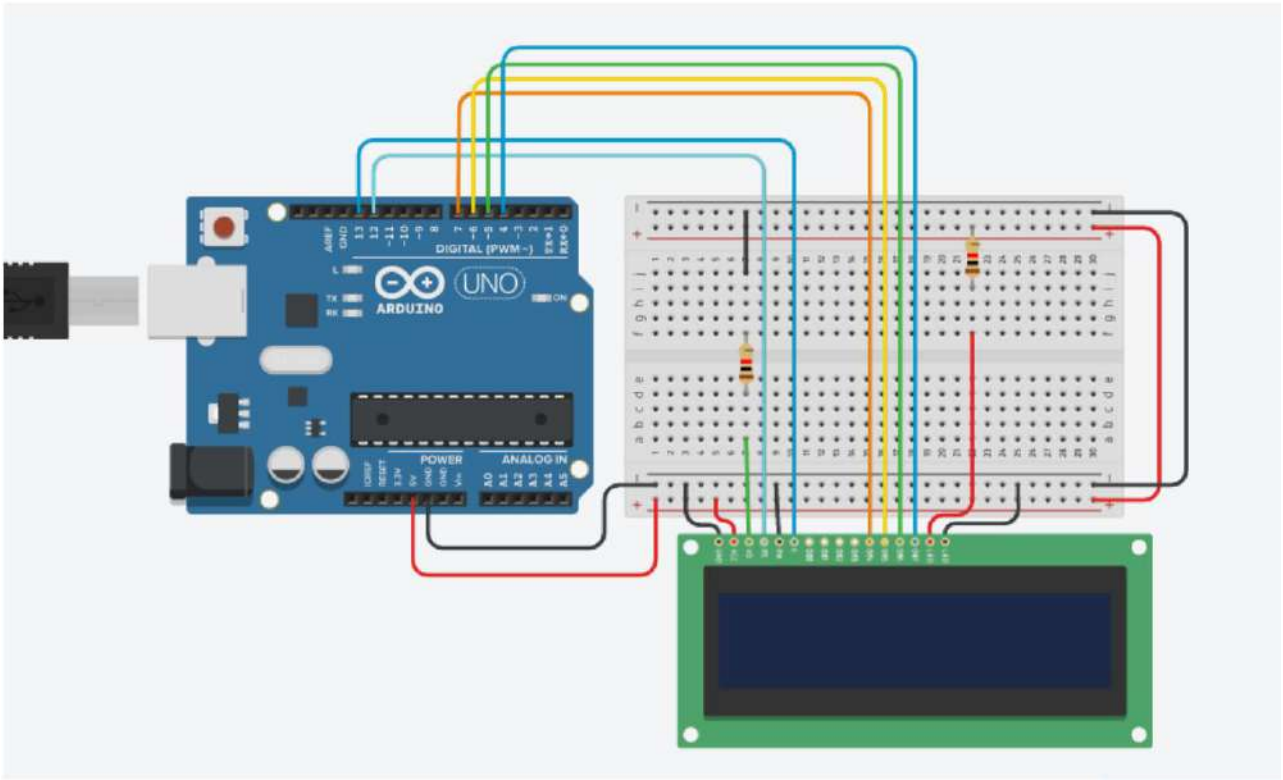


Figura 1 – Circuito com Display LCD

1. We want to calculate and display the area of a square. Whenever the cycle of the loop() function starts, a counter must be incremented, which will be the length of the side of the square in cm. To do so, change the code as follows:

1.1. Declare the variable area of type int and initialize it to zero.

1.2. Declare the variable cont of type int and initialize it to zero.

1.3. Calculate the area of the square, considering the value of the variable cont as the side of the square, storing the result in the area variable.

1.4. Display the text “Square Area:” on the first line of the display.

1.5. Show on the second line of the display the value of the area of the square and the text “ cm2”.

1.6. Take a 5 second break.

2. Test the circuit. Analyze its operation.

2. Teste o circuito. Analise o seu funcionamento.

3. Download the file with the circuit and send it to the Teams platform in the class assignment.

Code:

```
#include <LiquidCrystal.h> // Adiciona a biblioteca "LiquidCrystal" ao projeto

LiquidCrystal lcd(12, 13, 7, 6, 5, 4);

int area=0;
int cont=0;
void setup()
{
  lcd.begin(16, 2);
}

void loop()
{
  cont++;
  lcd.clear();
  lcd.setCursor(1, 0);
  lcd.print("Area Quadrado:");
  lcd.setCursor(5, 1);
  area=cont*cont;
  lcd.print(area);
  lcd.print(" cm2");
  delay(5000);
}
```

8- Title: Pedestrian traffic light with button requesting passage

Addressed area: Tinkercad and Arduino

Subject: Create and Test a Learning Scenario - Traffic light for pedestrians with button requesting passage.

Context: This school is equipped with a road circuit and a training room with audiovisual means that allow to promote continuous actions, theoretical and practical, of road education among students, providing them with the knowledge and skills necessary for an adequate integration in road traffic.

Objetives:The main objective of this project is to present to students, in particular students of inclusive education, the real practice of an observer, and how this influence our lives. A second objective is to raise discussions and awaken interest in the subject, to promote research and autonomous work. Respecting the contents of the module: Know and use the circuit simulation platform (Tinkercad) and connect the Arduino board to a computer and use the Arduino IDE to program it.

NARRATIVE:

ACTIVITIES	MOTIVATION	TASKS	DURATION
Presentation of the project and new components (push button, leds) to create learning scenarios	Understand how the different components are physically assembled and act simultaneously	Analysis of the proposed model and possible changes	50 min
Prepare a learning scenario and apply it in a context pedagogical		Create and program the circuit. - Assessment Students' reflections; Teacher reflections;	200 min

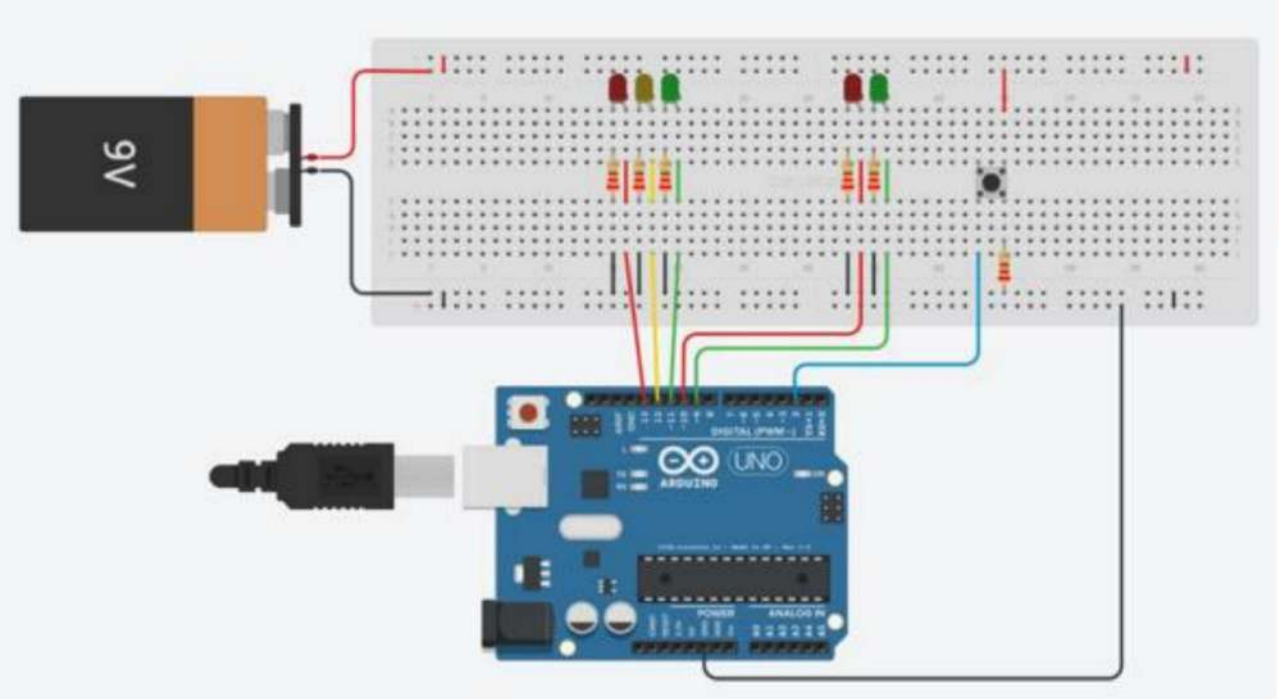
Reflection and evaluation:

The balance, which is frankly positive, allows for the discussion of ideas, building arguments to support decision-making. Promotes inter and transdisciplinary projects inside and outside the classroom; Students are able to collaboratively develop transversal cognitive skills and use various technological resources in order to organize knowledge and solve problems.

Resources:

- ✓ Arduino R3 board
- ✓ Breadboard
- ✓ Push button
- ✓ Yellow LED, Green LED and Red LED, 220 Ω resistors and 10 KΩ resistor

Circuit:




```
// SEMÁFORO PARA PEÕES COM BOTÃO A SOLICITAR PASSAGEM
int ledDelay = 200; // Tempo entre mudança de estado
int CarVermelho = 13;
int CarAmarelo = 12;
int CarVerde = 11;
int PeaVermelho=10;
int PeaVerde=9;
int Boton=2;
int TempoParaAtravessar = 5000;
unsigned long changeTime; // Tempo desde que o botão foi acionado
void
setup()
{
Serial.begin(9600);
int i,j;
for(i=9;i<14;i++)
{
pinMode(i,OUTPUT);
digitalWrite(i,LOW);
}
for(i=9;i<14;i++)
{
digitalWrite(i,HIGH);
delay(ledDelay/3);
}
for(i=9;i<14;i++)
{
digitalWrite(i,LOW);
delay(ledDelay/3);
}
}
void RotinaDeLuzes()
{
int estado=0;
for(estado=1;estado<4;estado++)
```

```
{
switch(estado)
{
case(0):
digitalWrite(CarVermelho, LOW);
digitalWrite(CarAmarelo, LOW);
digitalWrite(CarVerde, LOW);
digitalWrite(PeaVermelho, LOW);
digitalWrite(PeaVerde, LOW);
break;
case(1):
digitalWrite(CarVermelho, HIGH);
digitalWrite(CarAmarelo, LOW);
digitalWrite(CarVerde, LOW);
digitalWrite(PeaVermelho, LOW);
digitalWrite(PeaVerde, HIGH);
break;
case(2):
digitalWrite(CarVermelho, LOW);
digitalWrite(CarAmarelo, HIGH);
digitalWrite(CarVerde, LOW);
digitalWrite(PeaVermelho, HIGH);
digitalWrite(PeaVerde, LOW);
break;
case(3):
digitalWrite(CarVermelho, LOW);
digitalWrite(CarAmarelo, LOW);
digitalWrite(CarVerde, HIGH);
digitalWrite(PeaVermelho, HIGH);
digitalWrite(PeaVerde, LOW);
break;
}
delay(ledDelay);
digitalWrite(CarVermelho, LOW);
digitalWrite(CarAmarelo, LOW);
digitalWrite(CarVerde, LOW);
digitalWrite(PeaVermelho, LOW);
digitalWrite(PeaVerde, LOW);
}
}
void PassagemDePeoes()
{
int estado=0;
Serial.println(“pasagem de peoes”);
for(estado=1;estado<3;estado++)
{
switch(estado)
{
case(1):
digitalWrite(CarVermelho, LOW);
digitalWrite(CarAmarelo, HIGH);
digitalWrite(CarVerde, LOW);
digitalWrite(PeaVermelho, HIGH);
digitalWrite(PeaVerde, LOW);
break;
case(2):
digitalWrite(CarVermelho, HIGH);
digitalWrite(CarAmarelo, LOW);
digitalWrite(CarVerde, LOW);
digitalWrite(PeaVermelho, LOW);
digitalWrite(PeaVerde, HIGH);
break;
}
delay(ledDelay);
digitalWrite(CarVermelho, LOW);
digitalWrite(CarAmarelo, LOW);
digitalWrite(CarVerde, LOW);
```

```
digitalWrite(PeaVermelho, LOW);
digitalWrite(PeaVerde, LOW);
}
}
void loop()
{
int
EstadoBoton=digitalRead(Boton);
if(EstadoBoton == HIGH && (millis() – changeTime) > 5)
{
PassagemDePeoes();
}
else
{
RotinaDeLuzes();
}
}
```

9- Title: CHALLENGES FOR THE IMPLEMENTATION OF EPR@LC

Addressed area: Electronic Circuits, Arduino / Tinkercad Platform

Assunto: Criar e Simular um semáforo com 3 leds (amarelo, verde e vermelho)

Subject: Within the scope of the complementary offer discipline of "Programming and Robotics", in the 9th grade, through working with the Tinkercad platform and later with Arduino Boards, students will be able to acquire and consolidate knowledge about Arduino and some of its components.

Objetives:

•Develop algorithmic thinking and problem solving;

• Know the main potential of the Tinkercad platform, namely in the area of circuits;

• Know the Arduino board, understand how the analog and digital ports work.

• Program the Arduino using the Arduino IDE.

• Make a logic circuit, with 3 led's, and resistors, programming it logically so that it works as a semaphore simulator.

NARRATIVE

ACTIVITIES	MOTIVATION	TASKS	DURATION
Exploring the Tinkercad platform		Presentation of the Tinkercad Platform and access through the class created by the teacher.	**50 m**
Traffic light circuit simulation and block programming	Make a short video to record evidence and also submit it on the Moodle platform	Exploration of the circuit area and assembly of the traffic light circuit simulation, following instructions in a script	
Briefly explain the arduino board	Acquire some knowledge about the main capabilities of the Arduino board.	Explore a brief manual about the Arduino board;	**150 m**
Assembly of the physical circuit on the Arduino Board; Programming in Arduino IDE software and Traffic light effect testing Download programming and deliver on the Moodle Platform Make a short video to record evidence and also submit it on the Moodle platform	Understand how to connect components to the Arduino board. Check the functioning of a electronic board. Develop problem solving	Create, based on the project carried out in Tinkercad, the Traffic Light project on the Arduino Board (assemble and create connections) Perform programming in the Arduino IDE to achieve the Intended result, test and correct errors if necessary. Download the schedule and record the "traffic light" in action on video. Submit both files on the Moodle platform	

Reflection and evaluation:

• Students will be challenged to create a circuit to solve the proposed challenge: Traffic Light Activity.

• Students will work in pairs, solving the problems they encounter during the course. activity.

• As an assessment, students hand in the programming and video of the board performing the traffic light challenge. In the case of Tinkercad, the teacher has immediate access to the students' work.

• For those students who can perform the activity faster, it is suggested to carry out a challenge extra (traffic light with button).

Resources:

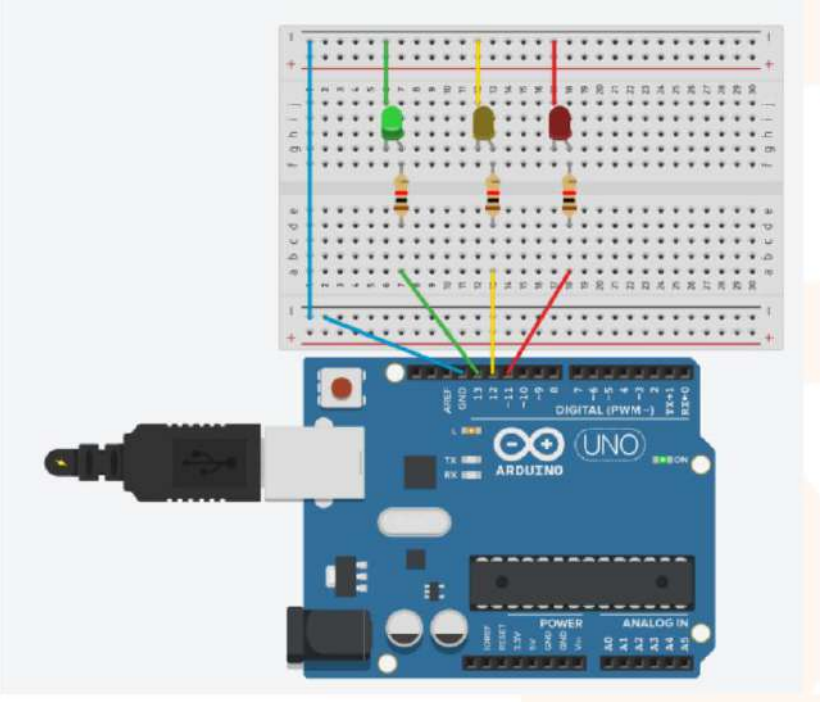
• Computers with Internet access and projectors;

• Tinkercad Online Tool;

• Arduino Kits;

• Students' cell phones

Circuit schematic in TinkerCad:



Note: This activity will be applied at the beginning of the 3rd period, in the 9th grade classes

10- Title: Traffic light simulator

Addressed area: Arduino

Subject: Create and Test a Semaphore

Context: In this activity, it is intended that students start their learning in electronics. They must build a circuit that allows simulating the operation of a traffic light, using the Tinkercad Circuits platform.

It is an activity that fits into the contents of the technical disciplines of the GPSI professional course, namely in Computer Architecture (AC) and in Programming and Information Systems (PSI).

Objetives:

1. Discover and explore the Tinkercad platform online
2. Know the Arduino board and understand how the different ports (analog and digital) work.
3. Identify and select the components needed to create the circuit.
4. Make a logic circuit, with 3 LEDs, and resistors, programming it logically so that it works as a traffic light simulator with 3 LEDs.
5. Apply the logic circuit to the Arduino.

NARRATIVE

ACTIVITIES	MOTIVATION	TASKS	DURATION
Eploring the Tinkercad online platform and understanding how arduino board works	Develop skills in using tinkercad platform online and the practival aplication in arduino in a more effective way	installation and operation of tinkercad based on the guidelines presented by the teacher, sharing knowledge among students and also autonomously	**100 minutes**
Development of logical circuit of the project	Understand how to connect components to the arduino board e how to control them by programming	Purpose of analysis of the project, based on a logic circuit and debate of ideas between peers	
Replication from the logical project in Arduino microcontrolador	Knowing the arduino IDE	implementation of the logic circuit and sharing in the classroom	**50 minutes**

Reflection and evaluation:

In the classroom, students share their solutions and reflect on what could be optimized.

The project developed must respond to the guidelines for creating the circuit: schematic and code (programming).

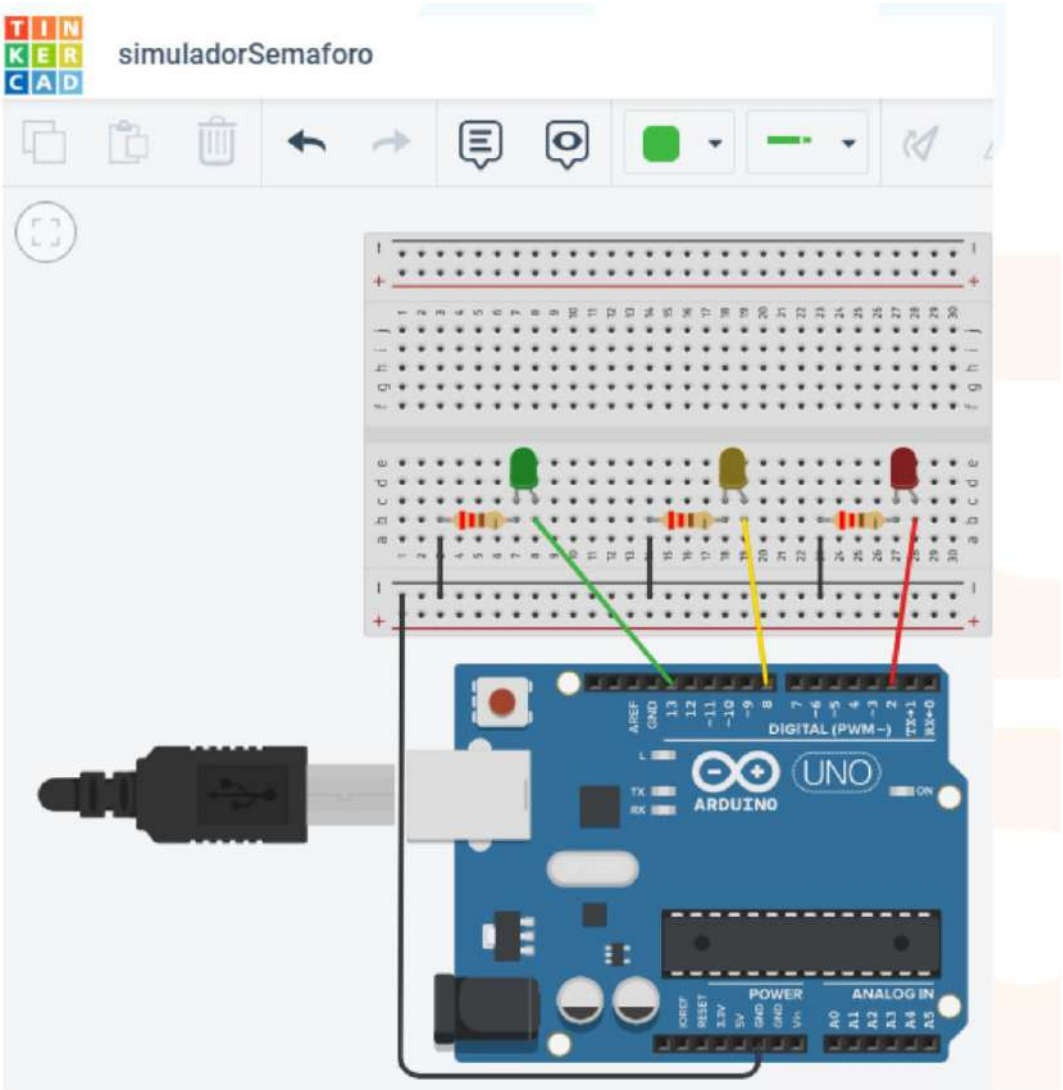
Creativity and innovation are valued.

Resources:

- Computer and Internet access
- Tinkercad application software (circuits) online
- Arduino board;
- Small breadboard;
- 3 LEDs;
- 3 resistors with 220Ω;
- wires

Circuit:

•Scheme:



Code:

```
// C++ code
//
#define ledPinG 13 //porta digital led verde
#define ledPinY 8 //Porta digital led amarelo
#define ledPinR 2 //Porta digital led vermelho

void setup(){
  //Definir as portas digitais dos leds como OUTPUT
  pinMode(ledPinG, OUTPUT);
  pinMode(ledPinY, OUTPUT);
  pinMode(ledPinR, OUTPUT);
}
void loop(){
  //Ligar o led verde e desligar os outros leds
  digitalWrite(ledPinG, HIGH);
  digitalWrite(ledPinY, LOW);
  digitalWrite(ledPinR, LOW);
  delay(5000); //Esperar 5 segundos
  //Ligar o led amarelo e desligar os outros leds
  digitalWrite(ledPinG, LOW);
  digitalWrite(ledPinY, HIGH);
  digitalWrite(ledPinR, LOW);
  delay(1000); //Espera 1 segundo
  //Ligar o led vermelho e desligar os outros leds
  digitalWrite(ledPinG, LOW);
  digitalWrite(ledPinY, LOW);
  digitalWrite(ledPinR, HIGH);
  delay(5000);
}
```

Programming guidelines:

Traffic light operating rules: Only one LED can be lit at a time. Each time a LED lights up, you must ensure that the other LEDs are off.

Color sequence:

Lights up Green (5 seconds then turns Yellow)

Lights up Yellow (1 second then turns Red)

Lights up Red (5 seconds then turns Green)

Schedule:

1st - Define which pins correspond to each led: #define

2nd - Configure the pins of the leds as output pins: pinMode

3rd - Use the digitalWrite function to turn on/off the leds and the delay function to determine the waiting time between traffic light transitions.

11- Title: Intelligent Lighting

Addressed area: Arduino

Subject: Turning on LEDs automatically with the LDR light sensor.

Context: This scenario enables the learning of programming and electronics and will help and challenge students to build technological solutions to solve real world problems. Therefore, it is intended that, through the Arduino board, some electronic components and sensors, students (in pairs) build an automation system that simulates the intelligent connection of a led through a light sensor (LDR).

Objectives:

- Foster interest in STEAM, in the areas of computing and electronics;
- Understand what Arduino is and its use;
- Know the functioning and types of ports for the Arduino;
- Knowing the IDE and basic programming for Arduino;
- Understand basic concepts of electronics;
- Assemble automation projects

ACTIVITIES	MOTIVATION	TASKS	DURATION
Introduction of Basic Electronic Concepts	Aquire knowledges about basic electronic components (resistors, Leds, Light sensors LDR)	Visualization of an electronic presentation about electrical energy, electrical voltage and electronic components	**30 min**
Introduction of an arduino board	Visualization of some elaborated projects with arduino	Guided Search of web pages with similar projects.	**30 min**
Explain the features and types of ports of Arduino	Know the arduino board	Visualization of an electronic presentation about arduino board	
Electronic circuit assembly	Understanding how to create a circuit using Arduino	Using a 'breadboard' protoboard, assemble the circuit according to the diagram presented by the teacher	**30 min**
arduino IDE installation	know the software to write and upload programs on arduino boards	visit arduino IDE official page, download and install the software	**5 min**
Arduino Programming	Develop logical and computational thinking	write the program and load it on the arduino	**30 min**
test the functioning of the arduino circuit	analysis and correction of programming errors or circuit assembly	circuit test	**10 min**

Reflection and evaluation:

• Promoting dialogue to find out what were the biggest difficulties encountered by students in realization of the learning scenario.

• Students carry out their self-assessment and peer assessment.

• Discuss new challenges, such as adding a horn sound to the lighting effect.

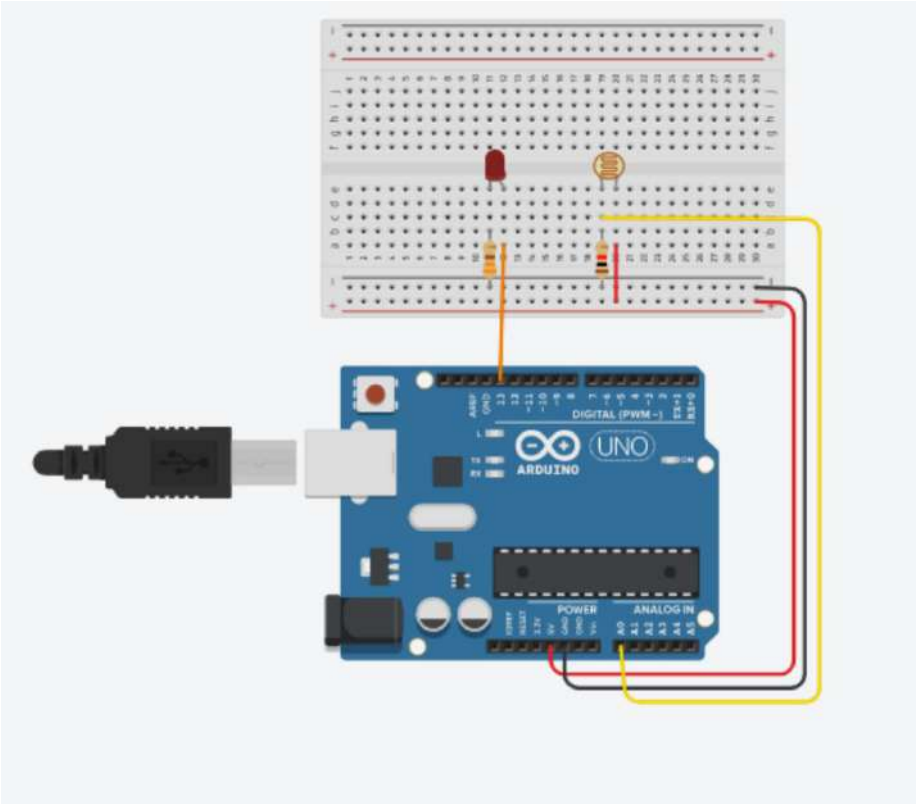
Resources:

• Computer

• ArduinoIDE

• Arduino board, protoboard, resistors, light sensors (LDR) and connecting wires.

• Electronic presentation of contents.



```
// C++ code
//
int sensorluz;

void setup()
{
  pinMode(13, OUTPUT);
  Serial.begin(9600);
}

void loop()
{
  sensorluz = analogRead(A0);
  Serial.println(sensorluz);

  if (sensorluz <500)
  {
    digitalWrite(13, HIGH);
  }
  else
  {
    digitalWrite(13, LOW);
  }
}
```

12- Title: Text message display on LCD display 16*2

Addressed area: Tinkercad and Arduino

Subject: Create and Test a Learning Scenario – Text message display on the 16*2 LCD display

Context: The school consists of computer rooms, used for teaching the syllabus within the scope of Information and Communication Technologies, equipped with audiovisual means and various electronic and micro robotic equipment and materials that allow the teaching-learning process to become fully hybrid, through the carrying out of experimental activities that allow the consolidation of theoretical learning and consequently the acquisition of knowledge and practical skills that are decisive in the success of the educational process of students in the different syllabus taught. The process of educational digitization is always present in pedagogical practice, as an indispensable tool in an area of training in constant technological evolution.

The present project is applied to students of the 2nd cycle, namely, of the 6th year of schooling, in the last unit of the discipline of Information and Communication Technologies, entitled Programming of Electronic Boards.

General objectives:

- Awaken interest in the technological area;
- Promoting autonomous work and critical thinking;
- Develop logical reasoning.

Specific Objectives (technical):

- Display and explore the 16*2 LCD display;
- Use the electronic circuit simulation platform (Tinkercad);
- Develop algorithms;
- Create programming code for Arduino, using your IDE;
- Perform electronic assembly;
- Test and repair possible software and/or hardware errors in the project

ACTIVITIES	MOTIVATION	TASKS	DURATION
Presentation of the project, equipment (breadboard, arduino board) and electronic components (LCD display, potentiometer, electrical resistance) to create learning scenarios.	Application of a project-based teaching-learning methodology through the placement of a problem that provides learning through its resolution, fostering an educational process centered on the student. Application of practical teaching through experimentation	Analysis of the proposed model and possible changes	**50 min**
Creation of the learning scenario and application in a pedagogical context		-Create, program and test the circuit in Tinkercad; -Circuit assembly on breadboard; - Conducting function tests, debugging and repairing possible errors; - Assessment; Students' perceptions; Teacher reflection;	**200 min**

Reflection and evaluation:

The evaluation of the project was an integral part of the teaching-learning process, having served as a key tool in the course of the teaching and learning process and consequently in the acquisition of knowledge/skills by the students. The evaluative process was triggered by combining the formative and summative assessments, with the formative assessment having greater final weight. The balance of the project activity carried out is frankly positive, taking into account the final results obtained, the consequent assessments of the students and the follow-up carried out, of the evolution of the teaching-learning process, by the teacher.

It was proven that the use of a project-based methodology, with the application of a hybrid teaching model, with a strong practical component, allowed all students to reach the objectives proposed in the activity, regardless of the abilities and pace of learning of each one.

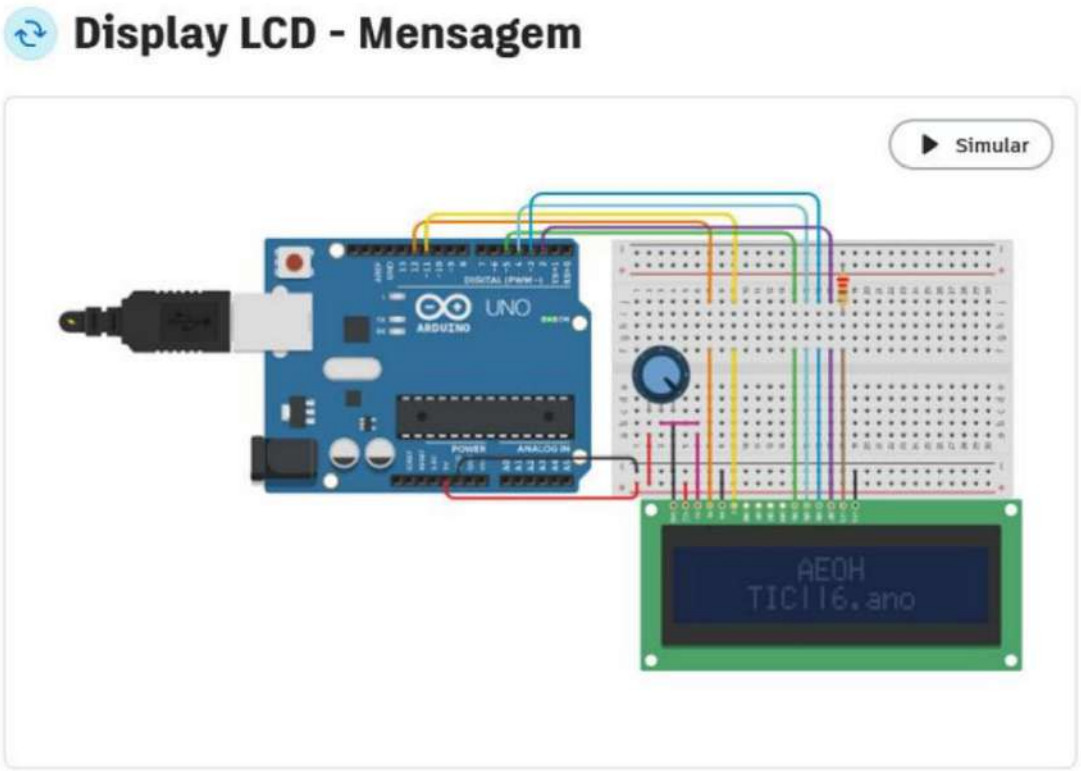
The students were very interested and motivated with the activity carried out.

The least positive aspect verified was the limitation of equipment available for carrying out the project, namely in the practical assembly phase, since there were only 8 braedboards and 8 Arduino boards available in terms of hardware. This situation conditioned the initial planning, as it was intended to form working groups of 2 students and, in the case of a class with a total of 24 students, it forced the formation of working groups of three students.

Resources:

- Tinkercad platform;
- Arduino IDE software;
- Arduino R3 board;
- Breadboard plate;
- Electrical conductors;
- 16*2 LCD display;
- Potentiometer (variable rheostat);
- Electrical resistance of 220 Ω

Hardware - Circuito Eletrónico



Arduino IDE Software – Programming code

13- Title Addressed area: Arduino

Subject: Simulator of a traffic light (3 leds) with Arduino

Context: With the growing importance of technologies in today's society, it becomes increasingly relevant for students to have the opportunity to develop skills in programming and robotics.

This scenario allows promoting learning through problem solving, practical projects and group activities. It is intended that, as a group, students build a traffic light simulator, using an Arduino board and some electronic components.

Objetives:

- Foster students' interest in science and technology, especially in the area of programming and robotics;
- Develop practical skills in programming and robotics;
- Stimulate critical thinking, creativity and problem solving;
- Encourage teamwork and collaboration among students.

ACTIVITIES	MOTIVATION	TASKS	DURATION
Presentation and operation of the arduino board arduino board	View examples created with the arduino Getting to Know the Arduino Board	View and analyze the materials available (activity guide, videos, electronic components, tools).	**90 min**
Assembly of the circuit on the Arduino Board	Understanding how a circuit works - Arduino	Identify and download the programs necessary for programming the simulation	**90 min**
Arduino programming	Develop practical programming skills Stimulate critical thinking and creativity and problem solving	for programming the simulation of the operation of a traffic light	
Presentation of the final product. Delivery of files on the Moodle Platform	Encouraging the students to develop practical projects, until implementation, to apply the learning concepts	Present and share information about the process of assembling, programming and installing the programs necessary for programming the Arduino board, using digital means of communication and collaboration.	**45 min**

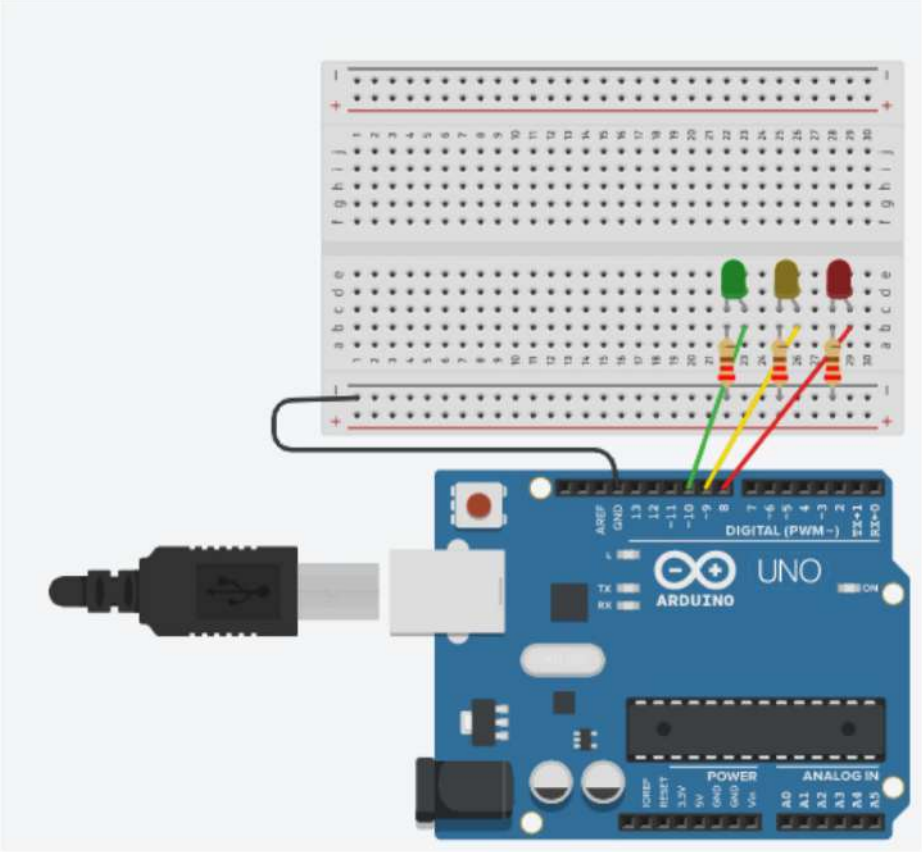
Reflection and evaluation:

Collaborative work promotes students' autonomy, responsibility and critical spirit. The assessment of learning will be carried out through direct observation of the dialogue established with the students, and must include the assessment rubrics. After the presentation of the works, the different groups will evaluate the work carried out by their colleagues. Students carry out their self-assessment and peer assessment using forms (Google Forms).

Resources:

- Computer;
- Breadboard;
- An Arduino board;
- 3 LEDs (red, yellow, green);
- Jumper wires;
- 3 resistors of 220 Ω (ohm).

Scheme and code:



```
void setup() {
  pinMode(8, OUTPUT); //Led vermelho
  pinMode(9, OUTPUT); //Led amarelo
  pinMode(10, OUTPUT); //Led verde
}

void loop() {
  //acende a luz verde durante 5 segundos
  digitalWrite(10, HIGH);
  delay(5000);

  //apaga a luz verde e acende a amarela durante 3 segundos
  digitalWrite(10, LOW);
  digitalWrite(9, HIGH);
  delay(3000);

  //apaga a luz amarela e acende a luz vermelha durante 5 segundos
  digitalWrite(9, LOW);
  digitalWrite(8, HIGH);
  delay(5000);
}
```

14- Title: Using Arduino and Sensors – "First steps with Arduino"

Addressed area: Arduino; Programming

Subject: How to create a circuit with some sensors and use them for teaching purposes

Context: Through working with the Arduino using the connection to various electronic components, students acquire knowledge related to the process of installing the Arduino IDE, necessary materials and structuring and implementing a program.

Objectives: Understand the concepts associated with the Arduino system and how to use the Arduino board, the analog and digital ports and the connection of various electronic components Understand how electrical energy is distributed across the breadboard in order to correctly connect the various components. Create a circuit in Tinkercad using jumpers(wires), a breadboard and a power supply. Program a circuit in Tinkercad applying programming, logic and electronics knowledge.

NARRATIVE

ACTIVITIES	MOTIVATION	TASKS	**DURATION**
Know the shields to control other devices such as motors and sensors.	Understand how to include them in the circuit if we use motors and sensors	Download and install libraries to control sensors, motors, and other components	1 hora
How to create a circuit with arduino	Understand how to create a circuit using arduino	create a circuit	1 hora
Create a circuit and program it	Understand how to create a circuit and program it in Tinkercad online	Create a circuit and program it	1 hora

Reflection and evaluation:

Students should create a circuit and program it using Tinkercad, explore the Tinkercad application, collaborate with each other and implement dynamics between peers. They will have to solve problems and carry out programmed activities.

Resources:

- Computer
- Internet connection
- Tinkercad (https://www.tinkercad.com/login)
- Support guide

15- Title: TINKERCAD | ELECTRONIC CIRCUITS

Addressed area: Arduino - Clube da Robotica | Basic education

Subject: Create a simulation of a rotating LED circuit using different colors

Context: through an online platform, students play by contacting the learning of concepts in the field of electronics and programming. Development of capacities and competences, of knowledge with application in the most varied areas of science and the labor market.

Goals:

Familiarize yourself with basic concepts of electronics and programming;

Contact with online platforms that allow simulating electronic circuits;

Establish a first contact with programming languages;

Develop problem solving skills.

ACTIVITIES	MOTIVATION	TASKS	DURATION
Apresentação de conceitos básicos de eletrónica e programação	Aprender os conceitos de eletrónica de programação	Breve explicação e visualização de pequenos videos	**1 hora**
Contacto com a plataforma Tinkercad - Circuitos	Compreender as Funcionalidades da plataforma	Realizar exemplos simples	**3 horas**
Criar circuitos na plataforma Tinkercad	Simular diferentes projeto	Criar um projeto com o circuito a funcionar	**1 hora**

Reflection and evaluation:

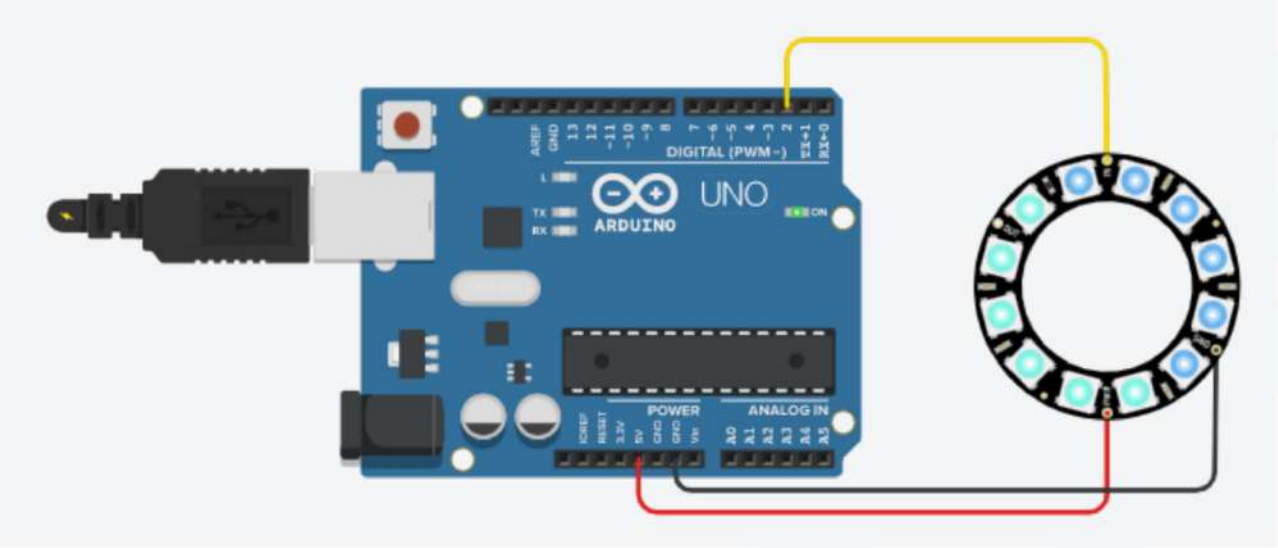
Tinkercad – Circuits allows students to simulate online real electronics environments together with programming. Challenges will be proposed, of different degrees of difficulty, so that students through collaborative work, succeed in solving the problem, which will culminate in the operation of the circuit.

Resources:

Computer with Internet access;

Tinkercad Platform – Circuits.

Simulation:




```
#include <Adafruit_NeoPixel.h>
#define PIN 2
#define NUMPIXELS 12 // numero de leds
Adafruit_NeoPixel pixels = Adafruit_NeoPixel(NUMPIXELS, PIN, NEO_GRB + NEO_KHZ800);
int delayval = 100; // tempo de delay
int redColor = 0;
int greenColor = 0;
int blueColor = 0;
// função setColor()
// gera valores RGB aleatórios
void setColor(){
redColor = random(0, 255);
greenColor = random(0,255);
blueColor = random(0, 255);
Serial.print("red: ");
Serial.println(redColor);
Serial.print("green: ");
Serial.println(greenColor);
Serial.print("blue: ");
Serial.println(blueColor);
}
void setup() {
pixels.begin();
Serial.begin(9600);
}
void loop() {
setColor();
for(int i=0;i<NUMPIXELS;i++){
pixels.setPixelColor(i, pixels.Color(redColor, greenColor, blueColor));
pixels.show();
delay(delayval);Cenários educativos
if (i == NUMPIXELS){
i = 0; // inicia tudo novamente
setColor();
}
}
}
```

16- Title - Simulate Temperature Sensor

Addressed area: Arduino

Subject: Creating and Testing a Temperature Sensor

Context: By carrying out this work with the Tinkercad circuits platform, students will be able to acquire and consolidate knowledge of electronics, logic, programming obtained in the different disciplines of the course (Computer Architecture, PSI, etc...). In this project, students will create a simple temperature sensor using an Arduino and a temperature sensor, plus a few other components.

Goals:

1. Understand how to use the arduino board.
2. Understand how and when to use the different ports (analog and digital).
3. Understand the basics of electronics.
4. Select and connect the necessary components to create the circuit.
5. Write the necessary code to control the sensor.
6. Test the sensor to verify that it is working properly.
7. Calibrate the sensor for more accurate results.

NARRATIVE

ACTIVITIES	MOTIVATION	TASK	DURATION
Presentation of a simple design. Explanation of the structure of a program	Understanding how to create a circuit using the TinkerCad tool and know at the same time that the same represents	Project analysis proposed and possible changes	**50 minutos**
Creation / Assembly of circuits know components to use		Create the project with working circuit detecting different temperatures	**60 minutos**
Presentation to the class	understand and understand the activity developed	Presentation to remaining group of students.	**50 minutos**

Reflection and evaluation:

- Analysis by each one, regarding their greatest constraints and virtues.
- Operation of the developed project.

- Presentation to the class

- Teacher evaluation regarding success or failure in carrying out the task, as well as the level of collaborative work between peers.

Resources:

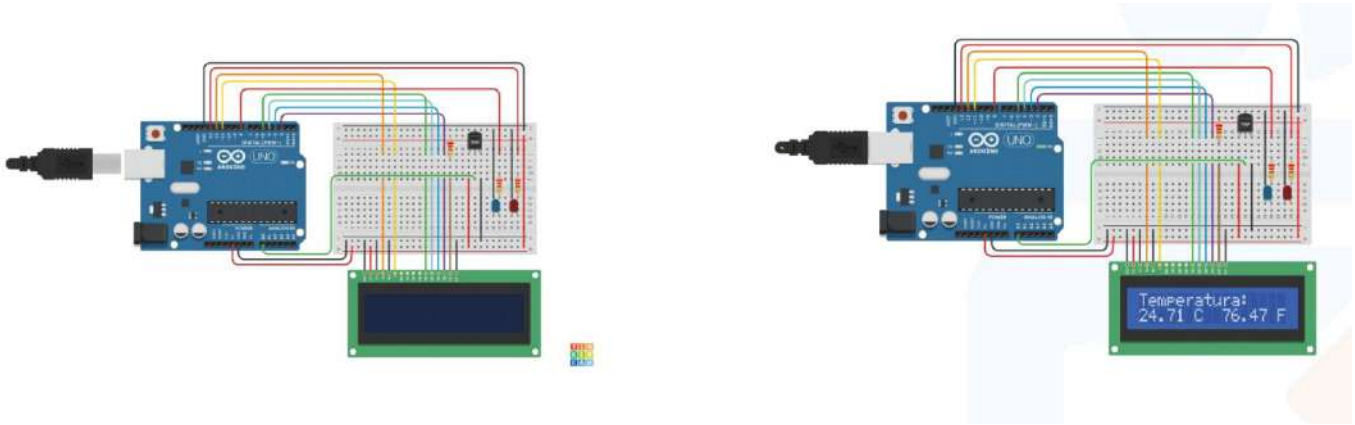
Software - Tinkercad application (circuits).

Portable/Desktop PC.

Arduino board, sensors, breadboard, jumpers, others;

Prototypes provided by the teacher.

Circuit:



Programming:

```
#include <LiquidCrystal.h>
LiquidCrystal LCD(12,11,5,4,3,2);
int SensorTempPino=0;
int AlertaTempBaixa=8;
int AlertaTempAlta=13;
int TempBaixa=0;
int TempAlta=40;
void setup()
{
pinMode(AlertaTempBaixa, OUTPUT);
pinMode(AlertaTempAlta, OUTPUT);
LCD.begin(16,2);
LCD.print("Temperatura:");
LCD.setCursor(0,1);
LCD.print(" C F"); }

void loop()
{
int SensorTempTensao=analogRead(SensorTempPino);
float Tensao=SensorTempTensao*5;
```

```
Tensao/=1024;
float TemperaturaC=(Tensao-0.5)*100;
float TemperaturaF=(TemperaturaC*9/5)+32;
LCD.setCursor(0,1);
LCD.print(TemperaturaC);
LCD.setCursor(9,1);
LCD.print(TemperaturaF);
if (TemperaturaC>=TempAlta)
{
digitalWrite(AlertaTempBaixa, LOW);
digitalWrite(AlertaTempAlta, HIGH);
}
else if (TemperaturaC<=TempBaixa){
digitalWrite(AlertaTempBaixa, HIGH);
digitalWrite(AlertaTempAlta, LOW);
}
else
{
digitalWrite(AlertaTempBaixa, LOW);
digitalWrite(AlertaTempAlta, LOW);
}
delay(1000);
}
```

17- Addressed area: Arduino, Tinkercad;

Subject: Create and Test a Learning Scenario

Context: Throughout the learning scenario, students will have the opportunity to work with practical examples of projects involving Arduino IDE, creating simple circuits using Tinkercad and programming them in C language. They will have the opportunity to interconnect components such as sensors, potentiometers or buttons, resistors, leds, breadboard and others, engaging with innovative methodologies.

Objectives: The objectives to be achieved by the students at the end of this learning scenario include mastery of basic concepts about electrical circuits in direct current; understanding the functioning and use of the Arduino microcontroller (function of the logic and analog gates), the connection of components through the breadboard, the development of basic programming skills in C language and the ability to implement interactive STEM projects.

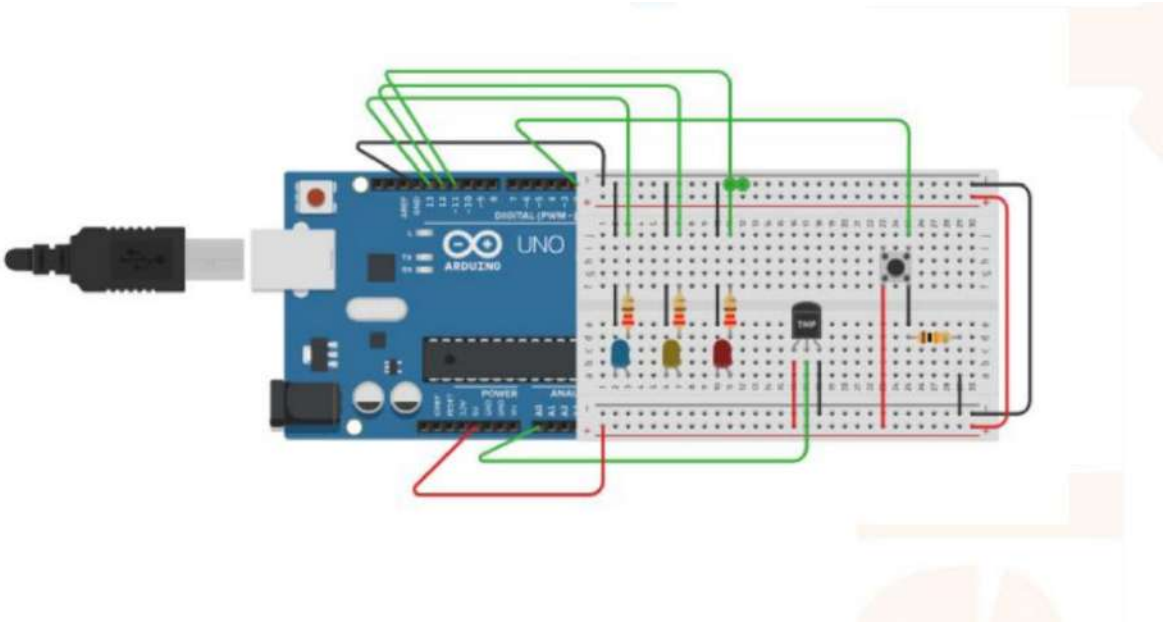
NARRATIVE

ACTIVITIES	MOTIVATION	TASK	DURATION
Apresentação das diferentes partes da placa arduino (portas lógicas e analógicas) Apresentar projetos desenvolvidos com a placa arduino	Aprendizagem baseada metodologias ativas, auto e hetero estruturantes, potenciando o conhecimento sobre as potencialidades do arduino e sua utilização pedagógica	Análise do problema proposto e possíveis alterações; Teste de projetos arduino; Inscrição no Tinkercad	**90 min**
Construção de um sensor de temperatura	Passos para construir circuitos com arduino IDE, envolvendo cenários de robótica educativa e de programação	Instalar bibliotecas para controlar sensores e outros componentes; Criar um circuito e programá-lo Criar um projeto com os circuitos a funcionar	**90 min**

Reflection and evaluation:

Reflection and evaluation: Students will be challenged to create a circuit that simulates a temperature sensor, collaborating with each other by programming in the Arduino IDE. They must solve problems and make scheduled activities.

Example provided:



C programming implement:

```
int LED_Vermelho = 11;
int LED_Amarelo = 12;
int LED_Azul = 13;
int Sensor_Temperatura = A0;
int ValorLido_SensorT = 0;
float Temperatura = 0;
int Botao = 2;
int Estado_Botao = 0;
int i = 0;
float PWM = 0; // Pulse Width Modulation, digital para analógico

void setup() {
  pinMode(LED_Vermelho, OUTPUT);
  pinMode(LED_Amarelo, OUTPUT);
  pinMode(LED_Azul, OUTPUT);
  pinMode(Sensor_Temperatura, INPUT);
  pinMode(Botao, INPUT);
  Serial.begin(9600); // taxa de transferência em bits por segundo
 }
```

```
void loop() {
   //Leitura e conversão da temperatura
   ValorLido_SensorT = analogRead(Sensor_Temperatura);
   Temperatura = ((0.488 * ValorLido_SensorT) - 49.76);

   //Condição inicial de funcionamento
   if (i == 0) {
    //Acender LED Azul
      if (Temperatura >= -25 && Temperatura <= 40) {
        digitalWrite(LED_Azul, HIGH);
      } else {
        digitalWrite(LED_Azul, LOW);
      }
    //Acender LED Amarelo
    if (Temperatura >= 40 && Temperatura < 60) {
      PWM = ((7.28 * Temperatura) - 182.14);
      analogWrite(LED_Amarelo, PWM); // varia o brilho do led
    } else {
      digitalWrite(LED_Amarelo, LOW);
    }
    //Acender LED Vermelho e piscar
    if (Temperatura >= 60 && Temperatura < 100) {
      digitalWrite(LED_Vermelho, HIGH);
      delay(200);
      digitalWrite(LED_Vermelho, LOW);
      delay(200);
    }
    //Acender todos os leds e bloqueia o sistema
    if (Temperatura >= 100)
    {
      digitalWrite(LED_Azul, HIGH);
      digitalWrite(LED_Amarelo, HIGH);
      digitalWrite(LED_Vermelho, HIGH);
      i = 1; //Condição para parar/bloquear
    }
  }
  //Ler estado do botão
  Estado_Botao = digitalRead(Botao);
  //Recomeçar/Desbloquear o sistema
  if (Temperatura <= 10 && Estado_Botao == HIGH) {
    digitalWrite(LED_Azul, LOW);
    digitalWrite(LED_Amarelo, LOW);
    digitalWrite(LED_Vermelho, LOW);
    i = 0;  //Voltar à condição inicial de funcionamento
  }
}
```

From the example provided, students will create new projects involving the acquired knowledge. At the end of the activity, students will be asked to provide feedback on the scenario and the activities carried out, allowing them to assess the pedagogical importance of the scenario and identify areas that can be improved. Students will also be asked to carry out a self-assessment in order to identify their strengths and weaknesses in relation to the activities carried out, as well as the choice of strategies and work methods that will help them to improve their skills in this area. It is edifying to implement this type of innovative active methodology for building electrical circuits involving Arduino boards, with simulation in Tinkercad and C programming, aiming at stimulating creativity, sharing and problem-solving skills in students, using STEAM projects with use of EPR.

In pedagogical terms, it is certainly constructive, since it involves students in the process of developing their own "knowledge", as well as allowing them to work on the areas of competence described in the PASEO document.

Resources:

- computer and access to Tinkercad;
- arduino UNO board, button, 3 leds (blue, yellow and red) temperature sensor, resistors, breadboard, connection wires
- tutorials and worksheets to promote self-knowledge on the topic;

18- Title: Arduino – Knight Rider Simulator (Leds blink sequentially and with reverse)

Addressed area: Arduino

Subject: Create and test a light sequence with LEDs (knight Rider)

Context: In this activity, the objective is to build a light sequence with LEDs, similar to the one used in the car from the series "O Punisher" (Knight Rider). The intention is to apply PSI and AC contents in the approach to the concept in a class of Management and Programming of Computer Systems. To begin with, it is necessary to select the components according to the list of materials and assemble the circuit following the representation in the figure below. Then it is necessary to program the circuit correctly. Before powering up the circuit, it is important to carefully confirm all connections. When the circuit is assembled, the LEDs will create a movement effect between each end of the row of LEDs.

Goals:

1. Understand how to use the Tinkercad platform.
2. Understand how to use the Arduino board.
3. Understand the basics of electronics.
4. Identify and select components according to the bill of materials.
5. Assemble the circuit as shown in the image “Circuit diagram”.
6. Carry out the respective programming.
7. Replicate the project developed in Tinkercad in the Arduino Microcontroller

ACTIVITIES	MOTIVATION	TASK	DURATION
Exploring the Tinkercad platform	Understand the process of creating a circuit using the online Tinkercad platform and acquire skills to use the platform effectively and reproduce safely on Arduino	Create an account on the platform and explore some tools	**50 min**
Introduction and operation of the arduino microcontroller		Visualization of an electronic presentation that addresses the main concepts related to electricity and electronics, as well as their fundamental components. Arduino Handbook.	**50 min**
Assembly of test circuits in Tinkercad with programming	Understand how to connect components to the Arduino board and how to control them through programming	Tutorial with explanation and assembly of circuits	**20 min**
Development of the logic circuit of the Tinkercad project		Analysis of the proposed project, design of the logic circuit and brainstorming on its efficient implementation, approach to the Array concept and its practical advantages	**30 min**
Concept and functioning of Aarrays (vectors) in C++	Understand the concept and operation of an Array. Advantages of its use		**10 min**
Replication of the project developed in the arduino microcontroller	Getting to Know the Arduino IDE	Implementation of the project developed in Tinkercad for arduino and sharing in the classroom. Possibility of creative adaptations to the project and presentation in the classroom in pairs	**50 min**

Reflection and evaluation:

In the educational dynamics of the classroom, students are encouraged to share their solutions and reflect on possible optimizations. The project to be developed must comply with the guidelines for creating the circuit, which involve both the schematic and the programming code. In addition, creativity and innovation are skills that are valued and encouraged throughout the learning process.

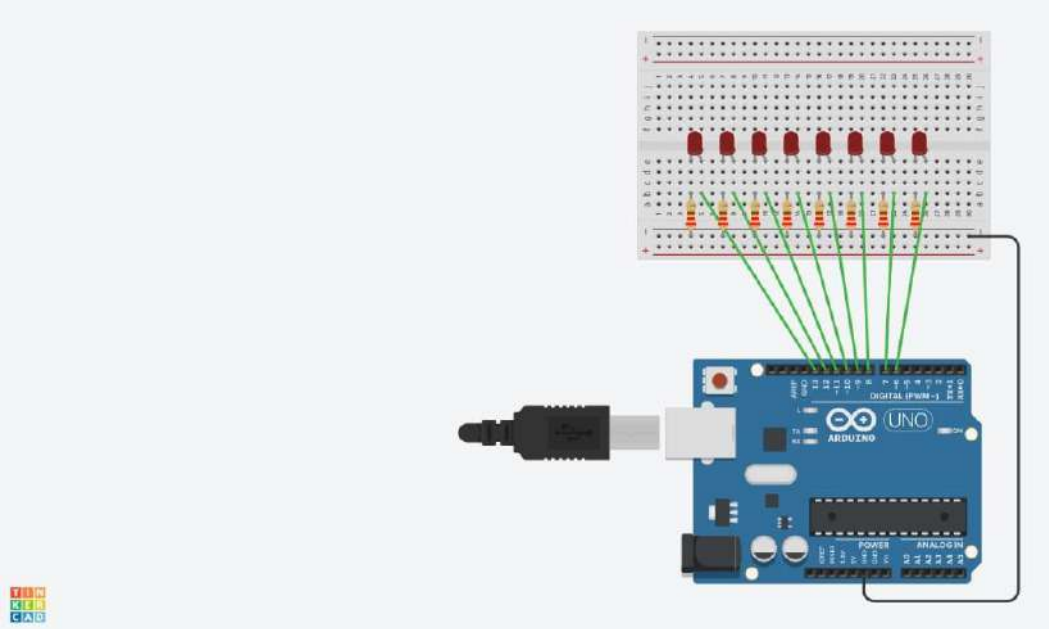
Resources:

- PC with internet access;
- Presentation of contents in Powerpoint.
- Arduino manual.
- Arduino basic kit.

Material needed:

8 leds	
8 Resistências 220 Ω	
Fios	
BreadBoard	
Placa Arduíno	

Circuit schematic:



Code:

```
// C++ code
//
//declaração de uma variável constante de um tipo especial: array de inteiros.
// ledPin[] identifica o nome do array e os valores dentro das chavetas permitem
//inicializar e atribuir o número das portas digitais a cada posição do array.
const int ledPin[] = {6, 7, 8, 9, 10, 11, 12, 13};
int i;
void setup()
{
  for (i =0; i<8;i++) {
    pinMode(ledPin[i], OUTPUT);
  }
}

void loop()
{
  //vão estar em simultâneo sempre 3 leds acessos
  for (i=0; i<6;i++) {
    digitalWrite(ledPin[i], HIGH);
    digitalWrite(ledPin[i+1], HIGH);
    digitalWrite(ledPin[i+2], HIGH);
    digitalWrite(ledPin[i-1], LOW);
    delay(100);
  }
  for (i=6; i>1;i--) {
    digitalWrite(ledPin[i], HIGH);
    digitalWrite(ledPin[i-1], HIGH);
    digitalWrite(ledPin[i-2], HIGH);
    digitalWrite(ledPin[i+1], LOW);
    delay(100);
  }
}
```

19- Title: Programming a Sound Traffic Light

Addressed area: Robotics, Citizenship

Subject: Programming the ARDUINO board to create a Sound Traffic Light to be installed in the school

Context: Sensitize students to the importance of silence in the classroom or in other educational spaces and show how robotics can be implemented as a form of signage that controls sound limits to be respected at the level of hearing health. The silence dealt with here is not interpreted as "absence of noise" but rather from the point of view of "controlled noise", which allows students and teachers a serene and peaceful coexistence that promotes learning and communication among all.

Thus, the creation of the "Sound Traffic Light" is framed within the areas of education for citizenship and programming and robotics, in order to make students aware of the control of noise at school and the associated advantages both in terms of levels of attention and concentration in the classroom and other school spaces, such as in relation to hearing health and respect for others. Examples were addressed for reflection on the importance of silence: Bar, Canteen, situation of group work, etc. This project has already been implemented and tested within the scope of the Computer and Robotics Club.

NARRATIVE

ACTIVITIES	MOTIVATION	TASK	DURATION
Motivation for creation of an audible traffic light and materials (software/hardware re) to use	Students interact with each other and create solutions that allow solving the problem, based on software and hardware.	Model analysis proposed and possible changes	**1h**
realization of a concrete approach through carrying out the Sheet 1 and discussion between the students	The internet search of examples that can be adapted to the problem and already a learning activity based on the selection of possible logical solutions that allow a more effective approach	The student tries to solve the questions posed in Sheet 1, based on guidance given by teacher. Teacher's help Correction of Sheet 1 in group of students with discussion about alternative solutions	**1h**
Programming a Simulation using the Mblock with the help of Sheet2.	Analyze the execution of a concrete programming	students perform in Mblack the proposed task on Sheet 2. students check the correct functioning of the proposed objective and makes the adaptations needed. teacher help, when necessary	**1h**
Component connection with the Arduino place, using support with pre-installation of electrical devices that allow to work sound traffic light	Direct interaction with the hardware and care connecting the cables to the right place, according to the programming to be carried out	The students teacher help, when necessary	**30m**
Solution programming final in Mblock and sending the programs for arduino board	Create a solution in programming that allows the execution of a task concrete and its interaction of physical devices. A possible solution of can be presented by the teacher (it's in the end of this scenario learning)	Students create the solution to implement, Mblock programming the reception of the signal sound and operation of the lights (green, orange, red) the teacher of Feedback to students about the program of the final solution semaphore in Mblock	**1h**
sound tests and microphone calibration	Operation of the initial project	Assessment: Students' perception; Teacher's reflection	**30m**

Objectives: To understand how the Arduino board works, regarding the control of Input and Output data, based on scenarios of Educational Robotics/Programming and Active Learning.

Prerequisites: Students should already know the basic functioning of MBlock and its interconnection with the Arduino board. The interconnection between the Arduino board and the Relays that controls the lamps and all the electrical part must already be built

Reflection and evaluation:

• Discussion about improvements to be implemented and places where the Traffic Light can be useful for noise management.

• Analysis of the observation grid, created by the students, to record the behavior of users of the spaces where the traffic light was installed.

Resources:

• Worksheet 1 – ANALYSIS OF THE PROBLEM FOR PROGRAMMING THE AUDIBLE TRAFFIC LIGHT

• Worksheet 2 - TRAFFIC LIGHT WITH Scratch/mBlock

• Arduino Uno Board

• Sound sensor (microphone)

• Connection cables for Arduino (input/output)

• Computer

• Mblock software

• Support with pre-installation of electrical devices that allow the sound traffic light to work

Ficha 1- ANÁLISE DO PROBLEMA PARA PROGRAMAÇÃO DO SEMÁFORO SONORO

	Interação com a Placa ARDUINO	
Equipamento	Input ou Output	Tipo de ligação (ANALÓGICA ou DIGITAL)
Sensor de som		
LED vermelho		HIGH/LOW
LED Laranja		HIGH/LOW
LED Verde		HIGH/LOW

Variável de entrada (INPUT) _____

Resultado de saída (OUTPUT) _____

1 - Como é que se determina qual LED vai acender?

_____

2 - Escreve uma instrução para que o LED vermelho acenda quando o som estiver acima de 800.

_____

3 - Se o LED vermelho acende, o que acontece aos outros LEDs?

_____

4 – Explica aqui a lógica a utilizar para que o LED verde acenda quando o valor do som estiver abaixo de 400.

_____

_____

_____

_____

_____

4 – Explica aqui a lógica a utilizar para que o LED laranja acenda quando o valor do som estiver entre 401 e 799.

_____

_____

_____

_____

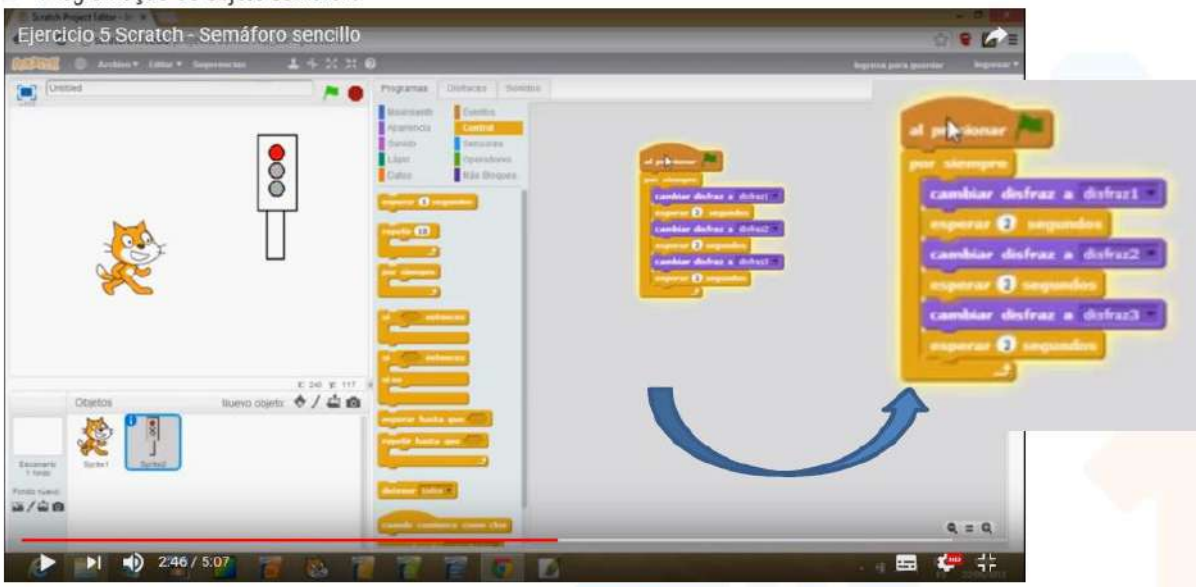
FICHA 2 – SEMÁFORO COM Scratch/mBlock

Video auxiliar da atividade em https://www.youtube.com/watch?v=DmjD5uk8MnU

1 – Criar um novo objeto/personagem com a aparência de um semáforo

No final, vão ficar 3 caraterizações associadas à mesma personagem (vermelho, amarelo, verde)

2 – Programação do objeto semáforo

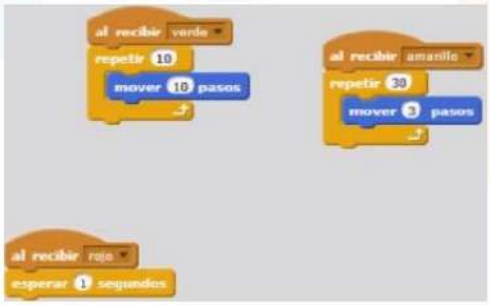


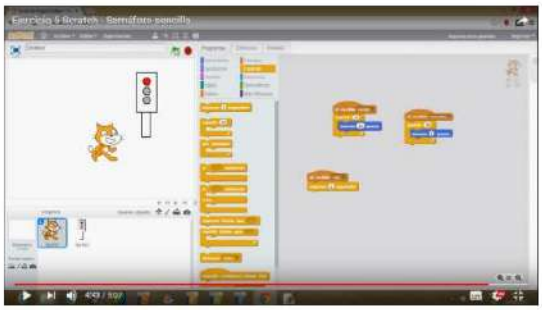
2 – Programação da personagem (Escolher uma pessoa)

Quando vê o verde -> CAMINHA

Quando ver o amarelo ->CAMINHA RÁPIDO

Quando vê o vermelho -> PÁRA





20- Title: Sound Distance Sensor

Addressed area: Arduino and Sensors.

Subject: Create and Test a Learning Scenario

Context: Students of the Electronics, Automation and Computers Course, within the scope of the Digital Systems discipline, will build a sound distance detector. For this activity, an Ultrasound Distance sensor HCSR04 and a buzzer will be used. Students will be challenged to add features to the initial proposal.

Goals:

- Create, apply and evaluate a learning scenario in an educational context;
- Develop autonomy;
- Apply electronics concentrations;
- Use of sensors;
- Programming Arduino;
- Build a distance detector with an audible warning in a real environment

ACTIVITIES	MOTIVATION	TASK	DURATION
Brainstorming with students about the challenge placed (create detector sound distance)	Define the components necessary electronics to carry out the activity proposal and propose solutions . Develop autonomy	visualization of a example of a sound distance sensor	15 min
Using TinkerCAD to create the schema project.	Know how to create circuits in simulation platform virtual tinkercad	Create the circuit in Tinkercad virtual simulation platform	15 min
actual implementation of circuit using necessary components (breadboard, jumper wires, distance sensor Ultrasound HC-SRO4, a buzzer, Arduino) and others for students to choose use to add features your activity.	Know how to create circuits in real environment. Know how to use sensors.	create circuits in real environment.	15 min
circuit programming using the IDE arduino	Getting to know the interface Arduino IDE. know how to program a microcontroller	Program and test the circuit using the Arduino IDE.	30 min
Filming the actual circuit in operation	Include in the student's digital portfolio a digital record of the circuit's operation.	Use a video camera (mobile phone) record the operation of the circuit	10 min
Evaluation	Recognize the work carried out, the difficulties and aspects to be improved	Self-regulation of students according to the rubric of the activity	5 min

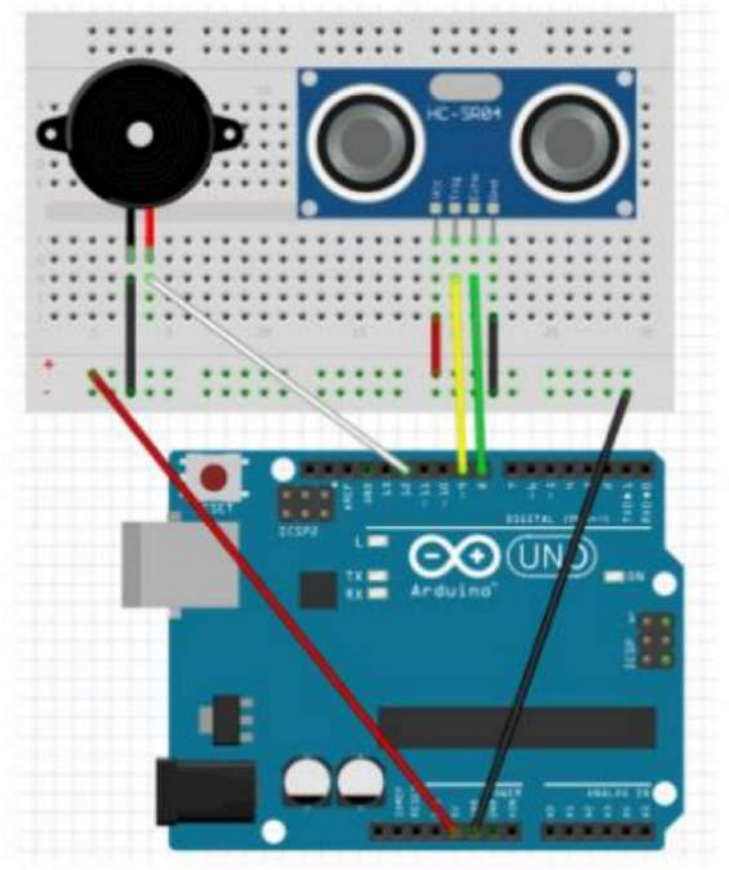
Reflection and evaluation:

- Activity heading analysis;
- Joint reflection on the results obtained;
- Completion of the student's self-regulation document;
- Teacher's evaluation according to the activity heading

Resources:

- Breadboard
- Arduino Board;
- Buzzer;
- Jumper wires;
- Ultrasound HC-SR04;
- LEDS (optional);
- 330Ω resistors (optional);
- Computer;
- Tinkercad platform;
- Internet
- Arduino IDE;
- “Ultrasonic.h” library
- Demo video of a sound distance sensor project.

Circuit scheme:



Code:

```
#include <SoftwareSerial.h>
#include <Ultrasonic.h>

//buzzer
const int buzzerPin =12;

//ultrassónico
#define triggerPin 9
#define echoPin 8

//Inicializa o sensor nos pinos definidos acima
Ultrasonic ultrasonic (triggerPin,echoPin);

//distância do sensor ao objeto
float distancia;

//tempo que o sinal demora a ser emitido
long tempo;

void setup() {

//buzzer
  pinMode(buzzerPin, OUTPUT);

Serial.begin(9600);
}

void loop() {

//ultrassónico
  tempo=ultrasonic.timing();
  distancia=ultrasonic.convert(tempo, Ultrasonic::CM); //converte em centimetros

  delay(100);

 Serial.println("distancia:");
 Serial.println(distancia);

//buzzer
if ((distancia<60) and(distancia>=35)){
    tone(buzzerPin, 262);
    delay(250);
    noTone(buzzerPin);

}
else if ((distancia<35) and(distancia>=20)){
    tone(buzzerPin, 262);
    delay(100);
    noTone(buzzerPin);
}
 else if (distancia<20){
     tone(buzzerPin, 262);
     delay(25);
     noTone(buzzerPin);

 }
 }
```

21- Title: Let's Create Our Circuit!

Addressed area: Arduino

Subject: Create and test the use of loops in Arduino

Context: In this module, it is intended that in groups, through working with the arduino, with connection to various electronic components and sensors programmed using the arduino IDE, students acquire knowledge, using logic and repetition control structures.

Objectives: Understand how to use the arduino board, the analog and digital ports and where we can connect other components such as motors, resistors, sensors and also understand how we can program it using an arduino IDE. Create a circuit using jumpers (wires), a breadboard and a power source, programming it to see what happens after understanding the logic of your programming. Create a circuit and do the programming we need to make it work involving knowledge of programming, logic and electronics.

ACTIVITIES	MOTIVATION	TASK	DURATION
Apresentação da placa Arduino. Explicar as diferentes partes desta placa (portas). Mostrar projetos desenvolvidos com a placa arduino.	Adquirir alguns conhecimentos sobre as potencialidades do arduino.	Pesquisa conjunta para recolha de informa s sobre a placa arduino.	60 min
Apresentação do tinkercad, circuitos, e as principais funções	Passos para começar a criar circuitos no tinkercad (https./WWW.tinkercad.corn)	Criar conta e explorar o Tinkercad online. Criar um circuito e programa-lo.	60 min
Criar um circuito com arduino no Tinkercad	Perceber como criar um circuito usando arduino	Criar um projeto com os circuitos a funcionar	180 min
Apresentação dos projetos criados, discussão e avaliacão.	Avaliação	Apresentação. Auto e heteroavaliação	45 min

Reflection and evaluation:

Project created, its presentation and defense.

Resources:

- computer
- arduino IDE
- tutorial and guide
- tinkercad

Destinatários:

Students of the TGPSI course, discipline Programming and Information Systems (PSI), 10th grade.

22- Title: CREATION OF THE TEAM NAME ON THE DISPLAY

Addressed area: Programming Discipline

Subject: Arduino and sensors

Context: Within the scope of the Programming discipline of the professional computer programmer course, this Learning scenario will allow students to become familiar with the Arduino board, its programming (C language) and, with some electronic components, to implement an LCD that displays the name of each team. Initially, students will be divided into teams and will build the prototype using the Tinkercad platform and then create the final project, using the Arduino physical board and the Arduino IDE environment.

Objectives:

- Stimulate students' critical and creative thinking;
- Promoting teamwork;
- Promoting reasoning and problem solving;
- Deepen knowledge of the C language;

ACTIVITIES	MOTIVATION	TASK	DURATION
Presentation about the main ones concepts of electronics and programming	acquire knowledge in electronics and programming.	Preview of the presentation and videos about the main electronics concepts and programming.	3 h
Presentation of platform tinkercad	acquire knowledge about the Tinkercad platform	visualization of demonstration of teacher	1 h
Demonstration of examples of projects created in Tinkercad	Realize the potential of the arduino board and its components	Creation of electronic circuits with the arduino board on the Tinkercad platform	4 h
Presentation of the project statement to be developed as a team	Learn how to create circuits on a breadboard (breadboard) and connect it to the arduino board	Prototype development on the Tinkercad platform Creation of the final product with a physical arduino board and its components	3 h
Presentation of the developed project	Knowing how to present the project	Presentation of the prototype and electronic circuit	1 h

Reflection and evaluation:

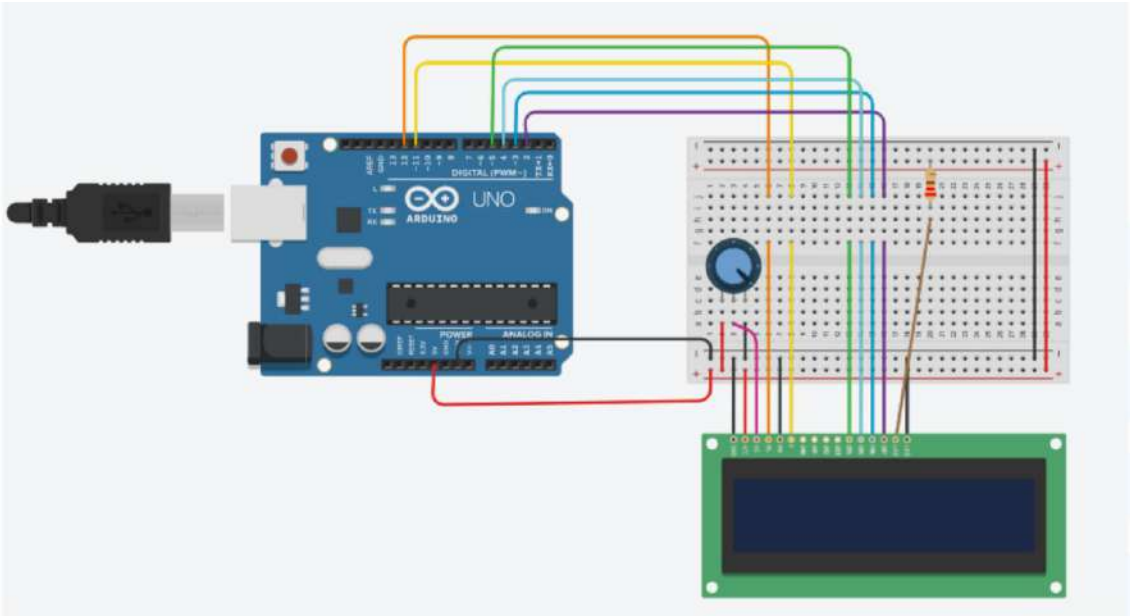
Arduino programming offers several advantages: it is accessible to anyone interested in learning to program or design electronics, it can be used in a wide variety of projects.

Arduino programming is relatively easy to learn and does not require a lot of programming experience, and it is compatible with a wide variety of electronic components, which means it's easy to integrate different sensors, modules and other electronic devices into your projects.

Students are evaluated on their presentation, on the project developed on the Tinkercad platform and on the assembled electronic circuit.

Resources:

- 1 arduino board
- A white test plate
- 1 LCD
- 1 potentiometer
- 1 resistance
- electrical wires
- Tinkercad platform;
- computer



Code:

```
#include <LiquidCrystal.h>

// C++ code
//


LiquidCrystal lcd(12,11,5,4,3,2);

void setup()
{
  lcd.begin(16,2);

}

void loop()
{
  lcd.setCursor(0,0);
  lcd.print("Susana");
  lcd.setCursor(0,1);
  lcd.print("Vieira");
  delay(2000);
  lcd.clear();
  delay(1000);

}
```

link: https://www.tinkercad.com/things/dKqm0FAsqGX?sharecode=HwwWJbYKv3rhp6p4MN6LAOlPa4iOqvpDQR4xTMfiTM

23- Title: Emergency light alarm

Addressed Area: Arduino and sensors

Subject: Triggering of an emergency luminous alarm via a push-button that allows connection to an LED.

Context: No area of the domain Create and innovate the 6th year ICT discipline of this Learning Scenario will be possible that students learn to work with the Arduino board, program and electronic assemblies using different electronic components. This feature can be used in real life when someone in distress presses a button to make a pedigree of help.

Goals.

- Use programming environments to interact with robots and other tangible artifacts;
- Produce and modify creative digital artifacts, to express ideas, feelings and understandings, in indoor digital environments.
- Understand the basics of electronics;
- Make electronic assemblies;
- Program the Arduino board;
- Use the Arduino IDE to program the Arduino platform.

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Apresentação do Arduino Uno	Mostrar o Arduino e algumas funções principais	Pesquisa de informação	**30 minutos**
Apresentar a placa Arduino associada a alguns exemplos	Mostrar exemplificando algumas potencialides do Arduino.	Pesquisa de informação	**30 minutos**
Conhecer componentes necessários ao projecto (Led, Botão de pressão, resistências e fios elétricos)	Identificar componentes e aplica-los no circuito	Visualizar os componentes e fazer as ligações necessárias	**60 minutos**
Montar o circuito	Criar o circuito com os componentes indicados	Montagem final	**60 minutos**
Programar o circuito	Realizar o programa associado ao projecto	Verificar se o Led pisca quando premido o Botão de pressão	**30 minutos**
Testar o funcionamento, verificar se o Led acende quando premido o Botão de pressão	Testar o projecto e verificar se o Led acende quando premido o Botão.	Circuito a funcionar	**30 minutos**

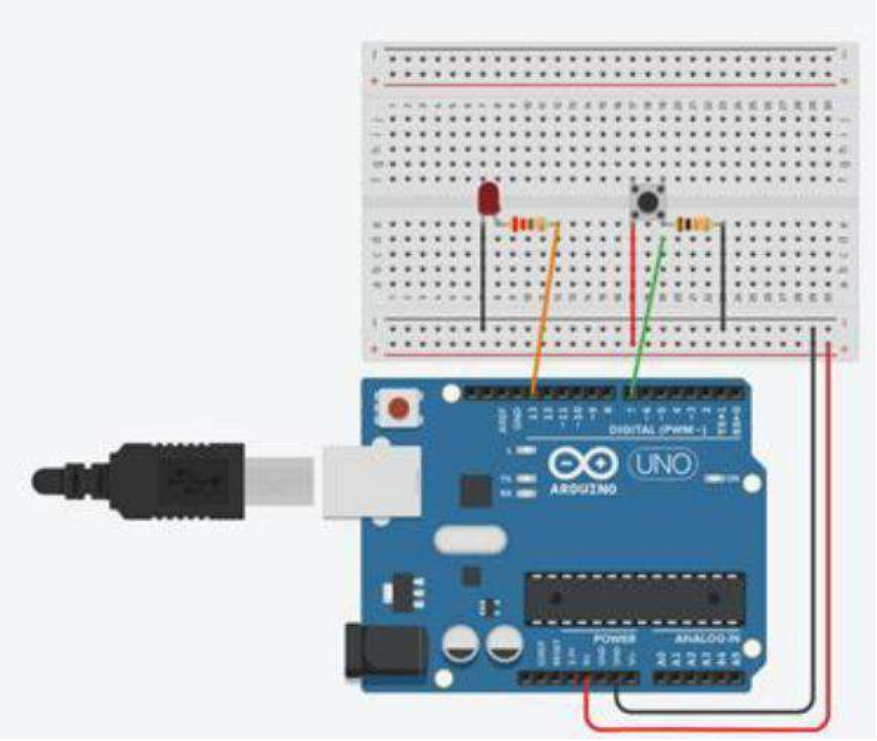
Reflection and evaluation:

In this activity, they performed the assembly of the circuit using the Arduino board and programmed it in the Arduino IDE. They learned how to connect the components (after knowing their function and name). After assembly and programming the students tested and were able to conclude that the activity the project worked as expected. Felt great empathy and enthusiasm for this type of task. The evaluation focused on the presentation before the class where the students also mentioned their difficulties they felt throughout the activity.

Resources:

- Arduino UNO and USB cable;
- Breadboard;
- LED;
- Pushbutton;
- 1 Resistor of 220 Ω;
- 1 resistor of 10 KΩ;
- 5 male-to-male jumper cables.

Scheme:



Code:

botaopressaoled

```
int estadobotao=0;
void setup()
{
  pinMode(13, OUTPUT);
  pinMode(7,INPUT);
}

void loop()
{
  estadobotao=digitalRead(7);
  if (estadobotao==HIGH)
    digitalWrite(13, HIGH);
  else
    digitalWrite(13, LOW);
}
```

24- Addressed area: Arduino - even odd

Subject:generation of random numbers between 0 and 100 and indication if it is even, if it is odd or if it is neither even nor odd (case of the digit zero)

Context:

Through working with the Arduino, with connection to various electronic components, sensors programmed using the Arduino IDE, students acquire knowledge and consolidate knowledge of Mathematics, using logic and implementing new innovative methodologies.

Objetives:

Understand how to use the arduino board, the analog and digital ports and where we can connect others components such as leds, resistors and also understand how we can program it using the IDE arduino.

Create a circuit using 6 resistors, leds (2 green, 2 red and 2 blue), jumpers (wires), two breadboards, an LCD, a potentiometer and a power source, programming it to see what happens once you understand the logic of your programming. Create a circuit to solve the proposed problem and do the programming we need for the put it to work involving knowledge of programming, logic and electronics.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Apresentação da placa Arduino Explicar as diferentes partes desta placa (portas).	Adquirir alguns conhecimentos sobre as potencialidades do arduino e da sua utilização	Leitura de algumas informações sobre a placa arduino e pesquisa na internet	**50 minutos**

Mostrar projetos desenvolvidos com a placa arduino			
Leitura de algumas informações sobre a placa arduino e as principais funções	Passos para começar a usar o arduino IDE	Fazer o download do IDE do arduino e respetiva instalação	**15 minutos**
Conhecer alguns componentes (LEDs, resistências,etc.)	Entender como deve incluí-las no circuito	Realizar a primeira montagem (Led a piscar)	**35 minutos**
Programar o circuito da primeira montagem de modo que o LED vermelho acenda se o n.º gerado aleatoriamente for ímpar	Entender como criar um circuito usando arduino e outros componentes ou no tinkercad *online*	Criar um projeto com o circuito a funcionar.	**50 minutos**
Ampliar o circuito de modo que gere um número aleatório (entre 0 e 100) e sinalize se esse número é par (LEDs verdes piscam) ou ímpar (LEDs vermelhos piscam) ou nem par nem ímpar (LEDs azuis piscam). A informação é também exibida num LCD, bem como no Monitor Serial.	Entender como criar um circuito usando arduino e outros componentes ou no tinkercad online	Criar um projeto com o circuito a funcionar.	**100 minutos**

Reflection and evaluation:

Students will be challenged to create a circuit that will generate random numbers between 0 and 100. Then indicates on the LCD and on the Serial Monitor if it is an even, odd or neither even nor odd number (zero digit case). At the same time that the information is displayed, the LEDs flash: green LEDs if it is even, red LEDs if it is odd or blue LEDs if it is neither even nor odd.

They must collaborate with each other, programming their own ideas in the arduino IDE and implementing dynamics between peers. They must solve the problem and carry out the scheduled activities.

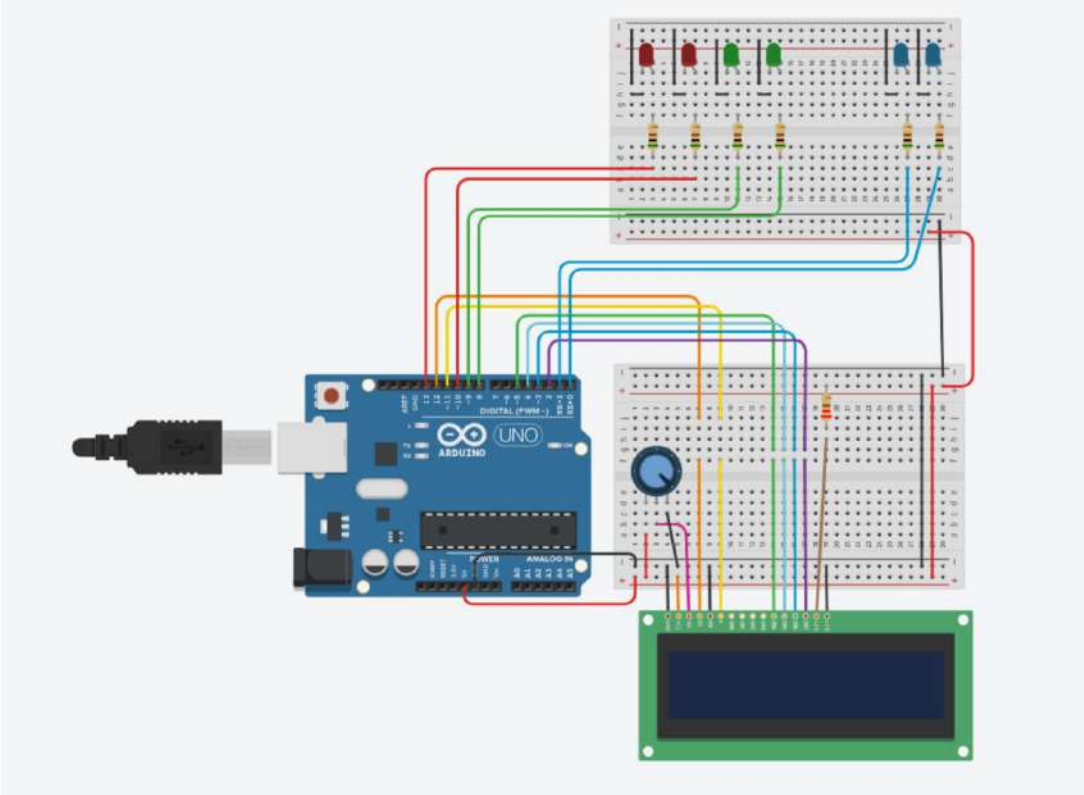
Resources:

- computer
- 1 arduino board, 2 red leds, 2 blue leds, 2 green leds, 6 500 ohm resistors, 2 breadboards, LCD, connecting wires (jumpers), a potentiometer
- arduino IDE
- tutorial and guide

Suggestion: You can use Tinkercad if you don't have the arduino board and the various components.

Login | Tinkercad - https://www.tinkercad.com/login

Example circuit https://www.tinkercad.com/things/bUpknOOmn6Y



Code:

```
//Instância a biblioteca em lcd com os pinos utilizados no interface
LiquidCrystal lcd(12,11,5,4,3,2);
//
/*
Par ou Impar
*/
int Numero = 0;
//Função para imprimir no LCD
void print_Lcd(int valor, int tempo){
//posição inicial coluna=1 e linha=1
lcd.setCursor(1, 0);
//Escrever no LCD
if (valor == 0) {
lcd.print ("Nao é Par nem Impar");
} else {
if (valor == 1) {
lcd.print ("E Impar");
}
else {
if (valor == 2) {
lcd.print ("E Par");
} }
}
//Aguardar 1 segundo para limpar o conteúdo
delay(tempo);
//Limpa o conteúdo do LCD
lcd.clear ();
```

```
}
//Função Setup que corre apenas 1 vez para configuração do nºlinhas=16 e colunas=2 do LCD
void setup()
{
pinMode(0, OUTPUT);
pinMode(1, OUTPUT);
pinMode(8, OUTPUT);
pinMode(9, OUTPUT);
pinMode(10, OUTPUT);
pinMode(13, OUTPUT)
lcd.begin(16, 2);
Serial.begin(9600);
}
void loop()
{
// Início Leds desligados
digitalWrite(0, LOW);
digitalWrite(1, LOW);
digitalWrite(8, LOW);
digitalWrite(9, LOW);
digitalWrite(10, LOW);
digitalWrite(13, LOW);
//posição inicial coluna=6 e linha=1
lcd.setCursor(3, 0);
// Gerar um número entre 1 e 100
Numero = random(1, 100 + 1);
Serial.println(Numero);
//Escrever o número no LCD
lcd.print ("Numero = ");
lcd.begin(16, 2);
Serial.begin(9600);
}
void loop()
{
// Início Leds desligados
digitalWrite(0, LOW);
digitalWrite(1, LOW);
digitalWrite(8, LOW);
digitalWrite(9, LOW);
digitalWrite(10, LOW);
digitalWrite(13, LOW);
//posição inicial coluna=6 e linha=1
lcd.setCursor(3, 0);
// Gerar um número entre 1 e 100
Numero = random(1, 100 + 1);
Serial.println(Numero);
//Escrever o número no LCD
lcd.print ("Numero = ");
// Se sair número par acendem os leds Verdes
if (Numero % 2 == 0) {
print_Lcd(2, 1000);
}
// Se sair número impar acendem os leds Vermelhos
else{
digitalWrite(10, HIGH);
digitalWrite(13, HIGH);
print_Lcd(1, 1000);
}
}
Numero = 0;
//Aguardar 1 segundo
delay (1000);
 }
```

25- Title: How to obtain and interpret the position-time graph of a person's rectilinear movement

Addressed area:: Representation Scatter Diagram and Linear Equation y=bx+a obtained from linear regression

Subject: Rectilinear motion detection simulator

Context: ICT 9th grade, excel worksheet

Objetives: How to obtain and interpret the position-time graph of a person's rectilinear motion. Through the Tinkercad online application, the goal is to create a movement simulator with sonar and collect rectilinear movement data. After achieving the previous objective, they should analyze the collected data, create a scatter plot with the rectilinear equation R on the spreadsheet and also analyze the equation and the error.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Iniciar o Tinkercad.com	Entender como funciona a aplicação online.	Criar conta no Tinkercad	10 minutos
Explicar a atividade e os resultados desejados.	Como obter e interpretar o gráfico posição - tempo do movimento retilíneo de uma pessoa		15 minutos
Explicar o funcionamento do simulador do circuito Arduino	Entender o funcionamento do simulador	Utilizar o simulador	30 minutos
Criar um circuito	Utilizar o simulador do Arduino	Criar um circuito com um sensor sonar	30 minutos

Programar e simular.	Programar o circuito e imprimir os resultados	Programar os blocos e converter para código Arduino.cc. Acrescentar Serial.print()	15 minutos
Criar o ficheiro texto com os dados.	Aprender a exportar o ficheiro	Criar o ficheiro texto com os dados.	5 minutos

Reflection and evaluation:

Through this practical activity, students studied the scatter diagram, which consists of a type of data representation that shows the relationship between two variables XX and YY. Each element of the data set is represented by a point obtained from the coordinates (x,y). They also studied the linear equation y=bx+a obtained from linear regression and also the coefficient of determination – R^2, used to verify the quality of fit of a regression, where R^2 is a measure of fit of a linear statistical model that varies between 0 and 1. In the end, the students were able to see the practical application of the scatterplot that is studied in the disciplines of mathematics and physics, with the creation of a circuit through an online simulator and even worked the results in the spreadsheet. In conclusion, this teaching model offers our students interdisciplinary learning, that is, the approach of several areas simultaneously. These areas are not worked on in isolation, as in the traditional teaching model, which allows students to understand their relationship and how these different learning areas are present in everyday life.

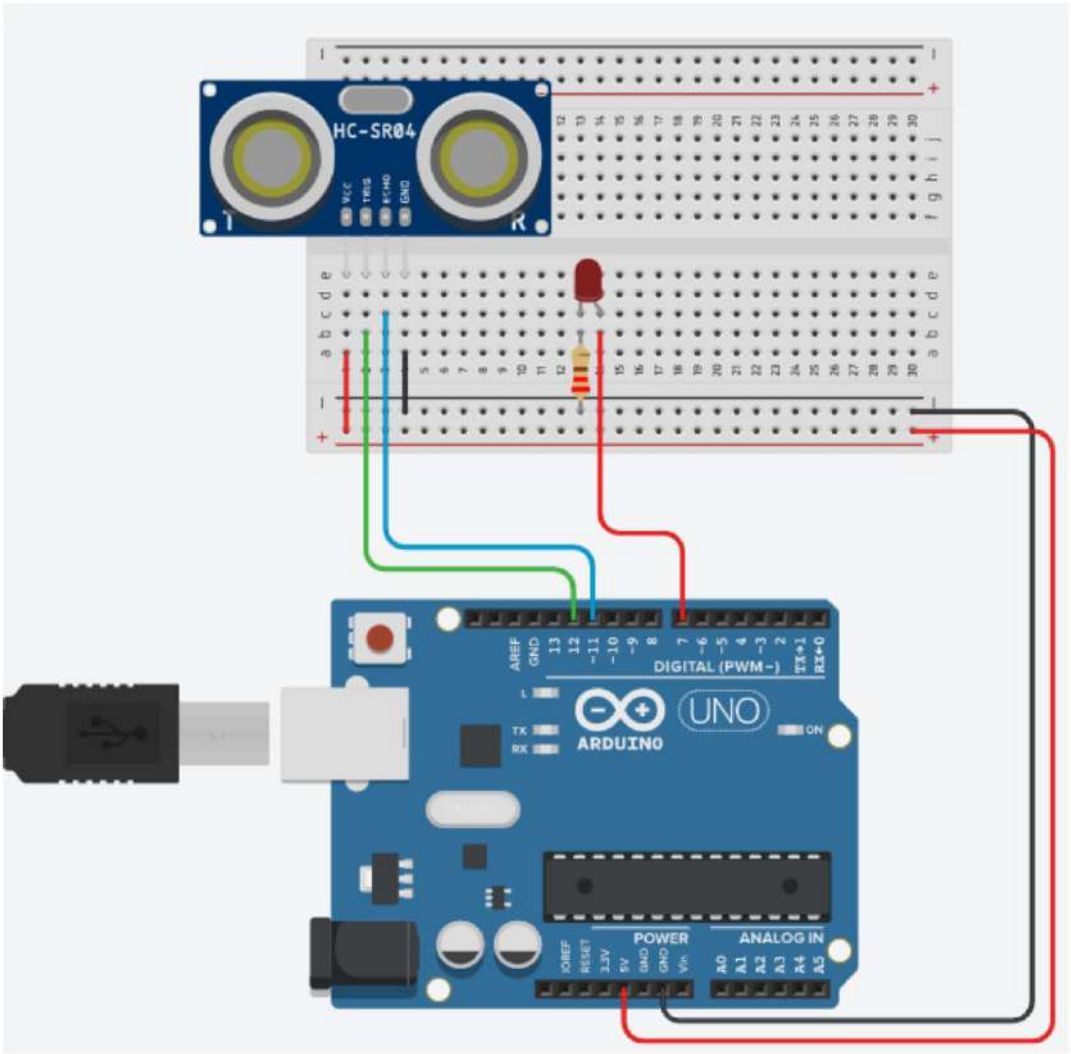
Resources:

- PC;
- Internet;
- Access to tinkercad.com;
- Arduino, test board, wires, sonar, LED;
- Spreadsheet

Activity:

1-Go to tinkercad.com and create an account.

2-Create the following circuit

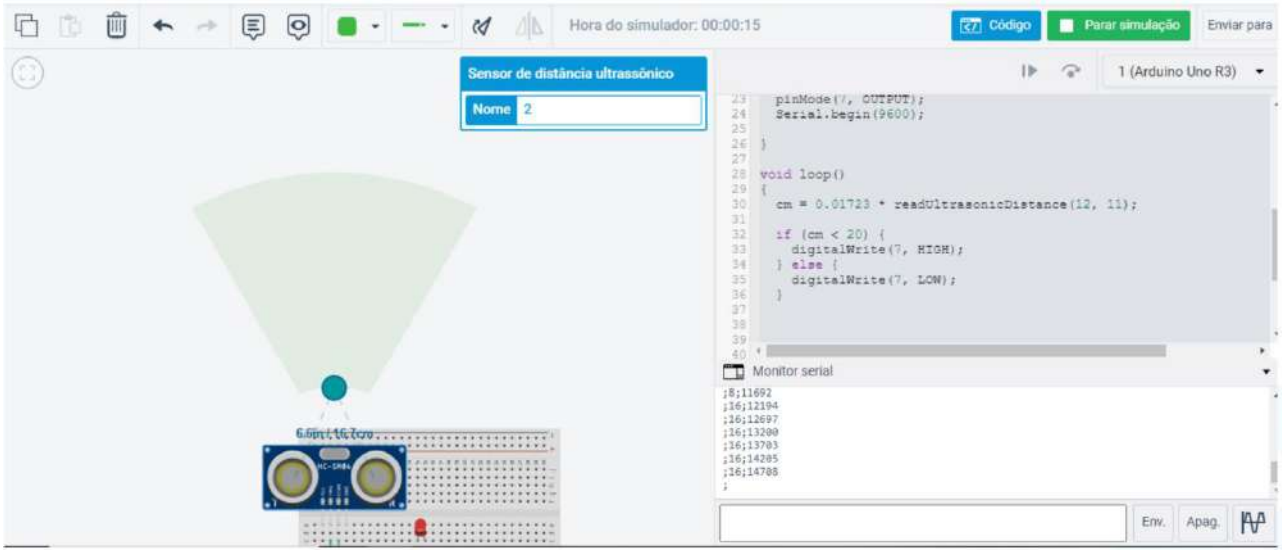


3-Code:

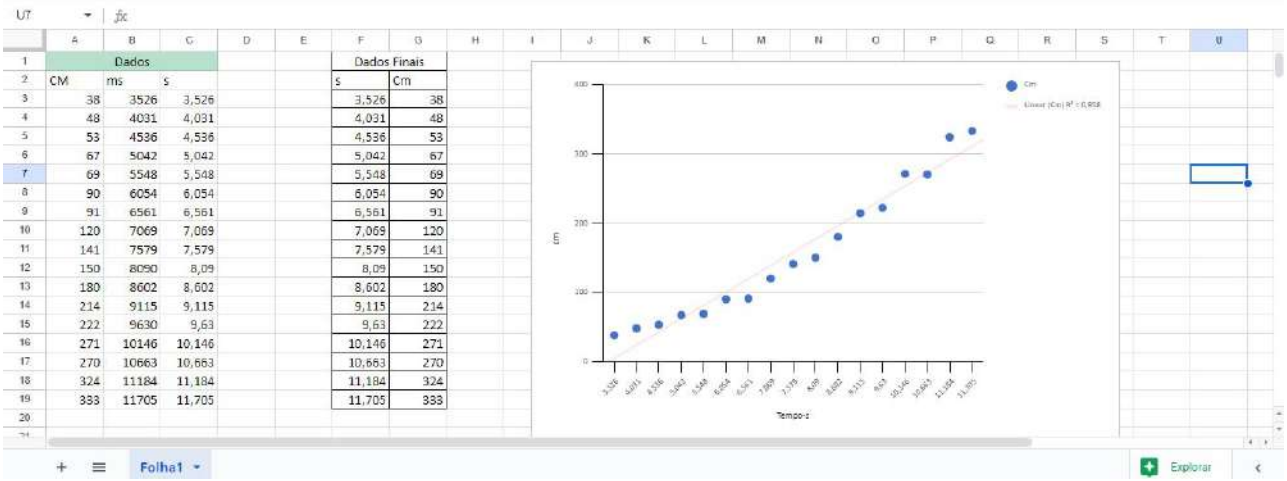
```
int cm = 0;
long tempoINI=millis();
long tempo=0;
long readUltrasonicDistance(int triggerPin,
int echoPin)
{
pinMode(triggerPin, OUTPUT);
digitalWrite(triggerPin, LOW);
delayMicroseconds(2);
digitalWrite(triggerPin, HIGH);
delayMicroseconds(10);
digitalWrite(triggerPin, LOW);
pinMode(echoPin, INPUT);
return pulseIn(echoPin, HIGH);
}
void setup()
{
pinMode(7, OUTPUT);
Serial.begin(9600);
}
void loop()
{
cm = 0.01723 *
```

```
readUltrasonicDistance(12, 11);
if (cm < 20) {
digitalWrite(7, HIGH);
} else {
digitalWrite(7, LOW);
}
delay(500);
tempo=millis()-tempoINI;
Serial.print(cm);
Serial.print(";");
Serial.println(tempo);
Serial.print(";");
int i=1;
if (tempo>=15000)
for(i=1;i<=100000000;i++);
}
```

4-Final result



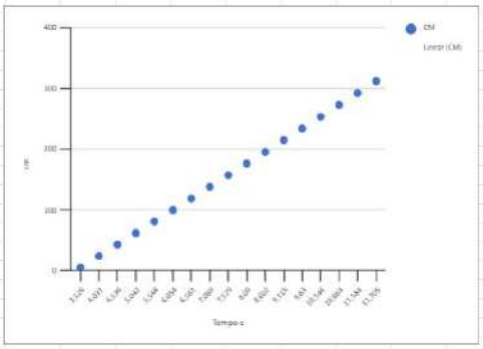
worksheet



	A	B	C	F	G
1		Dados		Dados Finais	
2	CM	ms	s	s	Cm
3	38	3526	3,526	3,526	38
4	48	4031	4,031	4,031	48
5	53	4536	4,536	4,536	53
6	67	5042	5,042	5,042	67
7	69	5548	5,548	5,548	69
8	90	6054	6,054	6,054	90
9	91	6561	6,561	6,561	91
10	120	7069	7,069	7,069	120
11	141	7579	7,579	7,579	141
12	150	8090	8,09	8,09	150
13	180	8602	8,602	8,602	180
14	214	9115	9,115	9,115	214
15	222	9630	9,63	9,63	222
16	271	10146	10,146	10,146	271
17	270	10663	10,663	10,663	270
18	324	11184	11,184	11,184	324
19	333	11705	11,705	11,705	333

Equação y = 37,49x - 126,96

s	CM
3,526	5,22974
4,031	24,16219
4,536	43,09464
5,042	62,06458
5,548	81,03452
6,054	100,0044
6,561	119,0118
7,069	138,0568
7,579	157,1767
8,09	176,3341
8,602	195,5289
9,115	214,7613
9,63	234,0687
10,146	253,4135
10,663	272,7958
11,184	292,3281
11,705	311,8604



Geometry

26- Theme: Geometry

Content: Geometric solids

Activity duration: 100 minutes

Class plan

Initially, students are asked to create a tinkercad account at https://www.tinkercad.com
After 15 minutes of familiarization and installation of the program, they are asked to access **Menu - New Project - 3D Project**

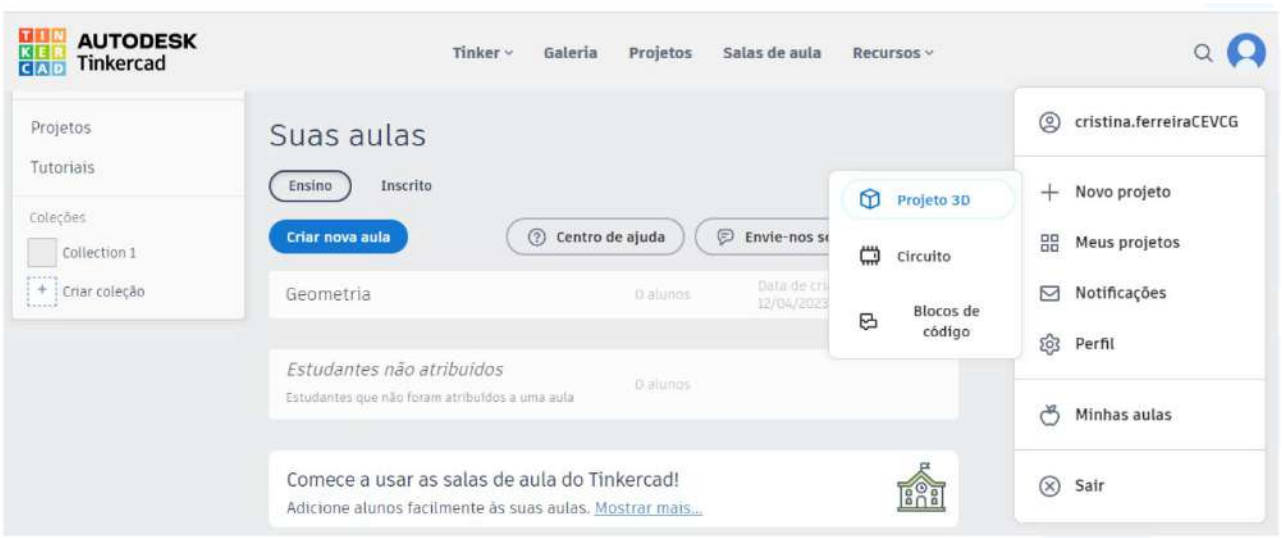


Fig. 1 - Visualização do acesso ao Projeto 3D

Next, students are asked to build some Geometric Solids (cube, parallelepiped, triangular prism, pentagonal prism, hexagonal prism, quadrangular pyramid, triangular pyramid, cone, sphere and cylinder) with the help of the **Basic Shapes** (right side of the screen) that the program offers. This **25-minute** exploratory activity helps the student to better handle the program and get the most out of it.

Fig. 2 - Visualização do plano de trabalho

Afterwards, the class is asked to open the link https://www.tinkercad.com/things/2ayheCTrim6 and get into **Edit this.**

Fig. 3 – Visualização do início da atividade Poliedros – Não Poliedros

Then, they are asked to solve the following questions, for **30 minutes**, through observation and movement of the work plane (change of the perspective of viewing the solids).

1. Complete the table according to what you observe.

Color
solid name
Number of

Cor	Nome do sólido	Número de faces	Número de Vértices	Número de arestas
Amarelo				
Verde-claro				
Verde-escuro				
Cor-de-laranja				
Vermelho				
Azul				

2. The number of faces plus the number of vertices equals_____.

3. Calculates the volume of the **six geometric solids** shown. To know the measurements of the geometric solid, you must select the respective solid with the mouse.

Formulário:

$V_{cilindro\ ou\ prisma} = área\ da\ base \times altura$

$V_{pirâmide\ ou\ cone} = \frac{área\ da\ base \times altura}{3}$

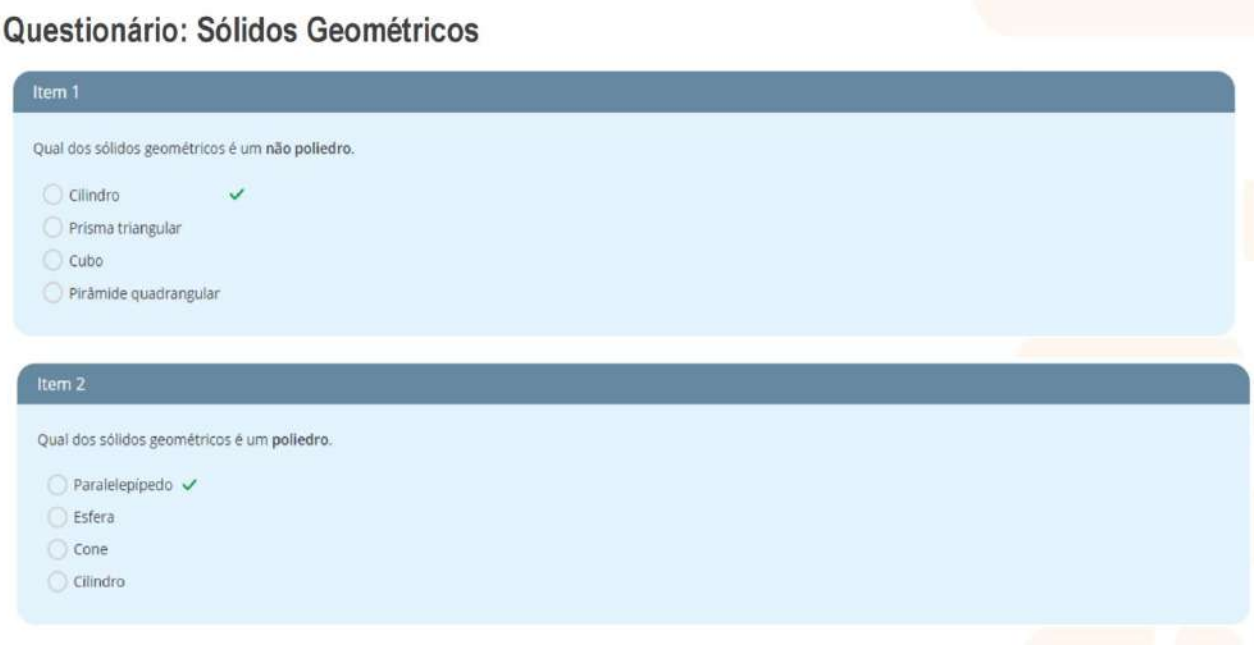
$V_{esfera} = \frac{4 \times \pi \times raio^3}{3}$

Cor	Nome do sólido	Volume (u.v.)
Amarelo		
Verde-claro		
Verde-escuro		
Cor-de-laranja		
Vermelho		
Azul		

4. What is the ratio of the red solid to the blue solid?

Finally, as a moment of summative evaluation of the geometric solids content, students will be asked to access the link https://tests.intuitivo.pt/publication/5f7b2dc4-d98e-4aa5-a1b3-12dd5757cd80 and try to answer the 10 questions, during **30 minutes**.

Fig. 4 - Visualização da abertura do teste Quizz



Item 3

Quantas **arestas** tem um prisma triangular?

- 12
- 10
- 9 ✓
- 6

Item 4

Quantas **faces** tem uma pirâmide quadrangular?

- 6
- 5 ✓
- 3
- 4

Item 5

Quantos **vértices** tem um cubo?

- 3
- 10
- 8 ✓
- 4

Item 6

Qual é o volume da esfera sabendo que tem de diâmetro 48 cm?

- 47906 cm^3
- 57905 cm^3
- 57900 cm^3
- 57906 cm^3 ✓

Item 7

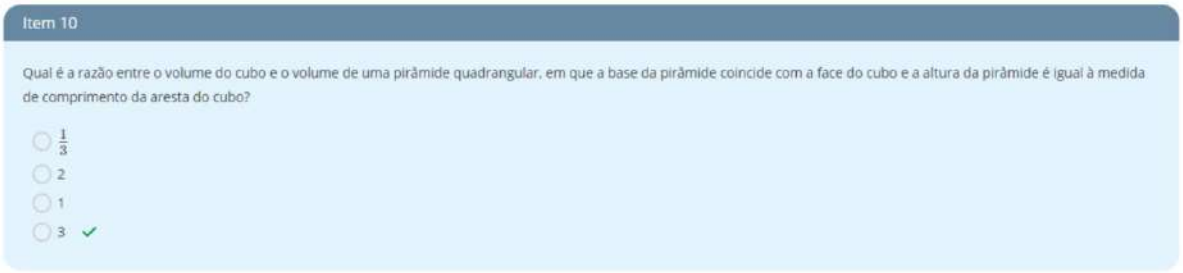
Qual é a área lateral do cubo sabendo que tem 38 cm de aresta?

- 152 cm^2
- 2888 cm^2
- 5776 cm^2 ✓
- 1444 cm^2

Item 8

Qual é o volume do paralelepípedo com 38 cm de comprimento, 9 cm de largura e 46 cm de altura?

- 414 cm^3
- 15732 cm^3 ✓
- 342 cm^3
- 1748 cm^3



Student evaluation

The assessment is made by visualizing the commitment and insight of the students in the activity of exploring the *Tinkercad* program and the respective construction of solids, qualitative assessment, and by the result obtained in the *Quizz of the Intuitivo platform*, quantitative assessment.

Reflection

The activity has not yet been applied in the classroom for reasons of scheduling and planning for the month of March, the end of the second period. This activity will be applied at the beginning of the third period, in the 8th grade classes. I consider that the use of the *Tinkercad* program is an asset for the observation of geometric solids, because students have difficulties with volume and imagination of solids and objects in 3D. Counting edges, faces and vertices or even imagining the geometric figure of the faces of the geometric solid, students reveal difficulties, especially when they do not visualize the solid. With the *Tinkercad* program, students are able to move the work plane, which facilitates the various perspectives of seeing the solid and/or object, an image that most students have immense difficulties in imagining.

note: The students' evaluation and critical reflection in relation to this learning scenario will be sent later. I will apply the learning scenario in the first week of term three, the week of April 17-21.

Resources:

Pencil

Calculator

Computer

Internet access

Tinkercad Quizz Program on Intuitive

27- Title: Arduino application and temperature and humidity sensors for measurements in a hydroponic garden

Addressed area: Arduino and sensors

Subject: Create and Test a Learning Scenario related to the Arduino and sensors theme

Context: In this last module, a learning scenario about arduino and sensors was created. The results obtained through the application of this scenario provided moments of sharing in which the students in the first part were challenged to build a small circuit and understand its code using the arduino virtually and in the real world, to then apply this knowledge using the arduino and temperature and humidity sensors and electrical conductivity and pH sensor in a hydroponic garden at school. Still in this scenario, it was intended to involve the sharing of knowledge between secondary and third cycle students of the grouping and in another. For this, the students of the professional education of Robotics went to the schools of the third cycle of our grouping and of another grouping of the county. It was an innovative experience where students learn with other students and older students felt more motivated and responsible and younger students grateful for this different experience.

Goals:

• Familiarize students with new technologies;

• Understand how to use the **Arduino board**, the **analog and digital port**s and where we can connect other components such as resistors, **temperature and humidity sensors (096-7807 Arduino compatible temperature and humidity sensor module (DHT11))** and **pH (Jeanoko PH Value Sensor Module AC/DC 5 ± 0.2V PH0 14 pH Sensor Module for pH sensor to collect pH value data for Arduino) and Electrical Conductivity (Analog TDS Sensor/Meter for Arduino - DFRobot SEN0244)** and how to program it using the Arduino IDE.

• Create a circuit using **wires**, a **breadboard**, and a **power source**, and program it to see what happens. happens after understanding the logic of its programming, on Tinkercard https://www.tinkercad.com/login

• Create a circuit and make and analyze the programming we need to put it to work involving programming and electronics knowledge to carry out measurements in the school hydroponic garden.

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
1-Apresentação da placa Arduíno e do Tinkercard; 2-Montagem dos componentes do ambiente virtual no Tinkercard e em placas de ensaio breadboard;	Adquirir conhecimentos sobre Arduíno e sensores e aplicá-los no Projeto "A hidroponia na Escola";	Montagem dos componentes em ambiente virtual e em placas de ensaio no mundo real. Testagem desta montagem na horta;	**2 hora** **1 hora**
3-Análise e resolução de e problemas; 4- Deslocação dos alunos da Secundária ao terceiro ciclo para apresentação, partillha de conhecimento da programação do Arduíno e o respetivo circuito na breadboard.	- Aplicação no mundo real da aprendizagem realizada; - Partilha de saberes entre ciclos.	- Partilha da metodologia utilizada pelos alunos do secundário para alunos do básico. - Avaliação dos alunos; Reflexão da atividade Realizada.	**2 horas** **1 hora**

Reflection and evaluation:

In this learning scenario we use the Problem Solving Learning methodology PLB, which promotes active student-centered learning, confronting them with complex real-world problems. Students are led to problematize, reflect and attribute meaning to their learning, as they find the answers to the problems presented to them. In this sense, this methodology, in addition to favoring essential skills for lifelong learning, encourages critical thinking, collaboration, creativity and communication.

The students of the 11th grade professional robotics course were challenged to research, investigate and reflect on the circuits and application of the arduino and sensors to share this knowledge with the 3rd cycle. They later built these for real-world use, applying them to a hydroponic garden. Still, they went to the third cycle to share activities and knowledge. Third cycle students were challenged to understand basic Arduino concepts in order to solve the problem of measuring temperature and humidity in the hydroponic gardens of our school.

After registering on Tinkercard, the created groups researched and explored the different virtual circuits and the corresponding arduindo code. Then, with the help of knowledge from other areas, the students developed together with the secondary education of the robotics course in the discipline of Physics and Chemistry, after the training they had with these students from our Group, using arduino, circuits and sensors.

The evaluation of the activity will be carried out after the period of academic interruption, where there will be self and heteroevaluation in forms with response to the feedback given in Teams.

Learning Scenario Implementation, Links: https://youtu.be/eWr97_0Ps1A ; https://youtu.be/c14seQCdCJA

Resources:

- Computer;
- Mobile phone;
- Tinkercad if you don't have the arduino board and the various components;

Login | Tinkercad - https://www.tinkercad.com/login;

- Arduino board; Shields for sensors; Breadboard; Binding wires;
- Temperature and Humidity Sensors, Electrical Conductivity;
- Arduino IDE;
- Forms;
- Teams;
- Hydroponic gardens.

Attachement

Arduino and humidity and temperature Sensor code:

```
#include <EEPROM.h>
#include "GravityTDS.h"
#include <OneWire.h>
#include <DallasTemperature.h>
#define ONE_WIRE_BUS 7 // Digitalpin where Temp sensor is connected
#define TdsSensorPin A2 // Where Analog pin of TDS sensor is connected to arduino
OneWire oneWire(ONE_WIRE_BUS);
GravityTDS gravityTds;
DallasTemperature sensors(&oneWire);
float tdsValue = 0;
void setup()
{
Serial.begin(115200);
sensors.begin();
gravityTds.setPin(TdsSensorPin);
gravityTds.setAref(5.0); //reference voltage on ADC, default 5.0V on Arduino UNO
gravityTds.setAdcRange(1024); //1024 for 10bit ADC;4096 for 12bit ADC
gravityTds.begin(); //initialization
}
void loop()
{
sensors.requestTemperatures();
gravityTds.setTemperature(sensors.getTempCByIndex(0)); // grab the temperature from sensor and execute
temperature compensation
```

```
gravityTds.update(); //calculation done here from gravity library
tdsValue = gravityTds.getTdsValue(); // then get the TDS value
Serial.print("TDS value is:");
Serial.print(tdsValue,0);
Serial.println("ppm");
Serial.print("Temperatura é: ");
Serial.print(sensors.getTempCByIndex(0));
delay(1500);
}
```

Tinkercad e Microbit

28- Addressed area: Tinkercad and placa Micro:bit

Subject: Creating and Testing a Learning Scenario – control of an RGB LED using the Micro:bit board with temperature monitoring.

Context: Using the knowledge acquired in the 6th year in the subject of Information and Communication Technologies of the Micro:bit board and those acquired in the subject of Physics and Chemistry in the 3rd cycle regarding the basic concepts of circuits, the students build a tool that, according to temperature, emits a representative LED color. This project can be used for example in a greenhouse, emitting a green light if the temperature is ideal for the plantation that appears there, blue if it is below the normal value and red for hot temperatures. It will be a reference for the person responsible for the greenhouse. This activity will take place as part of the Grouping Day Commemoration, where other activities in the area of programming tangible objects will be present.

Objetives:

-Use a circuit simulation platform (Tinkercad) with the Micro:bit board.

-Understand the function of the RGB LED and 220Ω resistor components.

-Understand and use Micro:bit connectors (pins) to connect to the RGB LED.

-Create a circuit using the Micro:bit board, RGB LED, resistor and connecting wires.

-Remember the use of sensors in Micro:bit.

-Program the circuit through blocks.

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Apresentação do Arduino em ambiente de simulação.	Demonstração das potencialidades do Arduino.	Visualização e experimentação de componentes básicos.	1 h30
Interpelação aos alunos acerca dos conceitos de circuitos básicos.	Remetendo à disciplina de Física e Química.	Explicar a função do LED RGB, resistor.	
Apresentação da plataforma Tinkercad (ambiente de simulação).	Relacionamento de conhecimentos prévios acerca da placa Micro:bit.	Criar e programar o circuito com sensor de temperatura.	2 h00
Apresentação da atividade.	Transposição do projeto para a vida real.	Em que situações poderíamos utilizar este projeto na vida real?	

Reflection and evaluation:

This activity will take place on the 26th of April, at the Commemoration of the School Grouping Day and will be aimed at students from the 3rd cycle, namely 9th grade. The assessment will be based on the successful functioning of the project and the students' opinion regarding the practical application of it.

Resources:

Computer;

Tinkercad https://www.tinkercad.com/dashboard;

Gide support.

29- Title: "Discovering Prime Numbers" – presentation and visualization of text message

Addressed area: Plataform Tinkercad and Arduino

Subject: Create and test a circuit, through the Tinkercad platform, that identifies prime numbers, with the support of the LCD electronic component (16x2).

Context: Elaboration of a project in the field of curricular autonomy involving the disciplines of Mathematics (MAT) and Information and Communication Technologies (ICT). Promotion of an activity, during the Week of Mathematics and Experimental Sciences, scheduled for the 3rd trimester – 2nd to 5th May of this year. The activity carried out with the support of the Tinkercad and Arduino platform, with connection to various electronic components and using the Arduino IDE, will allow students not only to reinforce knowledge of the Mathematics discipline, using computational logic, but also knowledge of the tools applied.

Goals:

▪ Reinforce the mathematical concept – Prime Number;

▪ Knowing the Tinkercad platform and its potential;

▪ Knowing the Arduino board, learning how analog and digital ports work;

▪ Use the Arduino IDE;

▪ Create and program a circuit with an Arduino, two resistors, connecting wires, a breadboard, a LCD display (16x2) and one button;

▪ Engage and articulate knowledge of computational thinking, programming and electronics, in order to respond to the problem;

▪ Develop critical thinking and skills in the context of collaborative work.

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Apresentar a atividade – objetivos e avaliação	Conhecer a(s) vantagem(ns) da	- Intervenção dos professores no âmbito das áreas específicas:	**40 min.**

	articulação entre as disciplinas de MAT e TIC	1. Expor o(s) objetivo(s) da atividade; 2. Visualizar um vídeo – rever o conceito de número primo; 3. Interpretar o conceito em linguagem computacional; 4. Partilhar o processo de avaliação formativa.	
Criar grupos de trabalho	Desenvolver competências com o trabalho colaborativo: 1. Relacionamento interpessoal; 2. Informação e comunicação; 3. Pensamento crítico e criativo.	- Definir grupos de 2 a 3 alunos - Escolher do porta-voz	**10 min.**
Apresentar a plataforma Tinkercad e o Arduíno	Conhecer a plataforma de simulação Tinkercad e os componentes eletrónicos a utilizar	- Visualizar: 1. uma apresentação – breve explicação sobre a plataforma e componentes eletrónicos; 2. exemplos de circuitos. - Criar conta na plataforma - Experimentar e manusear	**50 min.**
Criar a atividade e aplicar no contexto pedagógico	Aprender através de uma metodologia de projeto - resolução de um desafio com base na experimentação, interação entre pares e estimulação do espírito crítico e criatico. Aprendizagem centrada no aluno -	- Partilhar e explicar o código, intervenção dos professores MAT e TIC - Montar o circuito, papel autónomo dos alunos - Testar o circuito (alunos) - Identificar, analisar e corrigir eventuais - Questionar e observar outras possibilidades,	**100 min.**

	desenvolvimento de várias competências.	eventuais sugestões de melhoria	
Avaliar a atividade	Envolver o aluno no seu processo de aprendizagem	- Feedback dos professores através da observação direta - Interação entre todos os intervenientes - Retorno dos alunos a partir de um formulário disponibilizado	**20 min.**
Promover um campeonato designado "À descoberta de números primos"	Dinamizar uma atividade lúdica	- Definir regras - Utilizar o projeto criado - Jogar em equipa	**30 min.**

Reflection and evaluation:

This type of project promotes collaborative work between all stakeholders, articulation between disciplines will be an asset for student learning, experimentation and visualization makes knowledge more appealing and concrete. With the implementation of this scenario, it is expected that students will be motivated to develop small projects in an autonomous and rigorous way. The evaluation can only be carried out when the activity is applied, it will be formative and implemented in the manner presented in the narrative.

Resources:

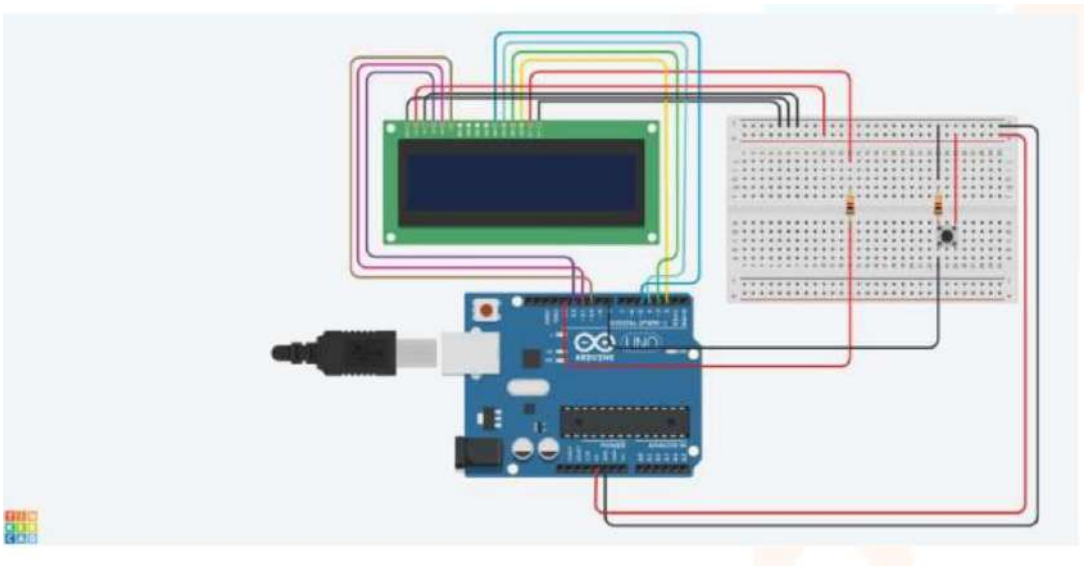
- Computers Internet Access
- Thinkercad Platform ▪ Arduino and electronic components
- Video projector
- Tutorials /Videos
- Direct assessment grids
- Form (student evaluation of the activity)

Lista de componentes

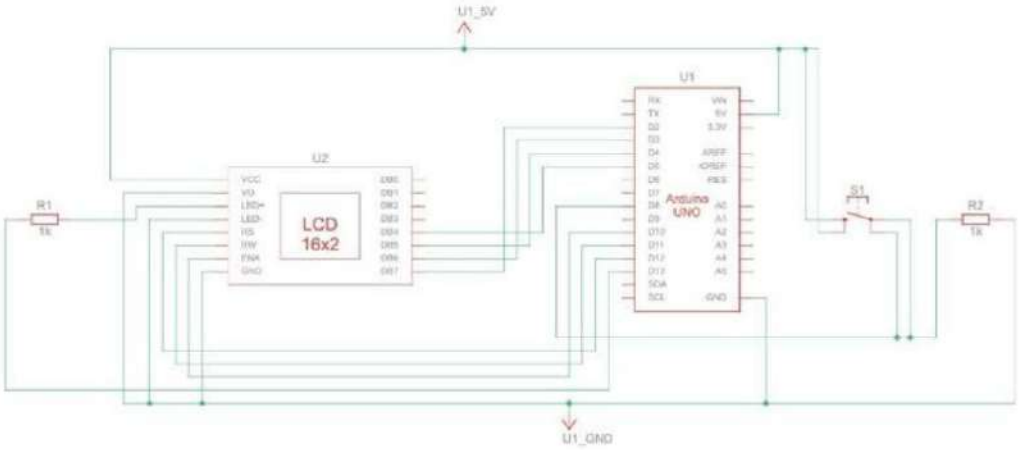
Nome	Quantidade	Componente
U1	1	Arduino Uno R3
R1 R2	2	1 kΩ Resistor
U2	1	LCD 16 x 2
S1	1	Botão

A solution:

▪ Circuit



Scheme and code



```
#include <LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 10, 5, 4, 3, 2); //pins
int luzFundo = 13;// controla a luz
int btnPin = 8;
int btnVal =LOW; //desligado
int min=1,max=100;
int n,k=0;
bool p=false;

void setup(){
  randomSeed(analogRead(0));//inicializar números distintos
  pinMode(luzFundo, OUTPUT);
  pinMode(btnPin, INPUT); //inicializa o botão para input
  digitalWrite(luzFundo, HIGH);// acende
  lcd.begin(16, 2);//Colunas, linhas display LCD 16x2
  mostraLinha(00);
  Serial.begin(9600);//Inicializa a comunicação serial em 9600 bits por segundo
  n=random(min,max+1);
}

void loop(){
int i;

  if(k==0){
    delay(2000);
    mostraLinha(n);
        k=1;
  }

  btnVal = digitalRead(btnPin);
          if(btnVal==HIGH){
            p=true;
            if(n==1)
              nPrimo();
            else if(n==2)
              ePrimo();
            else {
               for(i=2; i<n; i++)
               {
                 if(n%i==0){
                    nPrimo();
                    Serial.print(i);
                    p=false;
                    break;
                  }
                 p=true;
               }
            }
            if(p)
              ePrimo();
            else
                nPrimo();

            n=random(min,max+1);
            k=0;
          }
        }

        void mostraLinha(int n){
          lcd.clear();// Limpa o ecra
          lcd.setCursor(0, 0);// posição 00 do cursor |
          lcd.print("N gerado >");//
          lcd.setCursor(13, 0);//Posiciona o cursor para a coluna 13, linha 0
          if (n!=0)
             lcd.print(n);
          else
            lcd.print("?");
        }
        void ePrimo(){
                  lcd.setCursor(0,1);
              lcd.print("Primo  ");
        }

        void nPrimo(){
          lcd.setCursor(0,1);
          lcd.print("N Primo");

        }
```

30- Subject: Create and Test a Learning Scenario

Context: As part of the Professional Aptitude Test (PAP) for students in the 11th year of the Professional Computer Technician Course - Systems, it was proposed to explore various tools in the areas of Robotics and Programming and 3D Modeling/Printing.

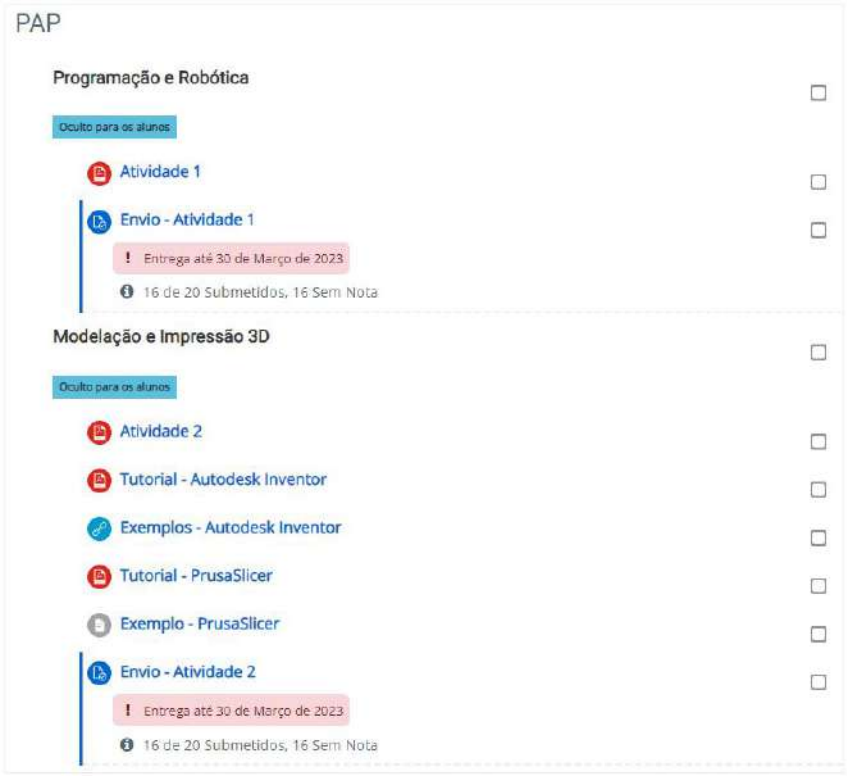
Objetives: To identify which tools can make it possible for students to carry out the PAP on an innovative theme. Create, apply and evaluate a learning scenario by developing EPR and its application in an educational context.

NARRATIVE

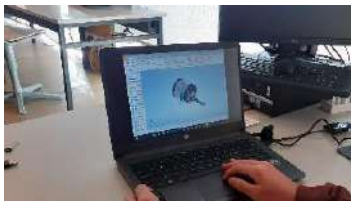
ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
✓ Apresentação e exploração das ferramentas de Róbotica e Programação (Autodesk TinkerCad e Arduino)	✓ Identificação das potencialidades das ferramentas. ✓ Exploração das ferramentas através de exercícios práticos. ✓ Avaliação do enquadramento no tema da PAP.	✓ Registo na plataforma TinkerCad. ✓ Instalação do software do Arduino. ✓ Realização de exercícios exploratórios.	**90 minutos**
✓ Apresentação e exploração das ferramentas de Modelação e Impressão 3D (Autodesk Inventor e PrusaSlicer).		✓ Instalação do software Autodesk Inventor e PrusaSlicer. ✓ Realização de exercícios exploratórios.	**90 minutos**
✓ Período Exploratório	✓ Utilização/exploração das ferramentas apresentadas	✓ Realização de exercícios exploratórios.	**Período de interrupção letiva**
✓ Avaliação Formativa	✓ Questionar os alunos sobre as potencialidades das ferramentas e do seu enquadramento no desenvolvimento da PAP. ✓ Reflexão sobre os resultados	✓ Resposta a um formulário (Google Forms)	**30 minutos**

Reflection and evaluation:

After presenting the tools, students performed exploratory exercises, shared through the Moodle platform.


PAP
Programação e Robótica
Oculto para os alunos
Atividade 1
Envio - Atividade 1
Entrega até 30 de Março de 2023
16 de 20 Submetidos, 16 Sem Nota
Modelação e Impressão 3D
Oculto para os alunos
Atividade 2
Tutorial - Autodesk Inventor
Exemplos - Autodesk Inventor
Tutorial - PrusaSlicer
Exemplo - PrusaSlicer
Envio - Atividade 2
Entrega até 30 de Março de 2023
16 de 20 Submetidos, 16 Sem Nota

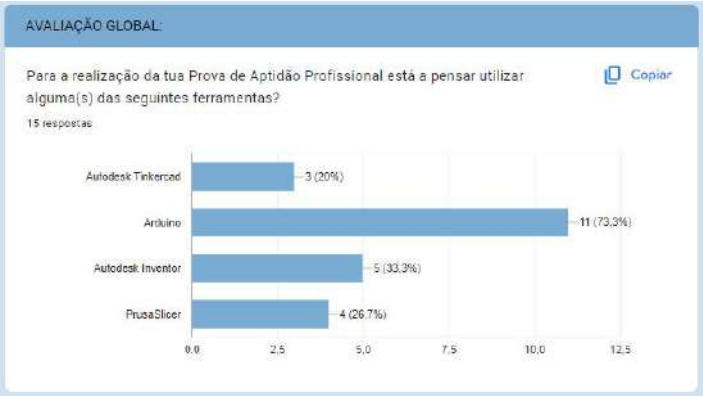





Subsequently, a survey was made available to collect data on the activities carried out: **https://docs.google.com/forms/d/e/1FAIpQLSdfXoFFz1sLqPe637QpDEbP0R8xvpoeGaShqSgyytavuAY6g/viewform?usp=sharing**

After analyzing the results (Figure 1), I concluded that the Arduino was the tool that proved to be the most motivating and with the greatest potential and that 11 students are considering developing their PAP on this platform.



Resources:

✓ Video projector.
✓ Portable Computers.
✓ Arduino boards.
✓ Electronic Components (resistors, LEDs, sensors, etc.).
✓ Tools.
✓ Specific software (Arduino IDE, Autodesk Inventor, PrusaSlicer and Autodesk TinkerCad platform)

31- Title: Simulate Temperature Sensor

Addressed area: Arduino

Subject: Creating and Testing a Temperature Sensor

Context: By carrying out this work with the Tinkercad circuits platform, students will be able to acquire and consolidate knowledge of electronics, logic, programming obtained in the different disciplines of the course (Computer Architecture, PSI, etc...). In this project, students will create a simple temperature sensor using an Arduino and a temperature sensor, plus a few other components.

Goals:

1. Understand how to use the arduino board.
2. Understand how and when to use the different ports (analog and digital).
3. Understand the basics of electronics.
4. Select and connect the necessary components to create the circuit.
5. Write the necessary code to control the sensor.
6. Test the sensor to verify that it is working properly.
7. Calibrate the sensor for more accurate results.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Apresentação de um projeto simples. Explicação da estrutura de um programa	Perceção de como criar um circuito usando a ferramenta TinkerCad e saber em simultâneo o que o mesmo representa	Análise do projeto proposto e possíveis alterações	50 minutos
Criação / Montagem de circuitos Conhecer componentes a usar Criação da programação associada.		Criar o projeto com o circuito a funcionar detetando diferentes temperaturas	60 minutos
Apresentação à turma	Entender e dar a entender a atividade desenvolvida	Apresentação ao restante grupo alunos.	50 minutos

Reflection and evaluation:

- Analysis by each one, regarding their greatest constraints and virtues.
- Operation of the developed project.
- Presentation to the class
- Teacher evaluation regarding success or failure in carrying out the task, as well as the level of collaborative work between peers.

Resources:

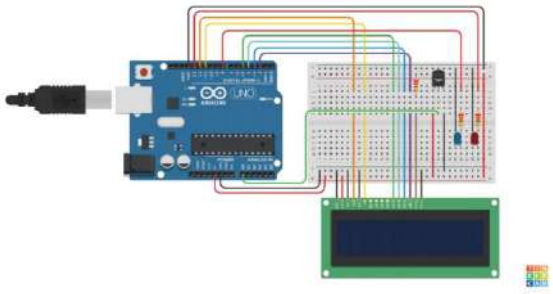
Software - Tinkercad application (circuits).

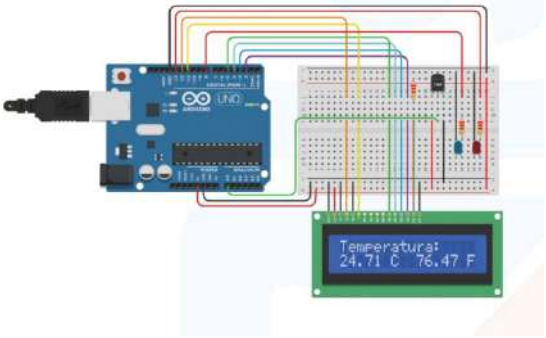
Portable/Desktop PC.

Arduino board, sensors, breadboard, jumpers, others;

Prototypes provided by the teacher.

Circuit:





Programming:

```
#include <LiquidCrystal.h>
LiquidCrystal LCD(12,11,5,4,3,2);
int SensorTempPino=0;
int AlertaTempBaixa=8;
int AlertaTempAlta=13;
int TempBaixa=0;
int TempAlta=40;
void setup()
{
pinMode(AlertaTempBaixa, OUTPUT);
pinMode(AlertaTempAlta, OUTPUT);
LCD.begin(16,2);
LCD.print("Temperatura:");
LCD.setCursor(0,1);
LCD.print(" CF");
}
void loop()
{
int SensorTempTensao=analogRead(SensorTempPino);
float Tensao=SensorTempTensao*5;
Tensao/=1024;
float TemperaturaC=(Tensao-0.5)*100;
float TemperaturaF=(TemperaturaC*9/5)+32;
LCD.setCursor(0,1);
LCD.print(TemperaturaC);
LCD.setCursor(9,1);
```

```
LCD.print(TemperaturaF);
if (TemperaturaC>=TempAlta)
{
digitalWrite(AlertaTempBaixa, LOW);
digitalWrite(AlertaTempAlta, HIGH);
}
else if (TemperaturaC<=TempBaixa){
digitalWrite(AlertaTempBaixa, HIGH);
digitalWrite(AlertaTempAlta, LOW);
}
else
{
digitalWrite(AlertaTempBaixa, LOW);
digitalWrite(AlertaTempAlta, LOW);
}
delay(1000);
}
```

32- Title: Application Development for Braille Learning using Arduino.

Addressed area: Automation and robotics – 12th Grade

Subject: Braille language system

Context: with the implementation of this scenario it is intended that students develop skills in the area of programming and automation, with the development of a small project with the TinkerCad platform and that later they can implement in the robotics club. The development of this scenario divides the class into small groups of 2/3 elements.

Objetives:

Braille is a reading system used by people who are blind or have low vision to communicate. The main objectives of this project are:

- The possibility for a child to learn Braille before starting his school career with the help of his parents;
- The possibility that a child can use an autonomous console to transport and use in any environment of their daily life;
- The possibility for parents to learn Braille together with their blind child.
- Creation of the Braille system with ARDUINO resource;
- Prototype development in TinkerCAD Circuits;
- Console design in TinkerCAD; • 3D console printing;
- Assembly of the Console and its configuration.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Apresentação do projeto e enquadramento dos objetivos gerais	Enquadrar a necessidade do projeto com a realidade da sua implementação	Identificação do professor face à problemática existente	15 min

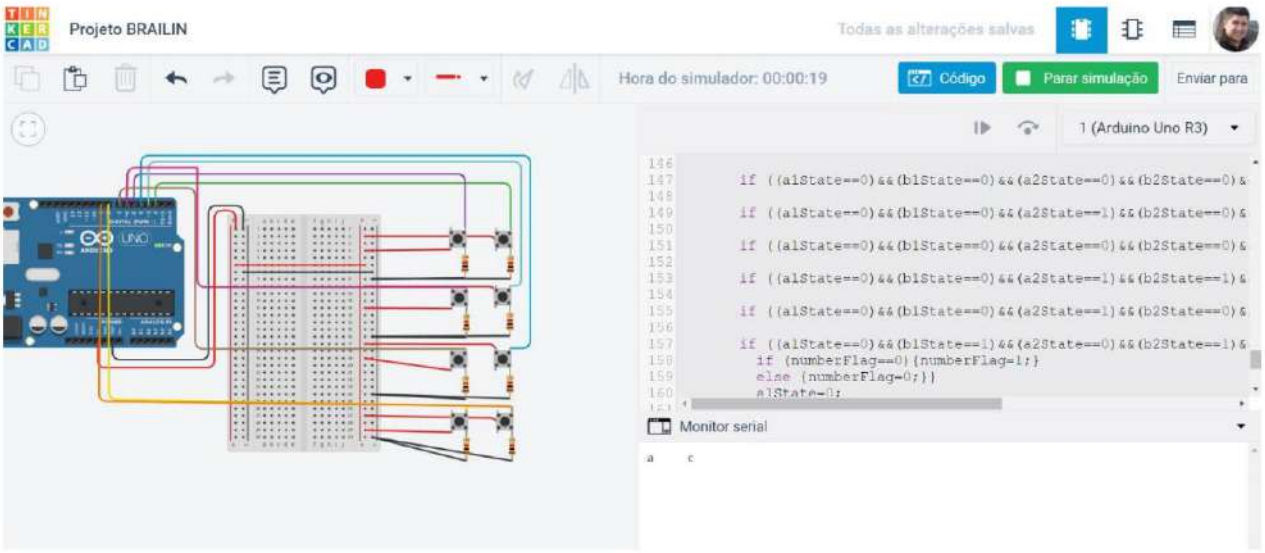
Visita ao CAA	O aluno deverá pesquisar, planear e identificar as necessidades dos utilizadores face à aplicação prática do projeto	O aluno deverá deslocar-se ao CAA para levantamento das necessidades junto dos alunos invisuais, bem como, as principais dificuldades de aprendizagem sentidas no início no Ensino Regular (planeamento)	**4 horas**
Desenvolvimento	O aluno deverá estar motivado a criar um protótipo / produto no tinkercad e ver as suas potencialidades na resolução das problemáticas dos invisuais.	O aluno deverá deslocar-se ao CAA para levantamento das necessidades junto dos alunos invisuais, bem como, as principais dificuldades de aprendizagem sentidas no início no Ensino Regular (planeamento)	**12 horas**
Apresentação do projeto final	Criação	Os alunos deverão elaborar um pitch para apresentação do projeto a realizar no CAA do AEAC.	**2 horas**
Avaliação	Envolvimento dos alunos no processo de avaliação e aprendizagem	Avaliação por pares através do teams – forms, bem como, avaliação de implementação do projeto.	**30 min**

Reflection and evaluation:

The teacher should make a short summary of the key points in the development of the project pointed out by the students. He should support the preparation of the schedule and the initial requirements for the project. It should help students evaluate the usability of the prototype and the model, evaluating its practical application. Students should be encouraged to create something practical, easy to transport and store.

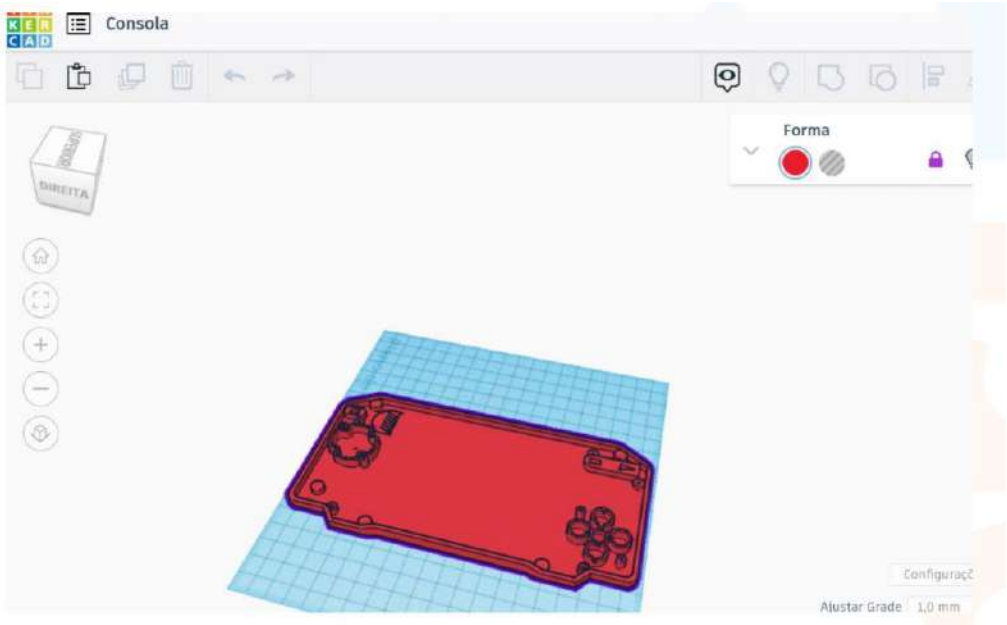
Resources:

DEVELOPMENT OF THE PROJECT

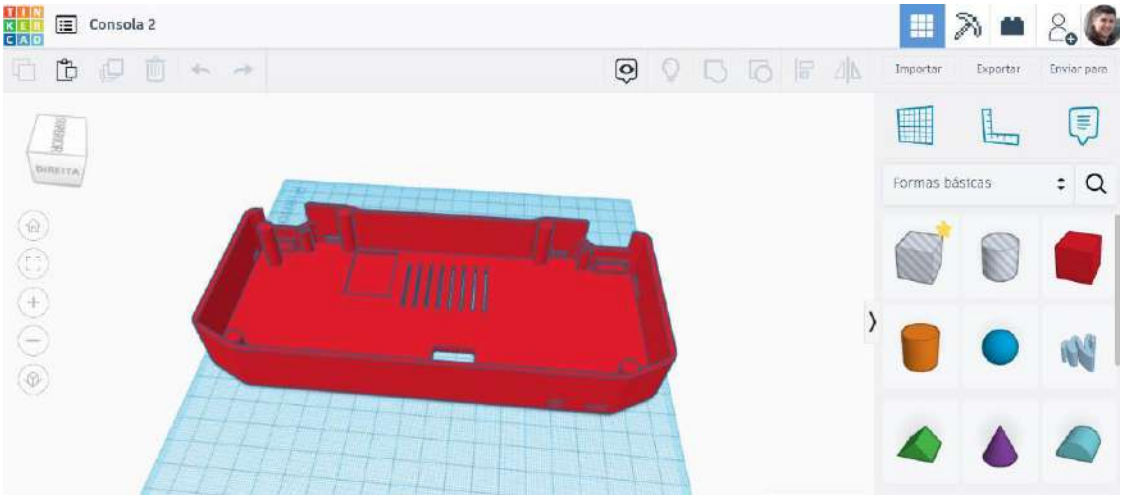


CONSOLE DESIGN PROPOSAL

- FRONT / FOR CUTTING



- BACK / CONSOLE



Source Code:

Source Code from the PROJECT:

```
const int buttonPin = 8;
const int ledPin = 13;
const int del = 9;
const int a1 = 5;
const int b1 = 2;
const int a2 = 6;
const int b2 = 3;
const int a3 = 7;
const int b3 = 4;
int a1State = 0;
int a2State = 0;
int a3State = 0;
int b1State = 0;
int b2State = 0;
int b3State = 0;
int delState = 0;
int buttonState = 0;
int lastButtonState = 0;
if (a1State==0){a1State = digitalRead(a1);}
else{a1State=1;}
if(a2State==0){a2State = digitalRead(a2);}
else{a2State=1;}
if (a3State==0){a3State = digitalRead(a3);}
else{a3State=1;}
if(b1State==0){b1State = digitalRead(b1);}
else{b1State=1;}
if (b2State==0){b2State = digitalRead(b2);}
else{b2State=1;}
if(b3State==0){b3State = digitalRead(b3);}
else{b3State=1;}
if (delState == 1){
a1State = 0;
a2State = 0;
a3State = 0;
```

```
b1State = 0;
b2State = 0;
b3State = 0;}
if (buttonState == 1){
if (buttonState == HIGH) {
if (a1State+a2State+a3State+b1State+b2State+b2State==0){
Serial.print(" ");
}
if ((a1State==1)&&(b1State==0)&&(a2State==0)&&(b2State==0)&&(a3State==0)&&(b3State==0)){
if (numberFlag==0){Serial.print("a");}
if (numberFlag==1){Serial.print("1");}}
if ((a1State==1)&&(b1State==0)&&(a2State==1)&&(b2State==0)&&(a3State==0)&&(b3State==0)){
if (numberFlag==0){Serial.print("b");}
if (numberFlag==1){Serial.print("2");}}
if ((a1State==1)&&(b1State==1)&&(a2State==0)&&(b2State==0)&&(a3State==0)&&(b3State==0)){
if (numberFlag==0){Serial.print("c");}
if (numberFlag==1){Serial.print("3");}}
if ((a1State==1)&&(b1State==1)&&(a2State==0)&&(b2State==1)&&(a3State==0)&&(b3State==0)){
if (numberFlag==0){Serial.print("d");}
if (numberFlag==1){Serial.print("4");}}
if ((a1State==1)&&(b1State==0)&&(a2State==0)&&(b2State==1)&&(a3State==0)&&(b3State==0)){
if (numberFlag==0){Serial.print("e");}
if (numberFlag==1){Serial.print("5");}}
if ((a1State==1)&&(b1State==1)&&(a2State==1)&&(b2State==0)&&(a3State==0)&&(b3State==0)){
if (numberFlag==0){Serial.print("f");}
if (numberFlag==1){Serial.print("6");}}
if ((a1State==1)&&(b1State==1)&&(a2State==1)&&(b2State==1)&&(a3State==0)&&(b3State==0)){
if (numberFlag==0){Serial.print("g");}
if (numberFlag==1){Serial.print("7");}}
if ((a1State==1)&&(b1State==0)&&(a2State==1)&&(b2State==1)&&(a3State==0)&&(b3State==0)){
if (numberFlag==0){Serial.print("h");}
if (numberFlag==1){Serial.print("8");}}
if ((a1State==0)&&(b1State==1)&&(a2State==1)&&(b2State==0)&&(a3State==0)&&(b3State==0)){
if (numberFlag==0){Serial.print("i");}
if (numberFlag==1){Serial.print("9");}}
if
((a1State==0)&&(b1State==1)&&(a2State==1)&&(b2State==1)&&(a3State==0)&&(b3State==0)){Serial.p
rint("j");}
if
((a1State==1)&&(b1State==0)&&(a2State==0)&&(b2State==0)&&(a3State==1)&&(b3State==0)){Serial.p
rint("k");}
if
((a1State==1)&&(b1State==0)&&(a2State==1)&&(b2State==0)&&(a3State==1)&&(b3State==0)){Serial.p
rint("l");}
if
((a1State==1)&&(b1State==1)&&(a2State==0)&&(b2State==0)&&(a3State==1)&&(b3State==0)){Serial.p
rint("m");}
if
((a1State==1)&&(b1State==1)&&(a2State==0)&&(b2State==1)&&(a3State==1)&&(b3State==0)){Serial.p
rint("n");}
if
((a1State==1)&&(b1State==1)&&(a2State==1)&&(b2State==1)&&(a3State==0)&&(b3State==1)){Serial.p
rint("ñ");}
```

```
IF
((A1STATE==1)&&(B1STATE==0)&&(A2STATE==0)&&(B2STATE==1)&&(A3STATE==1)&&(B3STATE==0)){SERIAL.P
RINT("O");}
IF
((A1STATE==1)&&(B1STATE==1)&&(A2STATE==1)&&(B2STATE==0)&&(A3STATE==1)&&(B3STATE==0)){SERIAL.P
RINT("P");}
IF
((A1STATE==1)&&(B1STATE==1)&&(A2STATE==1)&&(B2STATE==1)&&(A3STATE==1)&&(B3STATE==0)){SERIAL.P
RINT("Q");}
IF
((A1STATE==1)&&(B1STATE==0)&&(A2STATE==1)&&(B2STATE==1)&&(A3STATE==1)&&(B3STATE==0)){SERIAL.P
RINT("R");}
IF
((A1STATE==0)&&(B1STATE==1)&&(A2STATE==1)&&(B2STATE==0)&&(A3STATE==1)&&(B3STATE==0)){SERIAL.P
RINT("S");}
IF
((A1STATE==0)&&(B1STATE==1)&&(A2STATE==1)&&(B2STATE==1)&&(A3STATE==1)&&(B3STATE==0)){SERIAL.P
RINT("T");}
IF
((A1STATE==1)&&(B1STATE==0)&&(A2STATE==0)&&(B2STATE==0)&&(A3STATE==1)&&(B3STATE==1)){SERIAL.P
RINT("U");}
IF
((A1STATE==1)&&(B1STATE==0)&&(A2STATE==1)&&(B2STATE==0)&&(A3STATE==1)&&(B3STATE==1)){SERIAL.P
RINT("V");}
IF
((A1STATE==0)&&(B1STATE==1)&&(A2STATE==1)&&(B2STATE==1)&&(A3STATE==0)&&(B3STATE==1)){SERIAL.P
RINT("W");}
IF
((A1STATE==1)&&(B1STATE==1)&&(A2STATE==0)&&(B2STATE==0)&&(A3STATE==1)&&(B3STATE==1)){SERIAL.P
RINT("X");}
IF
((A1STATE==1)&&(B1STATE==1)&&(A2STATE==0)&&(B2STATE==1)&&(A3STATE==1)&&(B3STATE==1)){SERIAL.P
RINT("Y");}
IF
((A1STATE==1)&&(B1STATE==0)&&(A2STATE==0)&&(B2STATE==1)&&(A3STATE==1)&&(B3STATE==1)){SERIAL.P
RINT("Z");}
IF
((A1STATE==0)&&(B1STATE==0)&&(A2STATE==1)&&(B2STATE==1)&&(A3STATE==1)&&(B3STATE==0)){SERIAL.P
RINT("!");}
IF
((A1STATE==0)&&(B1STATE==0)&&(A2STATE==0)&&(B2STATE==0)&&(A3STATE==1)&&(B3STATE==0)){SERIAL.P
RINT("'");}
IF
((A1STATE==0)&&(B1STATE==0)&&(A2STATE==1)&&(B2STATE==0)&&(A3STATE==0)&&(B3STATE==0)){SERIAL.P
RINT(".");}
IF
((A1STATE==0)&&(B1STATE==0)&&(A2STATE==0)&&(B2STATE==0)&&(A3STATE==1)&&(B3STATE==1)){SERIAL.P
RINT("-");}
IF
((A1STATE==0)&&(B1STATE==0)&&(A2STATE==1)&&(B2STATE==1)&&(A3STATE==0)&&(B3STATE==1)){SERIAL.P
RINT(",");}
IF
((A1STATE==0)&&(B1STATE==0)&&(A2STATE==1)&&(B2STATE==0)&&(A3STATE==1)&&(B3STATE==1)){SERIAL.P
RINT("?");}
IF
((A1STATE==0)&&(B1STATE==1)&&(A2STATE==0)&&(B2STATE==1)&&(A3STATE==1)&&(B3STATE==1)){//SERIAL.
PRINT("#");}
```

```
if (numberFlag==0){numberFlag=1;}
if
((a1State==1)&&(b1State==1)&&(a2State==0)&&(b2State==0)&&(a3State==1)&&(b3State==1)){Serial.p
rint("x");}
if
((a1State==1)&&(b1State==1)&&(a2State==0)&&(b2State==1)&&(a3State==1)&&(b3State==1)){Serial.p
rint("y");}
if
((a1State==1)&&(b1State==0)&&(a2State==0)&&(b2State==1)&&(a3State==1)&&(b3State==1)){Serial.p
rint("z");}
if
((a1State==0)&&(b1State==0)&&(a2State==1)&&(b2State==1)&&(a3State==1)&&(b3State==0)){Serial.p
rint("!");}
if
((a1State==0)&&(b1State==0)&&(a2State==0)&&(b2State==0)&&(a3State==1)&&(b3State==0)){Serial.p
rint("'");}
if
((a1State==0)&&(b1State==0)&&(a2State==1)&&(b2State==0)&&(a3State==0)&&(b3State==0)){Serial.p
rint(".");}
if
((a1State==0)&&(b1State==0)&&(a2State==0)&&(b2State==0)&&(a3State==1)&&(b3State==1)){Serial.p
rint("-");}
if
((a1State==0)&&(b1State==0)&&(a2State==1)&&(b2State==1)&&(a3State==0)&&(b3State==1)){Serial.p
rint(",");}
if
((a1State==0)&&(b1State==0)&&(a2State==1)&&(b2State==0)&&(a3State==1)&&(b3State==1)){Serial.p
rint("?");}
if
((a1State==0)&&(b1State==1)&&(a2State==0)&&(b2State==1)&&(a3State==1)&&(b3State==1)){//Serial.
print("#");}
if (numberFlag==0){numberFlag=1;}
```

33- Area addressed: 3D editing software (tinkercad)

Subject: Create and Test a Learning Scenario

Context: 7th grade classes, discipline of Information and Communication Technologies

Objectives:

- ✓ Identify the building or monument to be modeled in 3D. Search and/or capture images of the building or monument. Create an account on the Tinkercad app. Enter the invitation code provided by the teacher.
- ✓ Explore the Tinkercad online application – Take some of the available lessons.
- ✓ Create the 3D model of the building or monument.
- ✓ Share the model with the rest of the class.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Apresentação de um modelo flexível para criar cenários de aprendizagem.	Encontre novas metodologias pedagógicas que permitam uma abordagem mais eficaz aos cenários de Robótica Educativa e Programação e Aprendizagem	Análise do modelo proposto e possíveis alterações	**1 hora**
Narrativa descritiva abaixo.		- Desenhar o LC - Implementação do LC em sala de aula - Avaliação Percepções dos alunos; Reflexão do professor:	**4 horas**

1. Create a building or monument of interest in the local environment in 3D.

2. Students should use internet image searches, information leaflets, and online map applications. When possible, photograph the building or monument.

3. Correctly use the internet to collect images.

4. Use image capture devices.

5. Use a 3D modeling tool

Reflection and evaluation:

• Locate and/or capture suitable images to help with 3D modeling.

• Using the basic features of a 3D application.

• I correctly constructed a building or monument model

Resources:

• Computer with Internet access;

• Multimedia projector; 3D editing software (tinkercad);

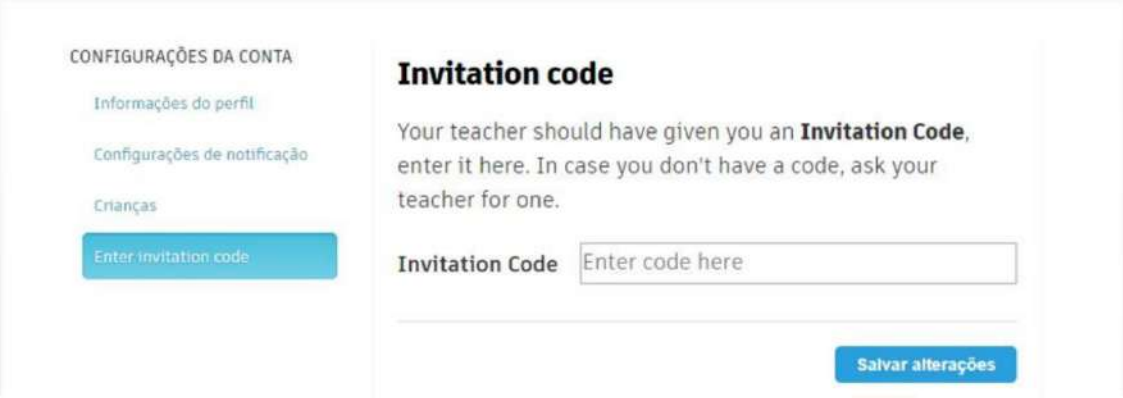
• Image Capture Device (Smartphone or camera);

• Collaborative platform.

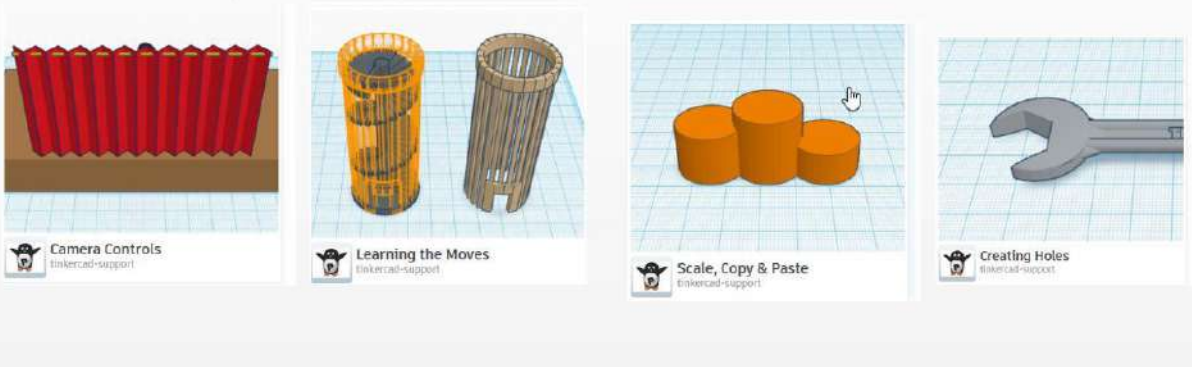
• www.tinkercad.com

• Criar uma conta (Inscrever-se)

• Introduzir código de convite para acesso do professor, através do perfil.



• Primeiros passos - Explorar as lições



34- Title: INTERACTION WITH ARDUINO – LCD (Liquid Crystal Display)

Arduíno Addressed area: Arduino

Subject: knowing and installing the LCD component (Liquid Crystal Display)

Context: knowing the LCD component, installing the Tinkercad online simulator and creating the program that will display the desired information on the LCD. In order to consolidate knowledge, an exercise will be carried out, in groups of 2 or 3 students, in which they will have to carry out the same situation in the Arduino Kit.

Objectives: get to know, install the LCD component, create a program to read information. Develop a simple exercise using the LCD in the Tinkercad online simulator and in the Arduino Kit.

NARRATIVE

CLASSES	MOTIVATION	TASK	DURATION
Mention the objectives of classroom	want to know the class content	- Viewing a presentation Power point	5 min
know the component LCD and the pins that constitute it	want to know the LCD component of Arduino	vision of presentation Power point	10 min
know the arduino components needed to install the lcd display	want to meet the necessary components to turn on the LCD	vision of presentation Power point	10 min
Assemble the components in the online simulator tinkercad	want to learn how does the LCD work online simulator tinkercad	want to learn how does the LCD work online simulator Tinkercad - Viewing of presentation Power point - Assemble the components	20 min

Explain and create program	Want to create the code that allows you to read text and print on LCD screen	- Viewing of presentation Power point - Create the code in Tinkercad	20 min
start the simulation	Want to check the LCD a work on Tinkercad	Start the simulation on Tinkercad	5 min
Create the project in Kit Arduino	want to learn how Does the LCD in the Kit work? Arduino	- Presentation support Power point	45 min

Reflection and evaluation:

Students will get to know the Arduino LCD component and the components that are needed to make it work and will learn how to assemble the components in question, in the Tinkercad online simulator and in the Arduino Kit. After these activities, students will be familiar with the Arduino LCD component and how it works.

Resources:

- Computers
- Video projector
- Powerpoint presentation (tutorial)
- Internet
- Tinkercad online simulator
- Arduino kit

35- Title: Traffic light for vehicles and pedestrians

Addressed area: Programming using the Tinkercad simulator (Arduino)

Subject: Create and test a Learning Scenario to program a traffic light for vehicles and pedestrians

Context: In this Learning Scenario it is intended that students continue to develop small projects involving computational thinking. In this phase, using the Tinkercad Circuits simulator, students acquire knowledge about programming logic, implement and simulate real situations, using block programming. At a later stage, it is intended to make the transition to the implementation and programming of the Arduino Uno board.

Objectives: To develop a project, using the Tinkercad Circuits simulator, which simulates a traffic light for vehicles and pedestrians.

NARRATIVE

CLASSES	MOTIVATION	TASK	DURATION
Apresentação do projeto e dos objetivos a atingir. Simulação do projeto	Adquirir conhecimentos sobre programação	Análise do projeto proposto e esclarecimento de dúvidas	50 min
Construção e programação dos componentes	Perceber como são programadas situação reais.	Montagem dos elementos, programação e testagem	100 min

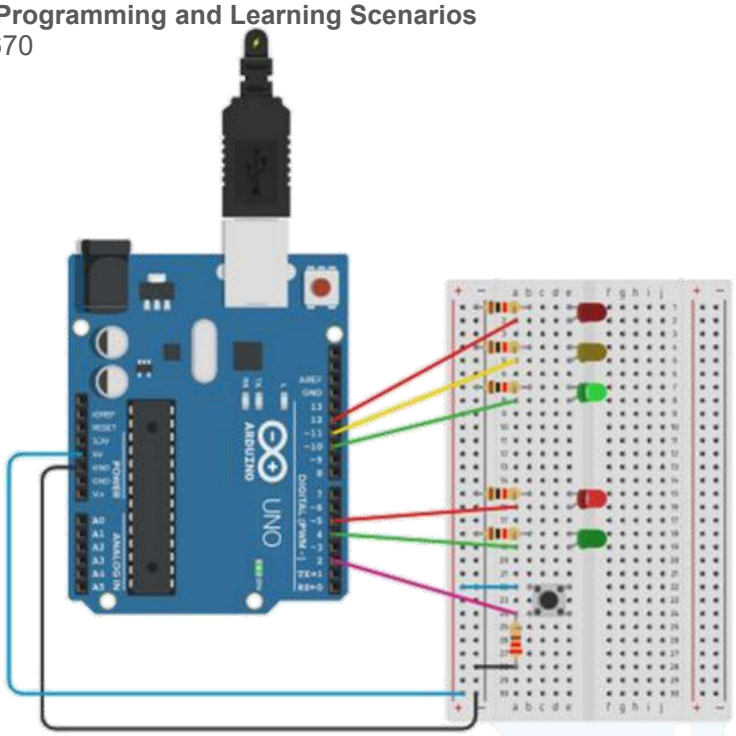
Reflection and evaluation:

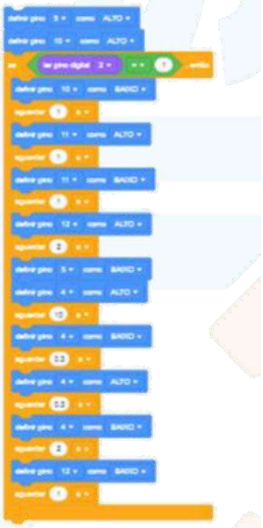
With the resolution of this project, it was possible to analyze the students' perception of a real situation. In addition to the concepts associated with computational thinking, which allowed students to reflect on how traffic lights are programmed, concepts about citizenship and critical thinking were also worked on.

Resources:

Computer with Internet access;
Tinkercad;

Work sheet:





Code:

```
// C++ code
//
void setup()
{
pinMode(5, OUTPUT);
pinMode(10, OUTPUT);
pinMode(2, INPUT);
pinMode(11, OUTPUT);
pinMode(12, OUTPUT);
pinMode(4, OUTPUT);

}
void loop()
{
digitalWrite(5, HIGH);
digitalWrite(10, HIGH);
if (digitalRead(2) == 1) {
digitalWrite(10, LOW);
delay(1000); // Wait for 1000 millisecond(s)
digitalWrite(11, HIGH);
delay(1000); // Wait for 1000 millisecond(s)
digitalWrite(11, LOW);
delay(1000); // Wait for 1000 millisecond(s)
digitalWrite(12, HIGH);
delay(2000); // Wait for 2000 millisecond(s)

digitalWrite(5, LOW);
digitalWrite(4, HIGH);
delay(10000); // Wait for 10000 millisecond(s)
digitalWrite(4, LOW);
delay(300); // Wait for 300 millisecond(s)
digitalWrite(4, HIGH);
delay(300); // Wait for 300 millisecond(s)
digitalWrite(4, LOW);
delay(2000); // Wait for 2000 millisecond(s)
digitalWrite(12, LOW);
delay(1000); // Wait for 1000 millisecond(s)
}
}
```

3D Printing

36- Addressed area: Arduino, Tinkercad and 3D printing

Subject: Create and Test a Learning Scenario involving the above areas

Context: Professional course in management and programming of computer systems, disciplines of Aqc and/or programming aimed at the Professional aptitude test.

Objectives: Understand how to use the Arduino board, the analog and digital ports and where we can connect other components such as leds, resistors and also understand how we can program it using the Arduino IDE.

Draw using codeblocks, programming, a possible box that can contain the project appealing to the creativity of the students. Finally introduce "slicing" software, open source slicers and introduce them to the 3d printer, all within the spirit of project-based learning and based on constructivism.

A learning scenario involving Arduino, Tinkercad and 3D printing:

1. Introduction to Arduino: Introduce students to the concept of microcontrollers and the Arduino platform. Show how to create simple circuits in Tinkercad and program Arduino using the C language.
2. Build a simple project: Challenge students to create a simple project involving the use of Arduino and Tinkercad. They start by using code blocks, then export the file and can manipulate it in the projects functionality, in this process explaining some aspects of 3D printing, namely the issue of angles and the use of supports.
3. Introduction to 3D printing: After students have created their project in Tinkercad, teach them how to use a 3D printer to print their project. Show how to prepare the model for printing and how to use the 3D printer.
4. Assembling the project: After students have printed their parts, they can assemble their project using the Arduino and the circuit they created earlier. They can also use Tinkercad to make adjustments to their design and reprint parts if necessary.
5. Fine-tuning the design: Once students have built their design, they can begin to experiment and make adjustments to improve the design. For example, they can add additional sensors or create a more complex system.

This learning scenario is a great way to introduce students to the basics of electronics, programming, 3D modeling, and 3D printing. In addition, it also encourages creativity and problem solving, as students need to work as a team to create a functional project and perfect it over time.

It is important to consider the specific objectives of the scenario to choose the best approach and its evaluation, and also keep in mind that the evaluation must be continuous and over time, allowing for adjustments and improvements in the teaching and learning process.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Apresentação de um modelo flexível para criar cenários de aprendizagem.	Aprendizagem baseada em projetos: metodologia é centrada no aluno e se concentra em projetos que permitem aos alunos aplicar competências de resolução de problemas, colaboração e comunicação.	Análise do modelo proposto e possíveis alterações	**1 hora**
Narrativa descrita acima		- Desenhar o LC - Implementação do LC em sala de aula - Avaliação Percepções dos alunos; Reflexão do professor:	**4 horas**

Reflection and evaluation:

Students will be challenged to create a simple circuit with LEDs and breadboards, then create a box using programming (They must collaborate with each other, programming Tinkercad code blocks, their own ideas and implement dynamics between pairs. They must solve the problem and make the scheduled activities.)

Rating of this scenario:

1. Observation: observe the students' behavior while carrying out the activities proposed in the scenario, assessing their ability to work in a team, to apply acquired knowledge and to solve problems.
2. Portfolio: ask students to keep a portfolio with the work developed during the Educational Robotics and Programming classes, allowing a more detailed assessment of each student's individual progress.
3. Feedback: request feedback from students about the scenario and the activities carried out, allowing to assess the effectiveness of the scenario and identify areas that can be improved.
4. Self-assessment: encourage students to self-assess, identifying their strengths and weaknesses in relation to the activities developed, and to set goals to improve their skills.

Resources:

- computer
- 3d printer
- arduino board, leds, resistors, breadboard, connecting wires
- Tinkercad Circuits
- tutorial and guide

37- Title: CHALLENGES FOR THE IMPLEMENTATION OF EPR@LC - 'Project creation of a Robotic Arm´
Addressed area: All

Subject: Create and Test a Learning Scenario

Objectives: Create, apply and evaluate a learning scenario developing EPR and its application in an educational context.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Apresentação de um modelo flexível para criar cenários de aprendizagem.	Encontre novas metodologias pedagógicas que permitam uma abordagem mais eficaz aos cenários de Robótica Educativa e Programação e Aprendizagem	Análise do modelo proposto e possíveis alterações	**1 hora**
Prepare um cenário de aprendizagem e aplique-o num contexto pedagógico		- Desenhar o LC - Implementação do LC em sala de aula - Avaliação Percepções dos alunos; Reflexão do professor:	**4 horas**

Subject: Educational Programming and Robotics@Learning Scenarios (EPR@LS - PT)
Website: Training Platform - Educational Programming And Robotics @ Learning Scenarios
In a class of the 11th year of the Equipment Management Course, several learning scenarios were proposed with programming and educational robotics applied in an educational context.
Students had the opportunity to research and investigate project themes and select a theme.
The class was divided into groups of 2 or 3 students.
Each group had access to an Arduino Kit and a set of complementary components according to their needs.
group project needs.
For this evaluation I selected 2 learning scenarios that involve the creation of 2 projects with Arduino and 3D modeling and printing.

Project objectives:

Subject: Educational Programming and Robotics@Learning Scenarios (EPR@LS - PT)

Website: Training Platform - Educational Programming And Robotics @ Learning Scenarios

In an 11th grade class of the Equipment Management Course, several learning scenarios with programming and educational robotics applied in an educational context were proposed.

Students had the opportunity to research and investigate project themes and select a theme.

The class was divided into groups of 2 or 3 students.

Each group had access to an Arduino Kit and a set of complementary components according to the needs of the group's project.

For this evaluation I selected 2 learning scenarios that involve the creation of 2 projects with Arduino and 3D modeling and printing.

Learning scenarios with Arduino and 3D Modeling and Printing
Project creation of a Robotic Arm

This project consists of creating a robotic arm that performs a certain movement based on the orientations of the other arm. 3D printed parts are used for the entire slave arm structure.

In this scenario, students start by researching the components and their characteristics.

Then they researched the parts to be used and then proceeded to print the turret parts on the 3D printer

Then, the students assembled the printed pieces;

Then the students move on to connecting the components;

Later proceed to programming the Arduino board using the Arduino IDE.

Finally, they carry out tests to verify the functioning of the project.

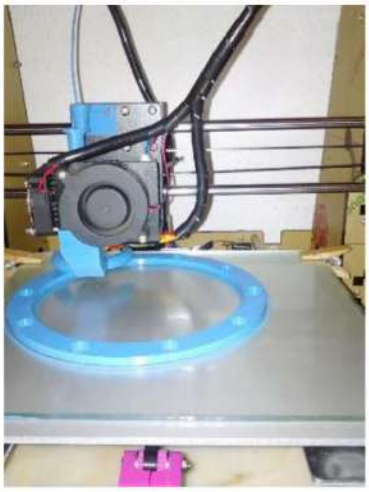
Project development:

Since there are hundreds of projects for robotic arms, the great challenge was to find the project that best fit our needs, so we used the thingiverse website to search for 3D models.

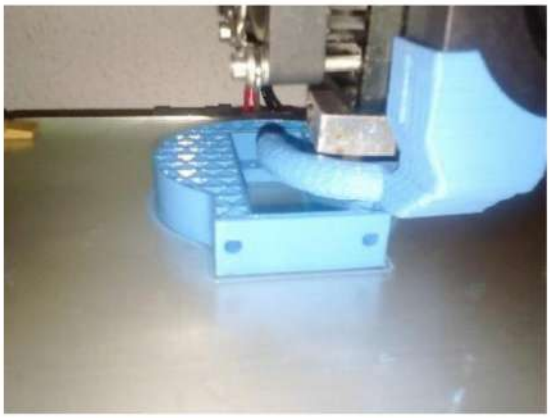
At the same time, the parts are printed.

The raw material used in the printing was PLA of three qualities: blue PLA, white PLA and also gray PLA which differ only in appearance.

Below are some printed pieces and their respective printing times.



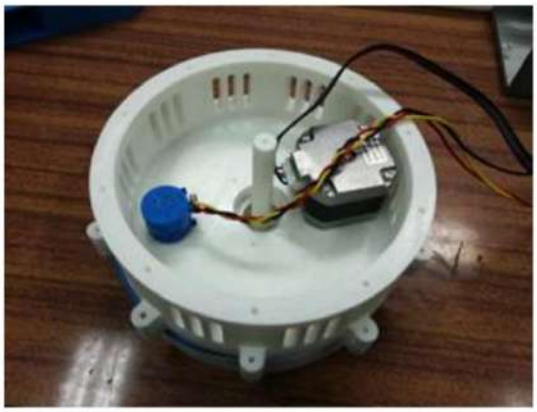

200/200°
46/45°
X 163 Y 165 Z 4.4
40% SD 99% 02:45
Heating done.

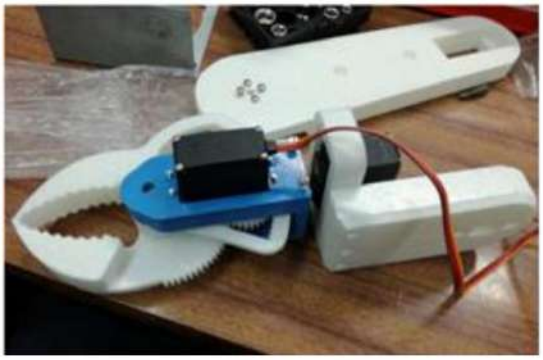



202/200°
46/45°
X 134 Y 84 Z 14
40% SD 92% 03:09
Heating done.


19/0°
19/0°
X 0 Y 0 Z 88.8
40% SD---% 21:37
21h 37m 7s

Once the entire printing process is finished, the assembly process takes place, which consists of joining the pieces together. printed through fittings or through fixing screws and fixing the servo motors.





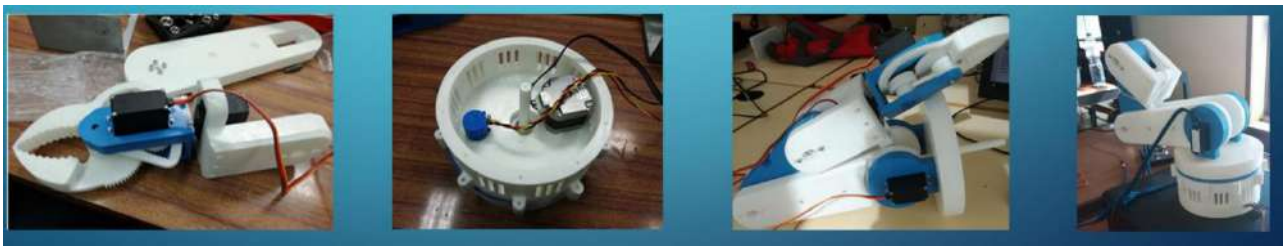
To power the entire structure, an ATX power supply was used.

Then the students proceeded to connect the components;

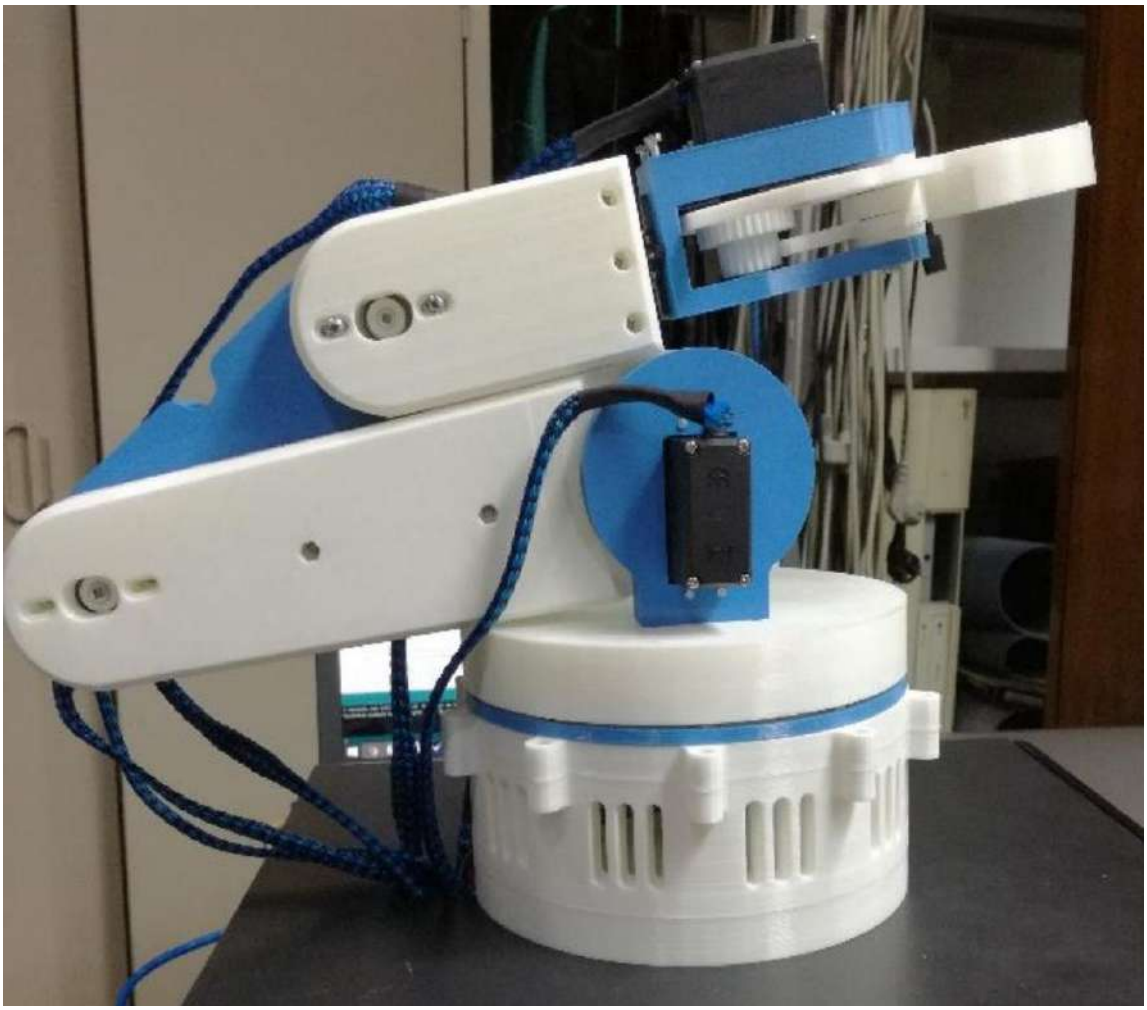
Later proceed to programming the Arduino board using the Arduino IDE.

Finally, they carry out tests to verify the functioning of the project.

Arm assembly phase:



Completed Project Pictures:



Project creation of a “Nerf Turret” with 3D printer

This project consists of building a **“Nerf Turret”** controlled by a mobile phone. A turret is a type of fixed machine gun that can be placed in various locations, for example, on warplanes or even in ground situations.

In this scenario, students start by researching the components and their characteristics.

Then they researched the parts to be used and then proceeded to print the turret parts on the 3D printer

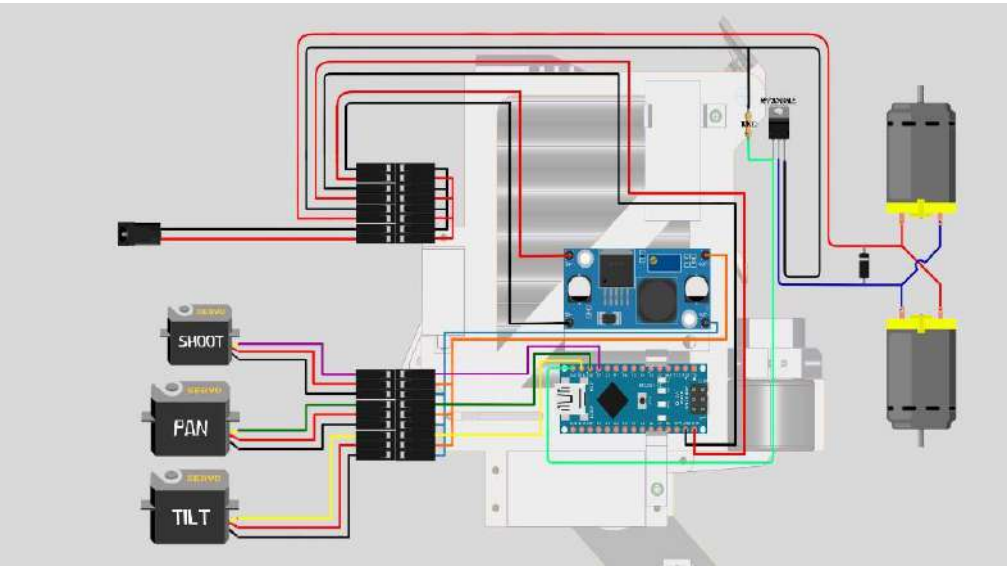
Then, the students assemble the printed pieces;

Then the students proceeded to connect the components;

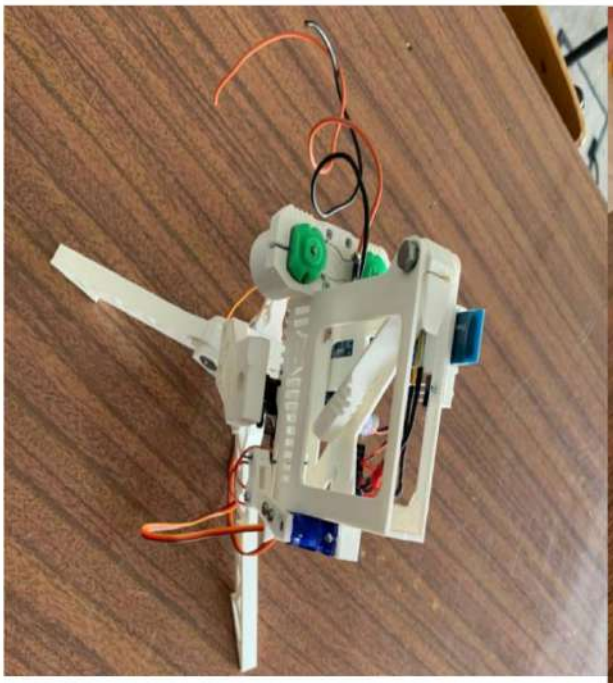
Subsequently, they proceeded to program the Arduino board using the Arduino IDE.

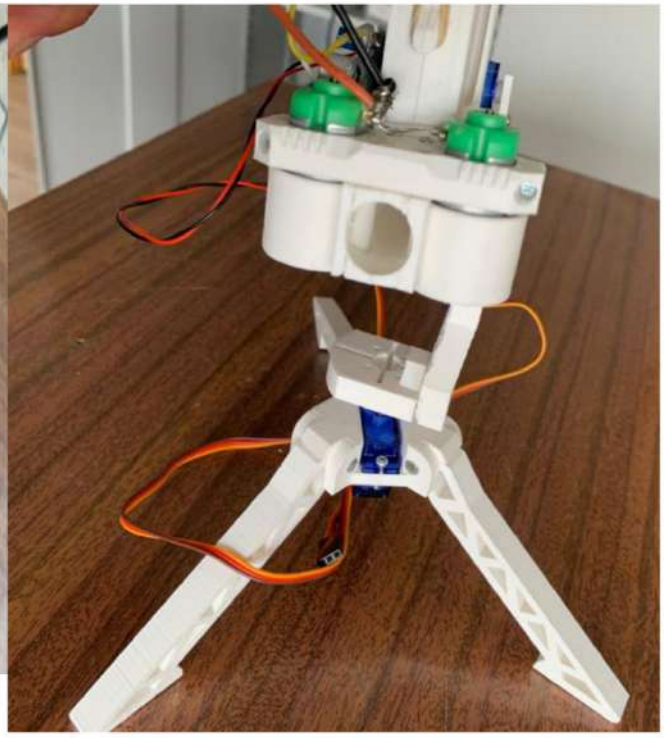
Finally, they carried out tests to verify the functioning of the project.

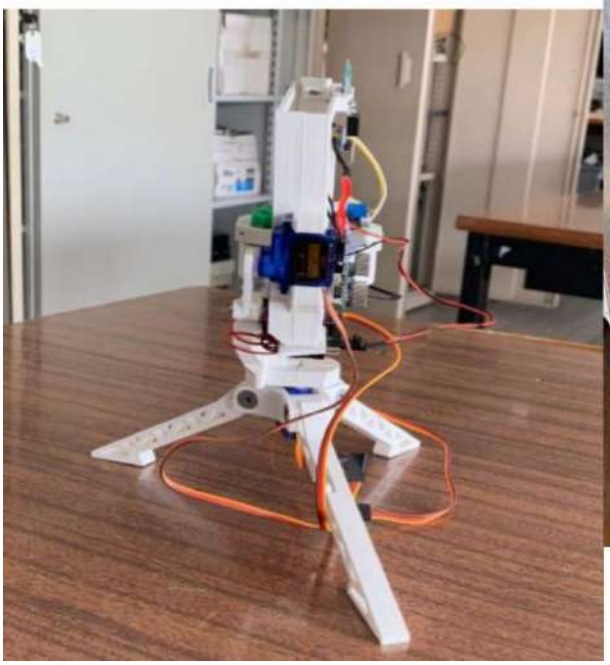
Project Circuit:

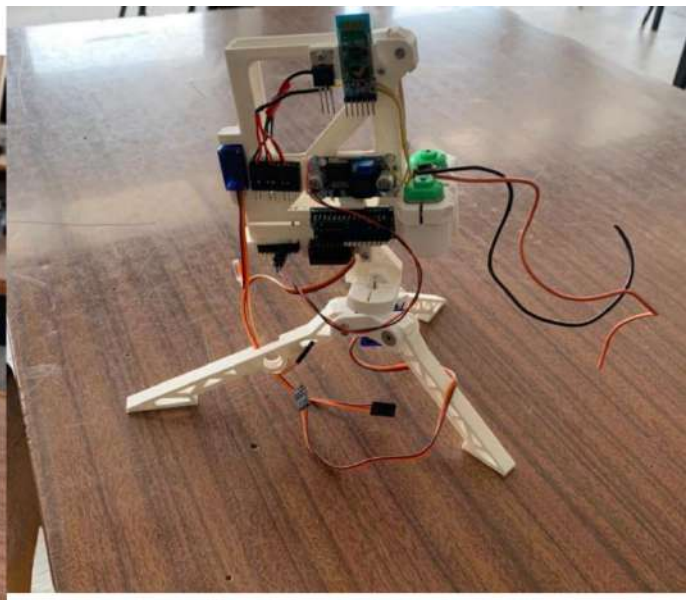


Parts printed on the 3D printer:









Final image of a model project:

Reflection and evaluation:

Students prepare a final report on the planning and development of the project and, at the end, present it to the class and teachers in the technical area.

This report is structured with several points:

Resources:

Tinkercad application;

Computer;

Arduino board and other electronic components;

3D printer;

Arduino IDE.

Evaluation of scenarios:

Teacher's perception:

the teacher evaluates the different moments of the construction of the project

Observation: observing the students' behavior while carrying out the activities proposed in the scenario, assessing their ability to work in a team, to apply acquired knowledge and to solve problems.

Construction of the Project: elaboration of the project (physical structure) and its programming;

Report: preparation of the report on the development of the project;

Project presentation: preparation of presentation in PowerPoint or Prezi;

Self-assessment of students on the scenarios and projects developed:

Students do a self-assessment on the developed scenarios taking into account the development, construction and presentation phases of the project.

38- Title: 3D replicas of tourist attractions in English-speaking countries

Addressed area: 3D Modeling and Printing

Subject: Using an application for 3D modeling

Context: Managing 3D modeling projects – 7th grade classes;

Objectives: In the domain of curricular autonomy (DAC), with the disciplines of Information Technologies and Communication, English and Visual Education, it is intended that students build in 3D, through the program ScketchUp, replicas of monuments or other types of buildings of tourist interest, from English-speaking countries.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Apresentar os objetivos do projeto e organizar a turma em grupos de trabalho.	Aquisição de novos conhecimentos sobre pontos de interesse em países de língua inglesa.	Escolha dos elementos do grupo de trabalho. Elaboração de pesquisas na Internet sobre as sugestões referidas no enunciado do projeto. Escolha do objeto a construir em 3D.	50 minutos
Apresentar o ambiente de trabalho do software de modelação 3D e as suas funcionalidades.	Exploração de um novo software	Familiarização com a ferramenta ScketchUp.	50 minutos
Construir o objeto em 3D através do software indicado.	Aquisição de novos conhecimentos e aplicação	Construção do monumento ou ponto de interesse turístico escolhida anteriormente, tendo em conta as pesquisas efetuadas.	150 minutos

reflection and evaluation:

● Through this project, students developed several areas of competence from the student's profile upon leaving school. compulsory schooling, which can be assessed by the different disciplines included in this work collaborative.

● With the development of this project, the students found that collaborative work is easy to apply and very beneficial, allowing that only one step work has an impact on assessment in different disciplines.

● The application of this project allowed students to get to know the potential of 3D Modeling software, as well as the entire process to apply until the models created in 3D are printed.

● This project work was quite demanding, taking into account that students in this age group still have little knowledge in this area, but it was interesting and motivating for students, allowing them to explore new software and demonstrate their non-standard skills. only on a technical level, but also artistically.

Resources:

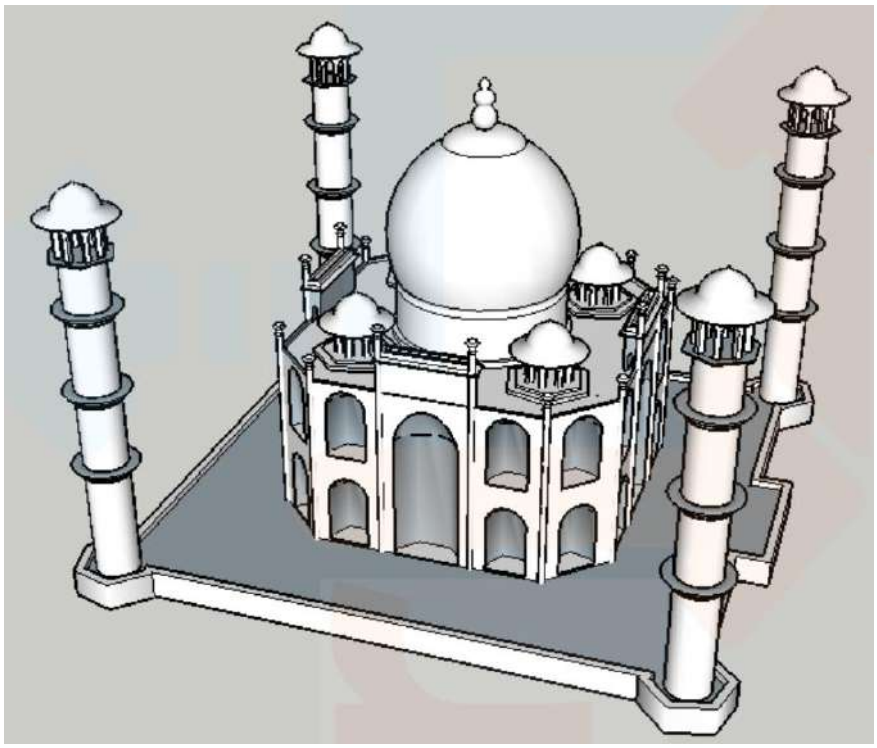
Computer with Internet access;

Project statement;

SketchUp application;

3d printer.

Example:



39- Subject: Create and Test a Learning Scenario

Context: The students of Clube da Robótica must produce a personalized Magnet with the logo of the Erasmus+ project "The school of the Future".

Goals:

Understand and explore the editing and modeling software - Tinkercad;

Create the product - Magnet - appealing to students' creativity.

Install and configure 3D Printer software -3D printer functions.Implementação:

Platform experience:

Construction activities of 3D figures;

Transformation of jpg file (Erasmus+ Logo) into STL file;

Creation of the final product.

3D printer configuration;

Installation of filaments.

Printing of the final product.

Sharing the Final Product with Erasmus+ Project members

Implementation:

Platform experimentation:

- ✓ Construction activities of 3D figures;
- ✓ Transformation of jpg file (Erasmus+ Logo) into STL file;
- ✓ Creation of the final product.
- ✓ 3D printer configuration;
- ✓ Installation of filaments.
- ✓ Printing of the final product.
- ✓ Sharing the Final Product with Erasmus+ Project members

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Apresentação da plataforma Tinkercad	Entender como modelar utilizando Tinkercad online. Saber como usar a plataforma	Criar Produto no Modelador	2 horas
Configuração da Impressora 3D	Compreender o funcionamento da Impressora 3D	Imprimir produto final	5 horas

Purpose of the EPR Learning Scenario:

Promoting the ability to diagnose, characterize, analyze and solve different situations;

Promoting autonomy, teamwork, a sense of responsibility and professionalism;

Production of a product.

Skills developed: with this project students develop:

Technical Skills: Modeling and 3D Printing;

Relational Skills: communication; collaboration; leadership; teamwork and cooperation;

Motivate to participate in Erasmus Projects;

Organizational Skills: time management and meeting deadlines and critical spirit.

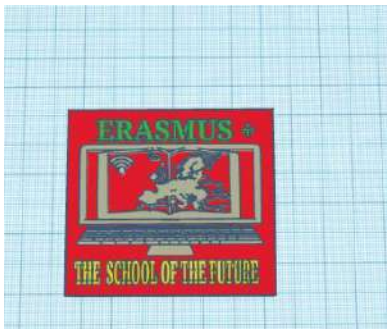


Figura 1 - Modelação em Tinkercad

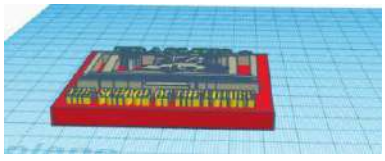


Figura 2 - Modelação em Tinkercad

Figura 3 - Configuração da Impressora/filamentos

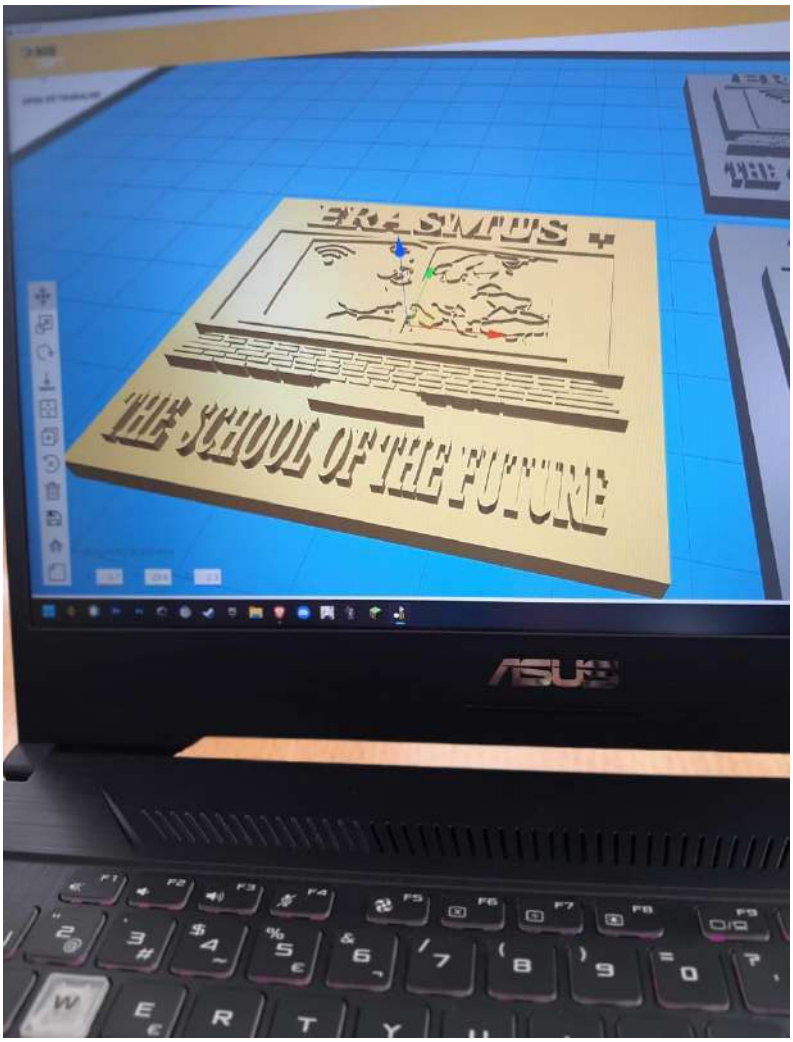


figura 4 - Modelação e configuração do produto Final

Figura 5 - Produto Fina

40- Area addressed: 3D Modeling and Printing

Subject: Create and implement a Learning Scenario "Modeling a prototype object in 3D – A container of the Ecopoint"

Interdisciplinarity: Science Club and ECO-ESCOLAS Project

Goals:
The aim is to create and implement the aforementioned Learning Scenario in the 6th grade ICT subject, articulated with the training curriculum module "Module 4- 3D Modeling and Printing"

1. Know and understand how to work in the Tinkercad application;
2. Create the aforementioned 3D model;
3. How to export 3D model to STL file;
4. Prepare file for 3D printer;
5. Prepare the 3D printer to operate and launch the process.

The works will be developed individually. However, students will be able to collaborate with each other.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFAS	DURAÇÃO
Introdução à aplicação Tinkercad . Com recurso à utilização de um sistema de projeção, apresentar: - a aplicação Tinkercad; - o seu interface gráfico; - a sua funcionalidade; - a sua flexibilidade.	Primeiro contacto com novas metodologias pedagógicas com uma abordagem interdisciplinar e inovadora num cenário de modelação 3D. Novidade.	O aluno entrar na Sala de Aula Virtual na aplicação Tinkercad com os códigos facultados pela professora. Explorar alguns recursos no Blog do Tinkercad.	50 minutos
Criação de um modelo 3D inspirado num objeto real do quotidiano do aluno.	O aluno ver um exemplo esperado para orientar-se e/ou inspirar-se na sua criação. Desenvolvimento das criações do modelo 3D.	Operações básicas modelação 3D: — Entrar na sala de aula virtual; — Atribuir um nome ao design; — Alterar as dimensões do plano de trabalho;	100 minutos

		Desenhar o objeto utilizando as técnicas adequadas de modelação 3D, tendo em vista encontrar soluções adequadas ao trabalho solicitado: — Utilizar a Shapes Library "Biblioteca das Formas". — Decompor um objeto nos seus elementos constituintes; — Utilizar e redimensionar um objeto; — Transformar um objeto sólido num orifício; — Fazer orifício; — Agrupar e desagrupar objetos; — Combinar formas; — Colorir objetos; — Interagir em diferentes planos.	
Feedback aos alunos durante as criações 3D	Reforço positivo da professora. O aluno visualizar as reações digitais atribuídas no Tinkercad.	Orientação e o apoio da professora "discutindo" com o aluno procedimentos utilizados e resultados esperados. Utilização das reações do Tinkercad.	
Análise e Aperfeiçoamento do um modelo 3D	Progresso, criatividade e estética nas criações 3D. Visualização das reações do Tinkercad atribuídas pela professora. Motivação para projetar modelos 3D.	Analisar que problemas podem ser resolvidos, usando a modelação 3D. Aperfeiçoar as suas criações 3D.	50 minutos
Descarregar ficheiro .STL para a impressora	Conclusão das criações 3D. Querer imprimir as criações 3D.	Exportar criações 3D para ficheiro extensão .STL	50 minutos As impressões terão tempos variáveis. Poderão ocorrer fora do contexto sala de aula.
Preparar criações 3D para impressão.	Querer aprender como funciona o afiamento 3D	Preparar e utilizar a impressora 3D.	

Imprimir criações 3D.	Contato físico com as criações 3D.	Impressão 3D. Exposição das criações 3D.	
Avaliação dos resultados (Autoavaliação) Feedback sobre o Cenário de Aprendizagem implementado (este é reajustado ao longo das aulas).	Diálogos abertos. Ferramentas digitais de apoio à autoavaliação e reflexão.	Autoavaliação dos alunos. Diálogo aberto reflexivo, junto dos alunos, sobre os seus resultados, as suas dificuldades e facilidades sentidas. E/ou não aplicar a autoavaliação e reflexão digital.	50 minutos

Reflection and evaluation:

With this Learning Scenario students will learn the fundamentals of modeling, preparing and printing 3D objects. After these activities, students will be familiar with 3D modeling and printing.

It is a Learning Scenario inspired by a real object in the daily life of students.

It is a Learning Scenario that encourages students' creativity in their creations, making them creators and co-authors in learning and problem solving (making, testing, evaluating and improving their creations).

It favors the demand for active and autonomous students.

It is a Learning Scenario that appeals to diversity (different 3D model creations), making it enriching, leveraging students' motivation, involvement, innovation, creativity and critical spirit in their creations.

Assessment

Observation:

1. I respected others. (Interpersonal relationship).
2. I participated. (Reasoning and problem solving).
3. I was autonomous/dexterous. (Personal development and autonomy).
4. I solved the activity (Create a 3D container model). (Scientific, technical and technological knowledge).
5. I was creative. (Creative and critical thinking)

Presentation of works

Using the Tinkercad Virtual Classroom. It will allow you to create, save, visualize, monitor, support, edit, evaluate and present all the works developed.

Feedback to students on the work developed:

Use of positive reinforcement by the teacher.

Guidance and support from the teacher “discussing” the procedures used and expected results with the students. Use of Tinkercad reactions on each of the works presented, making all students feel confident in carrying out the task. These reactions will allow a greater motivation of the students in the realization and improvement of their 3D works presented in the Virtual Room.

Student feedback on the Learning Scenario:

Carry out reflection dialogues and/or a digital reflection with the students. During classes readjust and/or reformulate the Learning Scenario in order to suppress the needs and/or difficulties felt.

Student self-assessment:

Encourage students to self-assess their results, identifying their facilities and difficulties felt in relation to the activities carried out, and to establish goals to improve your skills.

Resources:

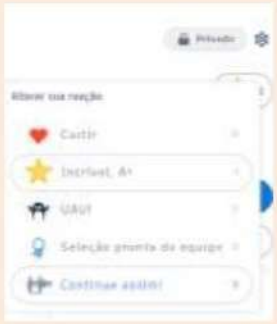
- Computers
- Internet access
- Tinkercad application
- 3d printer
- Tutorials

IMPLEMENTED NARRATIVE

Learning Scenario implemented in the ICT subject, with the students of a 6th grade class.

(*) I only teach the 2nd cycle, 50 minutes a week. This situation leads to the implementation of only 3D Modeling and Printing.

ATIVIDADES	MOTIVAÇÃO	TAREFAS	DURAÇÃO
Introdução à aplicação Tinkercad . Com recurso à utilização de um sistema de projeção, apresentar: - a aplicação Tinkercad; - o seu interface gráfico; - a sua flexibilidade.	Primeiro contacto com novas metodologias pedagógicas com uma abordagem interdisciplinar e inovadora num cenário de modelação 3D. Novidade.	O aluno entrar na Sala de Aula Virtual na aplicação Tinkercad com os códigos facultados pela professora. Explorar alguns recursos no Blog do Tinkercad. 	50 minutos
Criação de um modelo 3D inspirado num objeto real do quotidiano do aluno.	O aluno ver um exemplo esperado para orientar-se e/ou inspirar-se na sua criação. Desenvolvimento das criações do modelo 3D.	Operações básicas modelação 3D: Desenhar o objeto utilizando as técnicas adequadas de modelação 3D, tendo em vista encontrar soluções adequadas ao trabalho solicitado:   	100 minutos
Feedback aos alunos durante a realização das criações 3D	Reforço positivo da professora.	Orientação e o apoio da professora "discutindo" com o aluno procedimentos utilizados e resultados esperados.	

	O aluno visualizar as reações digitais atribuídas no Tinkercad.	Utilização das reações do Tinkercad.  	
Análise e Aperfeiçoamento do um modelo 3D	Progresso, criatividade e estética nas criações 3D. Visualização das reações do Tinkercad atribuídas pela professora. Motivação para projetar modelos 3D.	Analisar que problemas podem ser resolvidos, usando a modelação 3D. Aperfeiçoar as suas criações 3D.   	50 minutos
Descarregar ficheiro .STL para a impressora	Conclusão das criações 3D. Querer imprimir as criações 3D.	Exportar criações 3D para ficheiro extensão .STL	50 minutos As impressõe

		 	s terão tempos variáveis. Ocorrerão também fora do contexto sala de aula.
Preparar criações 3D para impressão.	Querer aprender como funciona o afiamento 3D	Preparar e utilizar a impressora 3D. 	
Imprimir criações 3D.	Contato físico com as criações 3D.	Impressão 3D. 	
Avaliação dos resultados (Autoavaliação) Feedback sobre o Cenário de Aprendizagem implementado (este é reajustado ao longo das aulas).	Diálogos abertos. Ferramentas digitais de apoio à autoavaliação e reflexão.	Autoavaliação dos alunos. Diálogo aberto reflexivo, junto dos alunos, sobre os seus resultados, as suas dificuldades e facilidades sentidas. E/ou não aplicar a autoavaliação e reflexão digital.	50 minutos

RESULTS OF THE DIGITAL STUDY CARRIED OUT

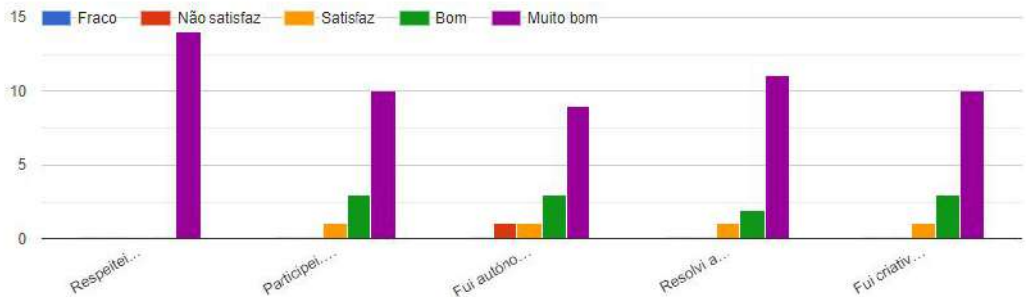
- SELF-ASSESSMENT OF THE RESULTS AND THE IMPLEMENTED LEARNING SCENARIO

Part I - "My attitudes and values"

1. Using the performance descriptors below, rate your attitudes and values today. (*Competence areas to which the ICT discipline contributes). Assign each descriptor a

nomenclature:

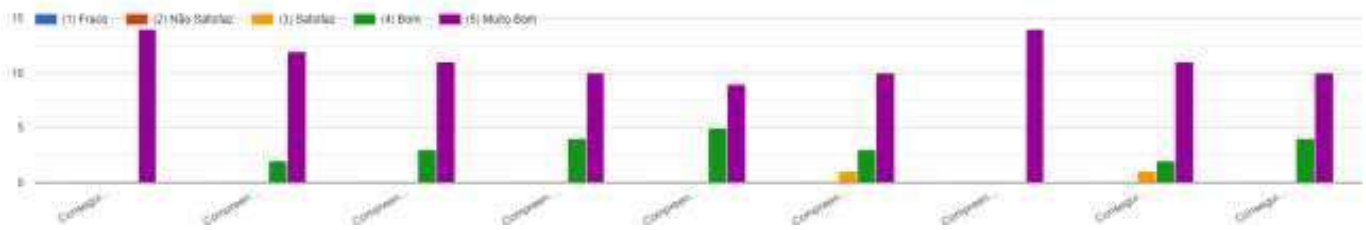
1. I respected others. (*Interpersonal relationship).
2. I participated. (*Reasoning and problem solving).
3. I was autonomous/dexterous. (*Personal development and autonomy).
4. I solved the activity (Create the 3D containers). (*Scientific, technical and technological knowledge).
5. I was creative. (*Creative and critical thinking)



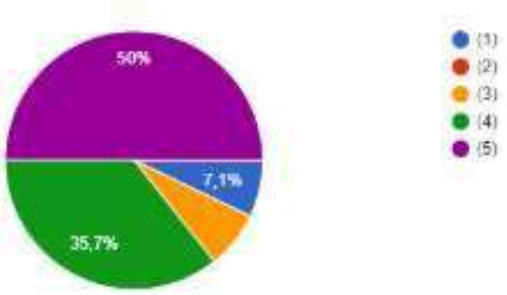
Reflection and regulation - monitoring the development of actors and context, critical evaluation,products

1. Rate your understanding and use of the **elementary 3D modeling techniques** below presented:

1. I was able to join the Tinkercad virtual class.
2. I understand and name the design.
3. I understood and entered the forms.
4. I understood and made holes (grouping objects).
5. I understood and managed to match shapes and positions.
6. I understood and was able to interact on different planes.
7. I understood and was able to color objects.
8. I was able to apply text to objects.
9. I managed to draw the 3D object, having found the appropriate solution for the work requested by the teacher



2. Classify your resolution (3D object "An Ecoponto container") on a scale of 1 (minimum) to 5 (maximum) values:



3. Justify your rating:

Eu acho que mereço 4 pois eu ainda tive dúvidas para fazer certos objetos mas sei que sou muito criativa e posso melhorar. Acho que consigo fazer bem o trabalho quando estou sozinha. Mas mesmo assim acho que não consigo fazer todo perfeitamente.
Pois consegui fazer as atividades propostas pela professora e ainda irei melhorar
Porque sobrou um que ficou sem o buraco quando agrupei
Não fiz pois faltei a aula porque estava doente
fui criativa e cumpro todas as tarefas sou boa a informática e gosta da matéria acho que mereço 5 pois fiz tudo certo e com criatividade
Pois respeitei todas as indicações da professora e fui criativo.
Porque nem sempre conseguia compreender a professora, mas sempre tentava experimentar e, ás vezes conseguia. Também na primeira aula de programação não estava a conseguir acompanhar a professora, ficava sempre um bocadinho atrasada comparado ao que ela estava a fazer, mas um amigo meu me conseguiu ajudar. Mas depois acabava por perceber e conseguir fazer. E é por isto que pedi a nota que pedi, pois conseguia fazer algumas coisas, mas tinha alguma ajuda.
Não consegui completar o exercício, mas com a ajuda da professora fiquei a entender melhor o pretendido.
Porque ficou um sem buraco
Eu acho que mereço um 3,porque ao fazer o trabalho,não percebi o que devia fazer e acabei por não ter um bom trabalho.
Pois consegui fazer os meus ecopontos 3D sem buracos e consegui aplicar a cor e o texto.
Eu acho que é um cinco, pois dei o meu melhor para conseguir fazer os ecopontos muito beml estive atentea as explicações e ao tive dificuldades a faze-lo.
Consegui fazer tudo e mais algumas coisa, já comecei enfeitar e e consegui compreender muito bem esta plataforma, pois já trabalhei com uma parecida num jogo.
Fiz tudo o que a professora mandou.

Part III "Learning Scenario in the Classroom"

A learning scenario is understood as a hypothetical teaching-learning situation (purely imagined or with a real substrate) composed of a set of elements.

- (i) **the context**, (ii) **the environment**, (iii) **roles and objective**s, organized in a story/narrative.

1. Classify the following statements:

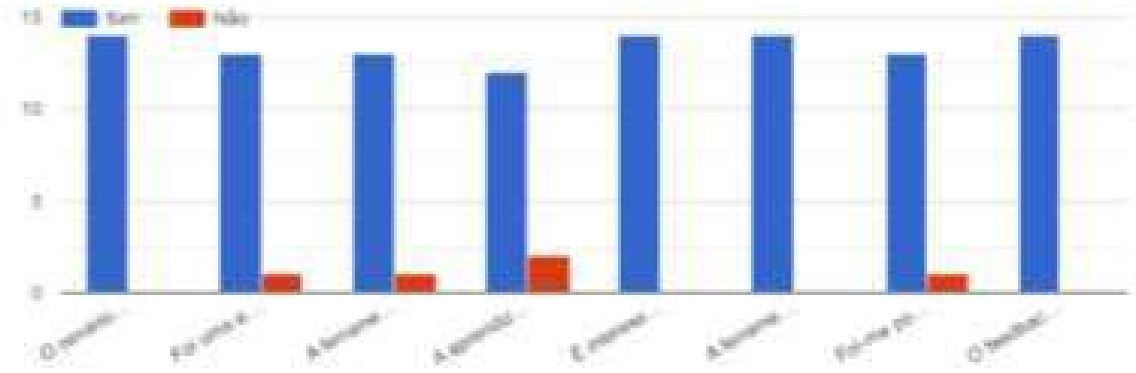
1. The learning landscape demonstrated innovation.
2. It was a successful innovative educational experience.
3. The tool used allowed us to think of new ways of envisioning the final result.
4. Learning was inspiring and allowed me to expand my creativity.

5. It is interesting to include the multidisciplinary project ECO Escolas in a 3D reality.

6. The tool used allowed me to evaluate and continuously improve, from the identification of contradictions and unforeseen innovations that emerge as a result of the introduction of new elements in the proposed activity.

7. I was given an apprenticeship where I got involved in exploring, experimenting and creating new learning objects.

8. The feedback given by the teacher on my resolutions was also a stimulus for my motivation and creativity.



Part IV "The 7 benefits of Learning Scenarios"

student-centered approaches

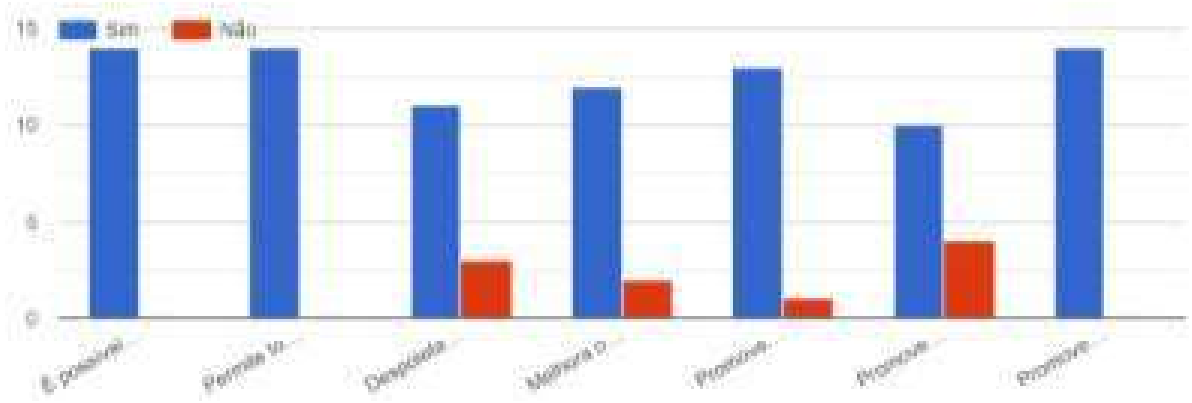
active learning

creative thinking

problem solving ability

Consider that in the implemented Learning Scenario:

1. It is possible to fail and learn from mistakes, as it happens in real life.
2. Allows you to make decisions, implement and experiment in a timely manner.
3. Trigger my memories.
4. Improves the level of information retention.
5. Promotes critical thinking.
6. Promotes emotional involvement.
7. Promotes collaborative work between people.



Part V "The 7 benefits of Learning Scenarios"

1. Briefly, it takes stock of the activity carried out. It presents aspects that more and/or less you liked it.

Gostei da experiência e não gostei do modo que aquilo travava.

Nesta atividade, o que mais gostei foi conseguir programar ecopontos e conseguir perceber o essencial. O que menos gostei foi ouvir a professora a explicar e eu a fazer e o computador travar e não conseguir acompanhar a professora.

Eu gostei muito de fazer os ecopontos em 3D pois foi uma experiência muito boa e assim consegui ter a sensação de trabalhar no "Tinkercad".

Não gostei de não ter tipo árvores e realistas e assim e gostei muito de poder criar o que quizer

Gostei muito de ter tido a oportunidade de explorar mais o mundo da Internet.
E foi muito divertido criar coisas 3D que podem virar realidade.
Também é bom para treinarmos a nossa criatividade e o nosso espirito critico que realmente desenvolvi sempre que observava que algo estava mal e corri atrás para melhorar e concluir com perfeição a atividade.
ADOREI a experiência e ficarei feliz se poder trabalhar o resto do ano com esta plataforma digital 3D.

Eu gostei quando tive que fazer as coisas mais simples, como: Meter a cor, meter objetos, meter o título no trabalho... Mas tudo é simples.

Os que mais gostei é que podemos fazer tudo o que quisermos com a nossa criatividade e os que menos gostei não há, gostei de tudo

gostei por ser diferente e que me inspira

Usar o excel

Gostei de poder compreender muito bem, as coisas e poder aprender mais coisas. Realmente foi muito interessante, só não gostei de a plataforma travar muito e de desagrupar só uma coisa de cada vez.

Nós construímos os três ecopontos (papel, plástico e vidro) e identifiquei-me mais com a decoração do trabalho

Não gostei de ao aumentar o a imagem aquilo da bug e gostei porque era uma coisa que eu sempre gostei desde criança gostei de poder criar minhas próprias coisas e etc...

Não gostei do facto de não ter conseguido comprir as tarefas na primeira tentativa, gostei do facto de a atividade envolver factos importantes como reciclagem!

Achei interessante. Gostei de colorir os ecopontos e trabalhar no projeto.

41- Title: The Tangram
Addressed area: 3D Modeling and Printing

Subject: Design and create a 3D tangram model

Context: Create and implement in the classroom, with the Tinkercad tool, a 3D model of a tangram for later practical use in the classroom, especially by colleagues from previous years, thus contributing to increase the educational resources of the school.

Objectives: Understand the use of Tinkercad in the implementation of 3D projects and subsequent modeling in the 3D printer.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
• Pesquisar conceitos básicos sobre desenho em 3D; • Pesquisar informações do software de modelação da impressora; • Desenhar o modelo proposto;	• Desenvolver a autonomia e a capacidade de desenho em 3D, com a aquisição de conceitos através das pesquisas e trabalho desenvolvido;	• Pesquisar sites; • Pesquisar conceitos sobre o desenho de formas básicas em 3D; • Desenhar o modelo em 3D.	**4 horas**
• Impressão do modelo desenhado; • Testar o modelo impresso com a realização de atividades específicas.	• Fomentar o trabalho em equipa; • Discussão e reflexão sobre melhorias a implementar	• Analisar documentação da impressora; • Analisar o modelo impresso e fazer uma análise crítica	**2 horas**

Reflection and evaluation:

The 11th grade students in the Computer Systems Management and Programming class were challenged in Mathematics classes to learn through research and practical application, to draw basic shapes in 3D.

For this purpose, working groups were created, the tasks of each one were established and a document, report type, of their conclusions was registered.

The students' works were essentially similar to each other, varying the colors and size used in the elaboration of the Tangram.

As this challenge is inherent to the discipline of Mathematics, and taking into account the teacher's knowledge acquired only during the training attended by ANPRI, it was understood to develop projects with the students simpler, where the main objective would be to be able to finish the same, given that the remaining modules dealt with deeper knowledge of electronics/robotics/programming.

Students' opinion:

Students enjoyed using the software used, having already done so in other disciplines. They were thus able to apply their knowledge to other areas, in addition to IT, and they enjoyed it. They were sorry that the final models could not be printed due to a problem with the filament (see the images below), but they promised that they would be as soon as the new filament arrived at the school.

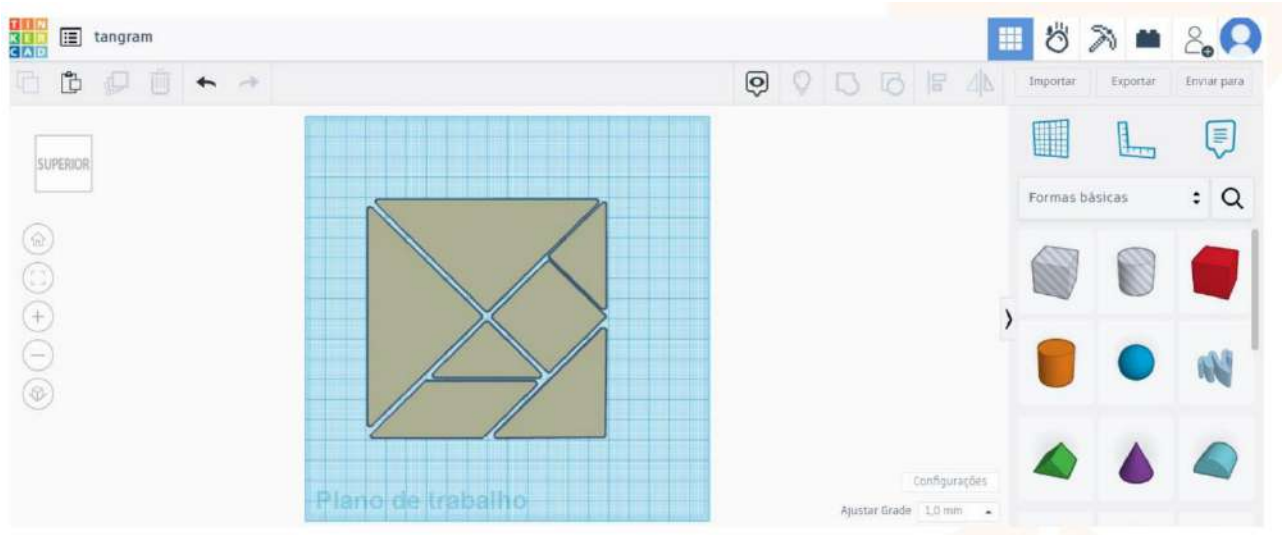
The evaluation was very positive.

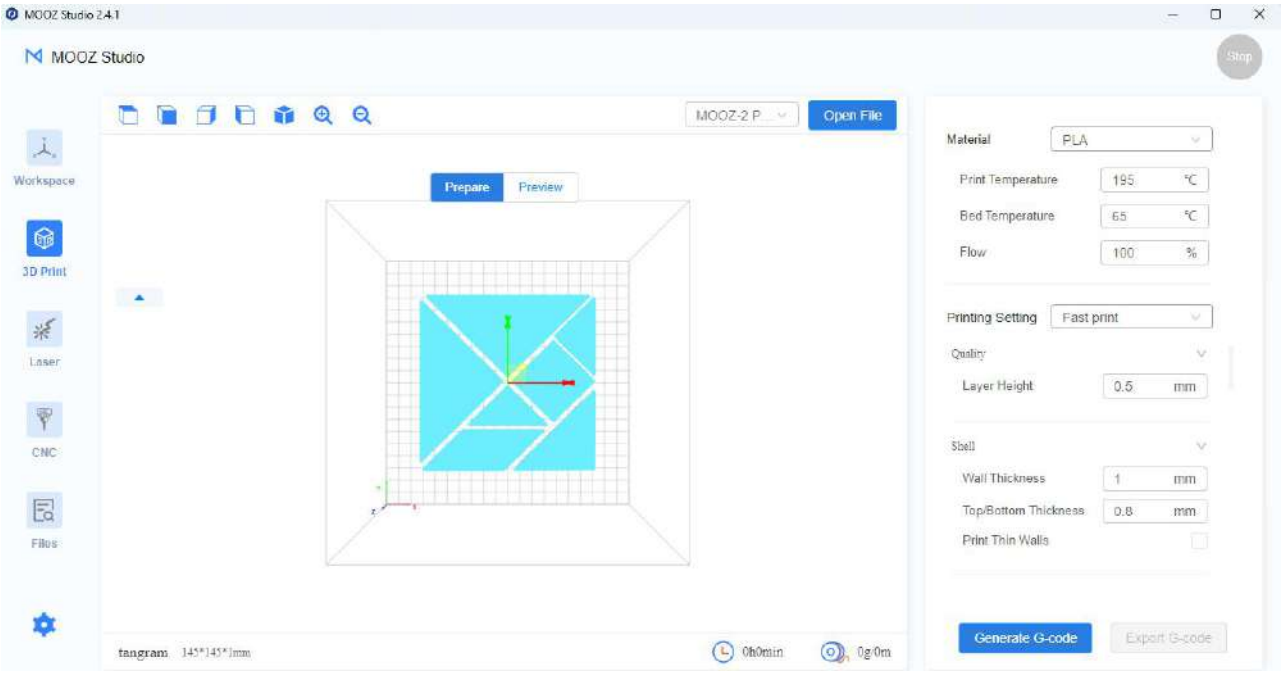
Resources:

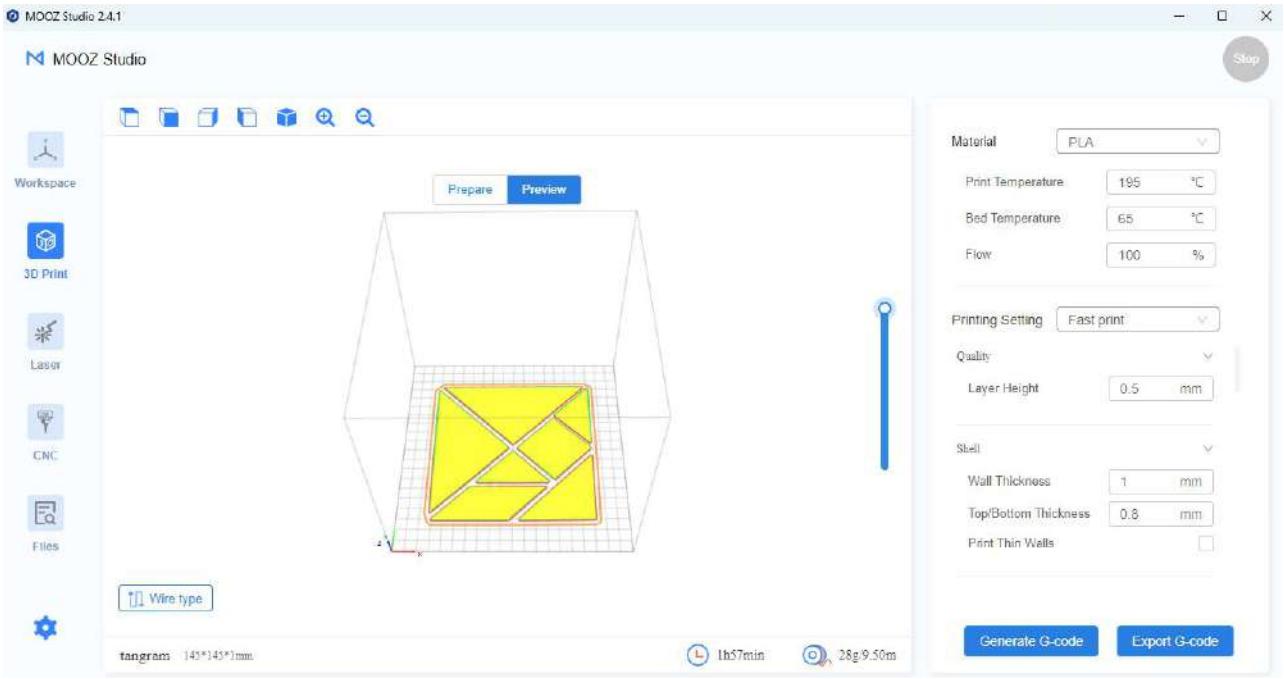
Software: Tinkercad and Mooze-studio

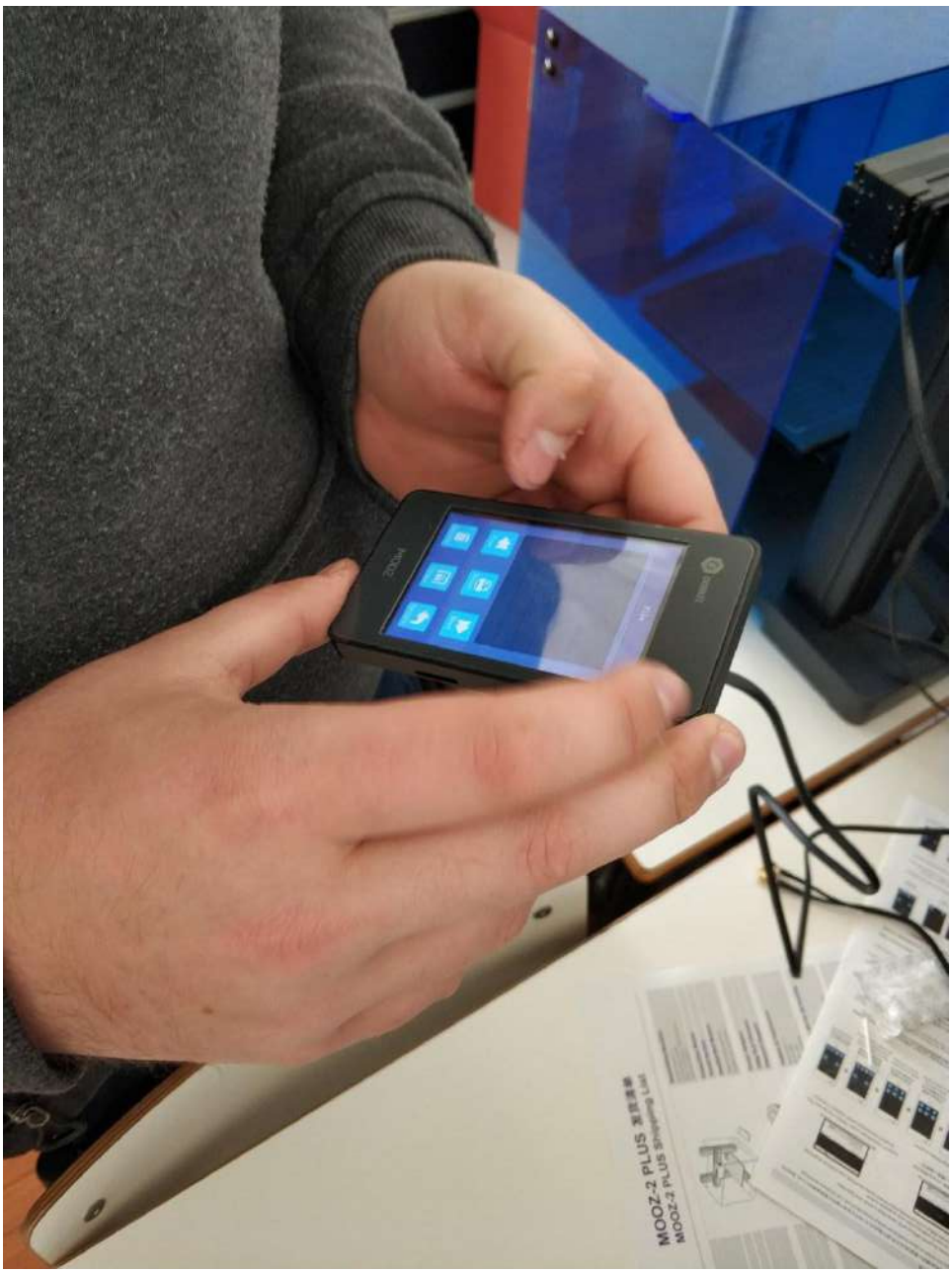
Internet: several websites about 3D design, Tinkercad tutorials

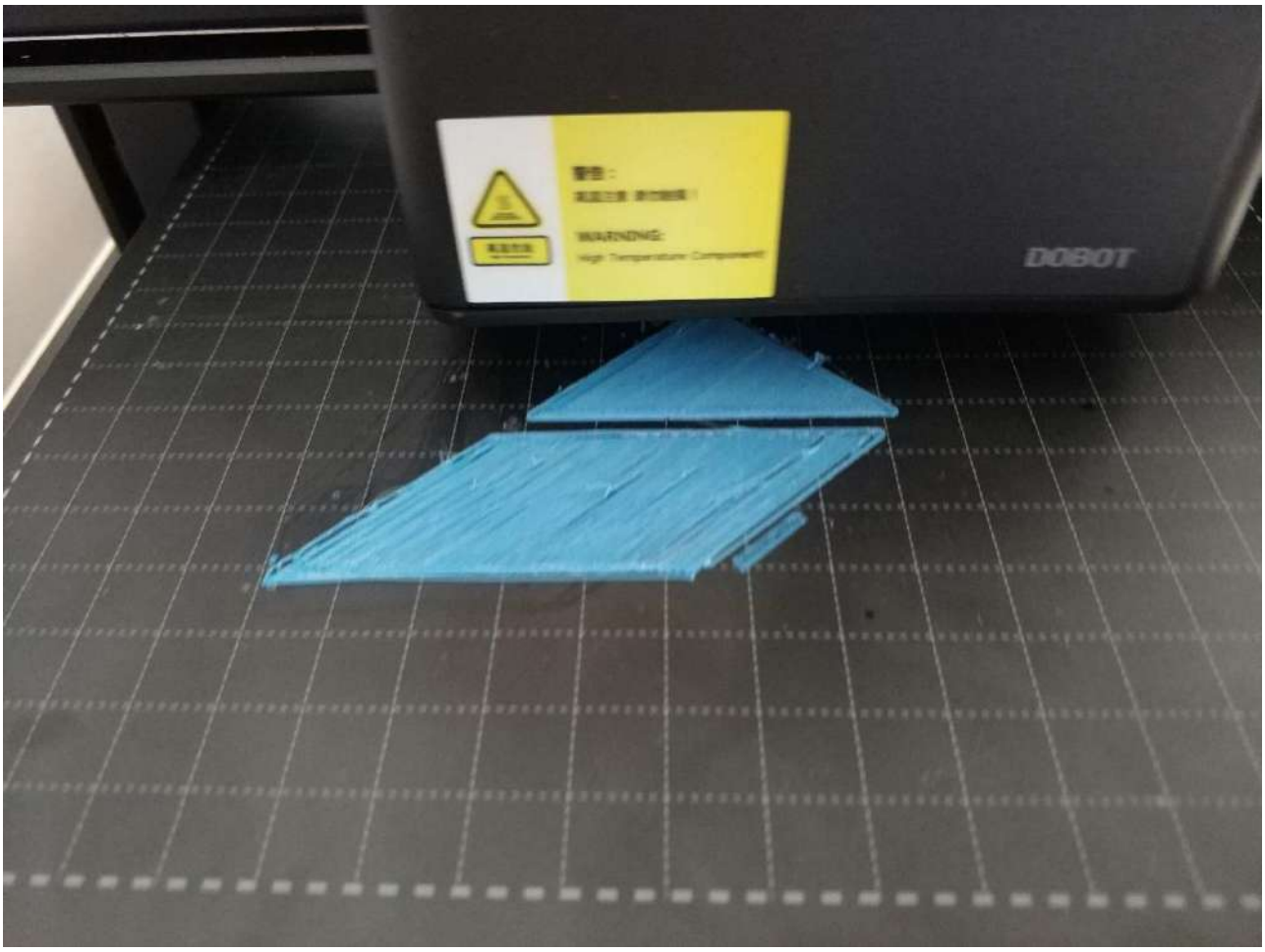
Some pictures:






MOOZ Studio 2.4.1
MOOZ Studio
Stop
Workspace
3D Print
Laser
CNC
Files
Prepare
Preview
Wire type
tangram 145*145*1mm
1h57min
28g/9.50m
Material
PLA
Print Temperature
195
℃
Bed Temperature
65
℃
Flow
100
%
Printing Setting
Fast print
Quality
Layer Height
0.5
mm
Shell
Wall Thickness
1
mm
Top/Bottom Thickness
0.8
mm
Print Thin Walls
Generate G-code
Export G-code


MOOZ-2 PLUS



Some videos:
Video of the 3D printer initializing the project:
https://drive.google.com/file/d/1t4_RrEj4aW9cOuh1Q2DL9xdX_POZh5LY/view?usp=sharing

Video of a printed part of the project (the beginning):
https://drive.google.com/file/d/1T8_a0wiOfLHrAdCZcUNzj_FK5Q32yVvR/view?usp=sharing

42- Subject: Programming and Information Systems

Module 16 – Software Design

Title: INTERACTION WITH ARDUINO – LCD (Liquid Crystal Display)

Addressed area: Arduino

Subject: knowing and installing the LCD component (Liquid Crystal Display)

Context: knowing the LCD component, installing the Tinkercad online simulator and creating the program that will display the desired information on the LCD. In order to consolidate knowledge, an exercise will be carried out, in groups of 2 or 3 students, in which they will have to carry out the same situation in the Arduino Kit.

Objectives: get to know, install the LCD component, create a program to read information. Develop a simple exercise using the LCD in the Tinkercad online simulator and in the Arduino Kit.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Referir os objetivos da aula	Querer conhecer o conteúdo da aula	- Visionamento de uma apresentação Powerpoint	**5 min**
Conhecer o componente LCD e os pinos que o constituem	Querer conhecer o componente LCD do Arduíno	- Visionamento da apresentação Powerpoint	**10 min**
Conhecer os componentes de Arduíno necessários para instalar o LCD Display	Querer conhecer os componentes necessário para ligar o LCD	- Visionamento da apresentação Powerpoint	**10 min**
Montar os componentes no simulador online Tinkercad	Querer aprender como funciona o LCD no simulador online Tinkercad	- Visionamento da apresentação Powerpoint - Montar os componentes no simulador online Tinkercad	**20 min**
Explicar e criar o programa	Querer criar o código que permita ler texto e imprimir no ecrã LCD	- Visionamento da apresentação Powerpoint - Criar o código no Tinkercad	**20 min**
Iniciar a simulação	Querer verificar o LCD a funcionar no Tinkercad	- Iniciar a simulação no Tinkercad	**5 min**
Criar o projeto no Kit Arduíno	Querer aprender como funciona o LCD no Kit Arduíno	- Apoio na apresentação Powerpoint	**45 min**

Reflection and evaluation:

Students will get to know the Arduino LCD component and the components that are needed to make it work and will learn how to assemble the components in question, in the Tinkercad online simulator and in the Arduino Kit.

After these activities, students will be familiar with the Arduino LCD component and how it works.

Resources:

- Computers
- Video projector
- Powerpoint presentation (tutorial)
- Internet
- Tinkercad online simulator
- Arduino kit

43- Title: 3D Modeling - Autodesk Inventor

Addressed area: 3D printing

Subject: Inventor support

Context: The purpose of this scenario is to teach participants Autodesk Inventor, a professional 3D design and modeling tool. The scenario focuses on introducing participants to the basic functions of the program and allowing them to create simple 3D models on their own.

Objectives:

Know the interface and basic functions of Inventor

Opening basic 3D models

Editing and modifying templates

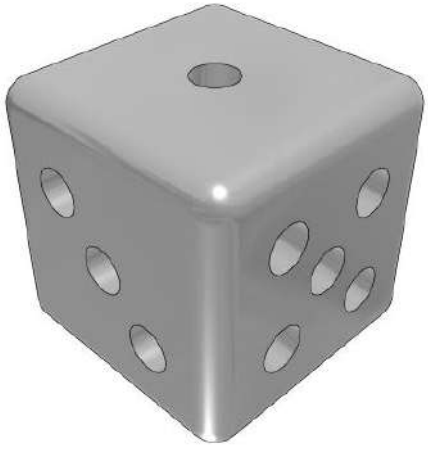
Use of export-ready templates

Self-education and 3D modeling development

NARRATIVE

CLASSES	MOTIVATION	TASK	DURATION
Presentation of the basic notions of using the program and presentation of its functions	Understand how the program works	Analysis of the presentation and the solutions described therein	50 min
Program installation and configuration	Learn the installation steps	Install Autodesk Inventor	15 minutes
Implementation of the first projects	Transform the acquired knowledge into a practical project	Doing any project	
Implementation of the project according to the pattern below	Developing your current skills	Making a project and exporting it to a file	30 minutes

Model default:



Reflection and evaluation:

This scenario is designed to help you understand what Inventor is all about, introduce you to the basics of how it works and use it, and guide you to more advanced features.

The scenario also allows you to present the method of exporting ready-made models so that they are ready for 3D printing.

Resources:

- Computer
- Autodesk Inventor software

44- Title: Design Emoji

Addressed area: 3D printing emoji feedback tokens

Topic: using tinkercad and 3d printing to make emoji tokens

Context:

Students will use a template sheet to draw their emoji tokens before moving on to the CAD software. Download and print multiple worksheets for each student team (recommended teams of 3-5)

https://cdn.fs.teachablecdn.com/sDdjVIyhRmWsv1BXfPqN

Emoji Tokens - Design Template.pdf

Overview

In this creative project, students will design and 3D print emoji feedback tokens. The lesson starts with an explanatory video, which gives students an overview of emoji tokens and how they can be used to get feedback on ideas, products, or experiences. The class then generates a series of ideas for how emoji tokens could be used in their school, and each team is given a feedback system to design from. Using 3D design tutorials as guidance, emoji tokens are created and used to provide feedback in a variety of ways across the school/organization.

Narrative:

CLASSES	MOTIVATION	TASK	DURATION
Show an overview of emoji tokens	Understand how imojis can be used	Look for solutions, discuss them how they can be used to get feedback	30 min
Distribution to each team of an imoji system to make their project	Know how to design the distributed imoji	Analysis of how to draw the imoji of the indicated task in 3D using a Computer Aided Design program	45 min
Preparation of 3D Printing of imoji	Learn how to prepare the printer for printing	Test the printer	50 min
Imoji printing and its use	Knowing and analyzing the printing procedures	Printing the imoji and using it in the classroom	80 min

Project duration and thematic areas

The process can be adapted to run the project over longer time periods. The lesson can be incorporated into the study of mathematics, design technology, citizenship and computing.

Learning Criteria

In this project, students will:

- develop contextual knowledge of feedback systems and their uses
- develop an emoji token feedback system for use in your school/organization
- Use CAD and 3D printing to make emoji tokens
- test and analyze your emoji token feedback system with a view to developing improved iterations in the future

Necessary equipment

- Laptops/computers (with Tinkercad or Fusion 360 software)
- 3D printer and filament

Features included

- Example emoji token 3D models (STL)
- Explanatory video of Emoji tokens (hosted on the PrintLab student portal)
- Emoji Design Sheets (PDF)

Tinkercad and Fusion 360 tutorial videos walking students through creating emoji tokens (hosted on the PrintLab Student Portal) Self-assessment document (PDF and Google Docs)

Lesson objectives

I can explain how emoji tokens can be used as a feedback system

I can develop an emoji feedback system for use in my school/organization

I can use CAD and 3D printing to design and make emoji tokens

in details:

Introduction to Emoji Tokens

Start the lesson by playing the explainer video on a big screen - giving students context around emoji tokens and their potential uses. After the video, give students a brief overview of the journey they will take through the project and clarify any questions they may have.

Use Brainstorm

As a class, brainstorm possible uses of emoji tokens in your school/organization. This can be done informally with students shouting out their thoughts or as an individual assignment where students spend a few minutes writing down their ideas before sharing them with the class.

Select Feedback System | 5 mins

Vote on which feedback systems create emoji tokens. Then divide students into groups of 3-5 and assign each team a different feedback system.

sketch of emojis

Ask students to discuss the feedback system they are designing for before using the emoji design worksheets to generate as many emoji token ideas as possible. Remind them to think carefully about being respectful, as the goal is to provide constructive feedback on whatever the feedback system is.

Once the emojis are sketched, students should analyze them and eliminate unnecessary options. By the end of this section, students should have a minimum of 6 emoji token designs, which will be turned into digital 3D models.

3D design and printing

Direct students to the CAD tutorial video on the PrintLab Student Portal and ask them to follow along on their individual machines to design the example emoji tokens. Once the design tutorial is complete, challenge them to recreate their own emoji tokens for the feedback system. As students finish their designs, send them to the 3D printers.

The remaining designs are to be 3D printed after class and once completed can be used as feedback systems within your school/organisation. As they are put to use, students should make observations and note how they behave with a view to revisiting the design in the future to create new and improved iterations.

Virtual Reality

45- Title: my bedroom - Mein Zimmer

Area of interest: VR/AR

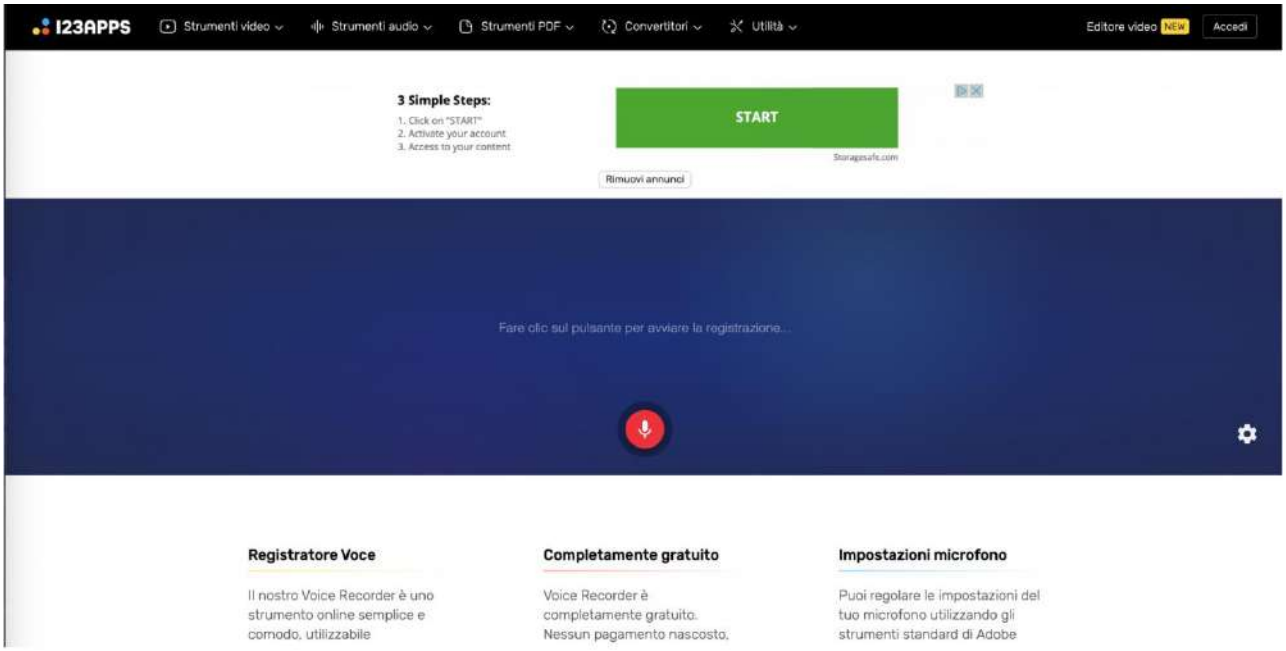
Object of the didactic intervention: Furnishing the room in a virtual environment after audio description in a foreign language, in the example illustrated here the vehicular language is German

School level to which the activity is aimed: the activity requires a linguistic competence referable to level A2 of the Common Reference Framework, depending on the language it can fall on different years of study.

Age of students: 12 - 16

Context: The beginning of the activity is based on the drafting of a brief description in a foreign language by the pupils of an environment of their own home. It is advisable to indicate no more than 8 objects. Subsequently and after correction of the text by the teacher, the pupils record the description in mp3 format, in this regard there are numerous applications for smartphones, but also free and easy-to-use programs such as:

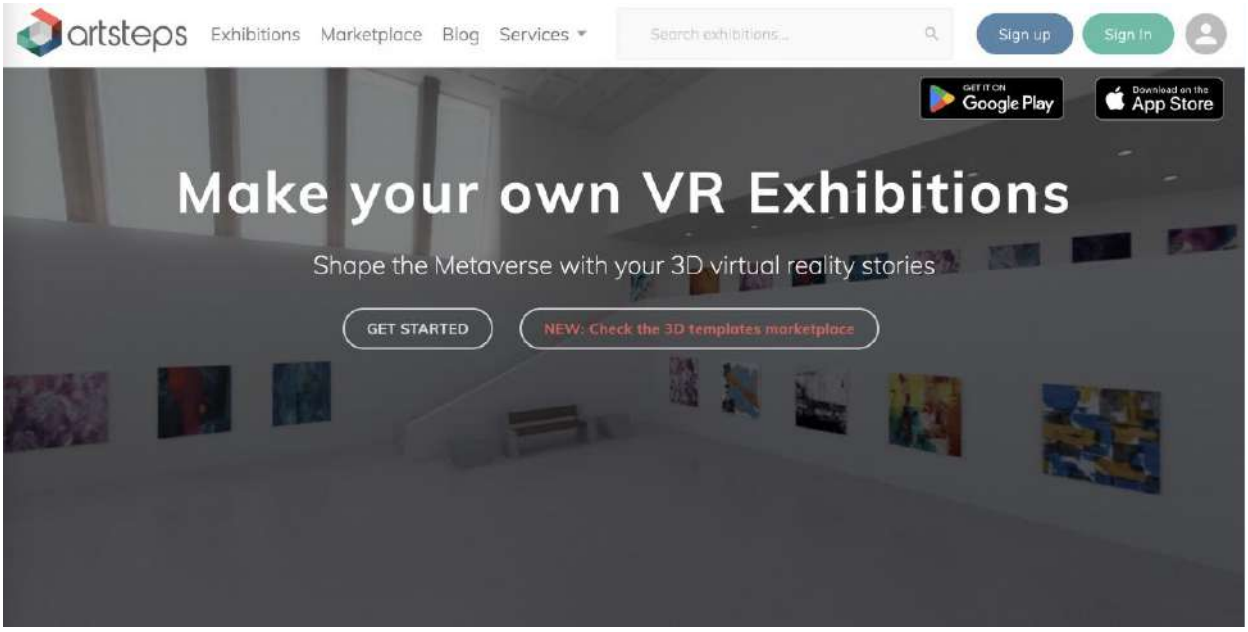
https://online-voice-recorder.com/it/



Subsequently, the pupils will have to create images, even photos, of the objects described and transform them into digital format, preferably jpeg.

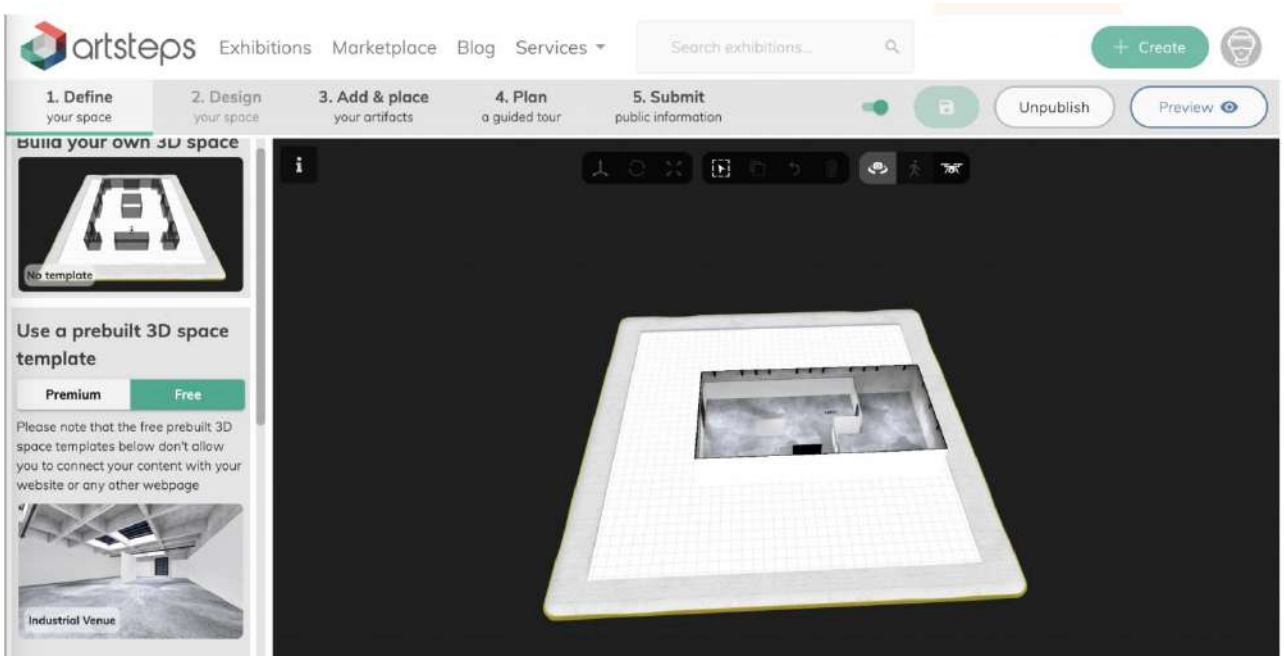
With the use of a free virtual reality and/or augmented reality program, in this case Artsteps, the pupils will create a virtual environment where they will enter the description in mp3 format and the related objects described. The program is easy to use and has intuitive features.

Accessible through the link: **https://www.artsteps.com/**



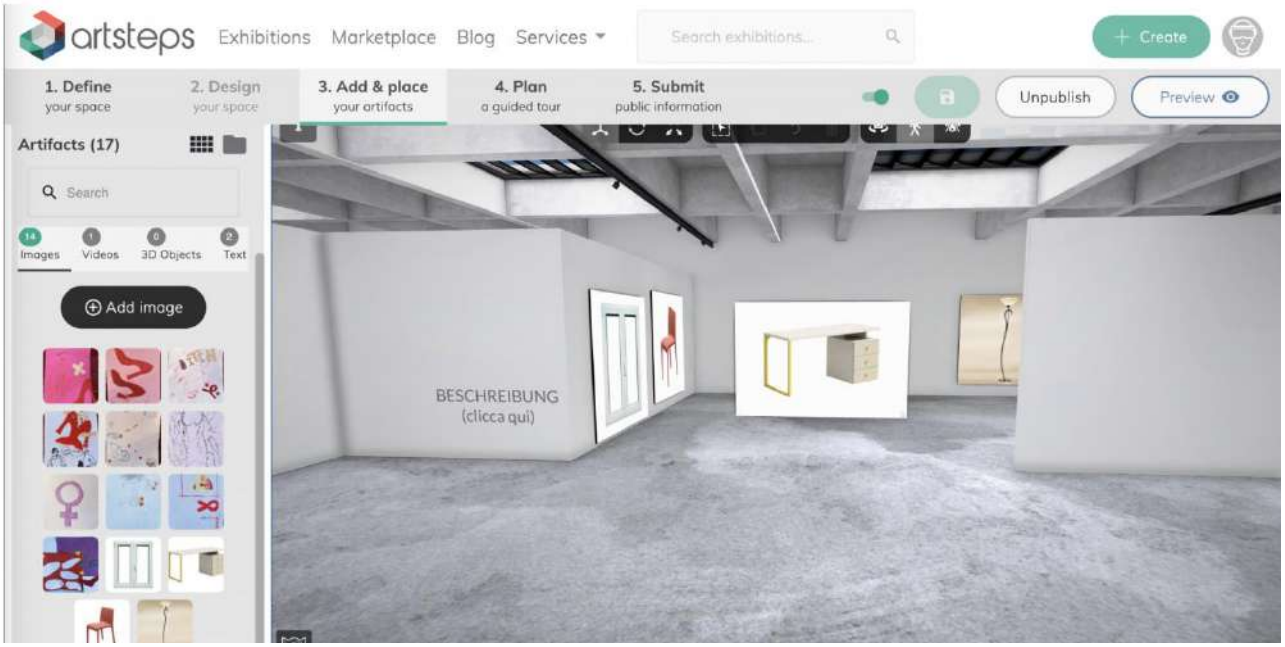
You will have to access the program after activating an account with the Sign in function and then start by clicking the create button. The first step will be to choose a suitable exhibition environment among those offered by the free version of the Artsteps program which allows partial customization. The display environment can be chosen and customized in the 1.*Define menu*.

For this activity, we recommend using a single, non-partitioning environment such as the Industrial Venue environment in the free version.



The audio file, which in this case has been called Beschreibung (description in German), will be inserted visibly inside the environment, as in the example (see following image). The images of the objects must be inserted randomly and not in accordance with the real situation as described. For this activity you need to access the *3.Add and place menu*.

The digital files of the products are first loaded into the program and then are available to be placed within the exhibition environment.



Each student will allow some students to access the environment directly from the open account, this is because sharing the link does not allow you to change the location of the objects. and after listening to the audio description they will place the objects correctly in the environment.

Link is attached to use the example: https://www.artsteps.com/view/64d24af4cf698f7a56d78e85

Goals:

- improve lexical language skills, writing and listening through activities combined with virtual reality
- management of activities in a peer-to-peer context
- creativity in the elaboration of the description and in the realization of the images
- create audio-visual products
- learn about virtual/augment reality programs and create virtual environments
- acquire digital skills combined with humanistic activities according to the principles of the STEAM method

ATTIVITA'	MOTIVAZIONE	COMPITO	DURATA
Lavorare sul lessico che riguarda oggetti in casa e elementi linguistici che indicano la collocazione	Fase creativa	Redigere la descrizione della collocazione di alcuni oggetti che si trovano in un ambiente a scelta della casa	60 min.
Realizzare gli elementi da impiegare poi in formato digitale all'interno dell'ambiente virtuale	Libera espressione, fase realizzata, altamente motivante	Creare un file mp3 che contenga la descrizione redatta e relative immagini in jpeg degli oggetti da collocare	60 min
Inserire gli elementi all'interno di un ambiente virtuale	Confronto con programmi di realtà virtuale, acquisizione di competenze digitali	Inserire i file digitali all'interno di un ambiente virtuale della piattaforma artsteps	60 min
Presentazione del prodotto finale ad altri studenti	Imparare a gestire un momento di peer-to-peer	Invita alcuni compagni di classe ad ascoltare la tua descrizione e a collocare in modo corretto gli oggetti nell'ambiente	60 min
VALUTAZIONE: la valutazione è data dal successo di ogni alunna/o nel saper collocare correttamente gli oggetti, ma anche dal successo, in termini di feedback, che avrà il proprio ambiente realizzato. autovalutazione attraverso momento di confronto dopo l'esposizione	/	L'alunna/o che più si avvicina alla corretta collocazione degli oggetti sarà indicata come vincitrice/vincitore. Chi vince più volte otterrà un badge come "best performance"	60 min

reflections and evaluation:

- the use of virtual/augmented reality to acquire linguistic skills has a strong positive impact since learning is supported by a combination of stimuli, from auditory to visual to kinesthetic.
- Assessment can have different facets and concern creativity, digital competence, linguistic competence, pronunciation, the ability to imagine what is being said, etc.
- for the realization there is the need of computer and/or smartphone

46- Title: Virtual Exhibition "Verbal Violence Against Women"

Area of interest: VR/AR

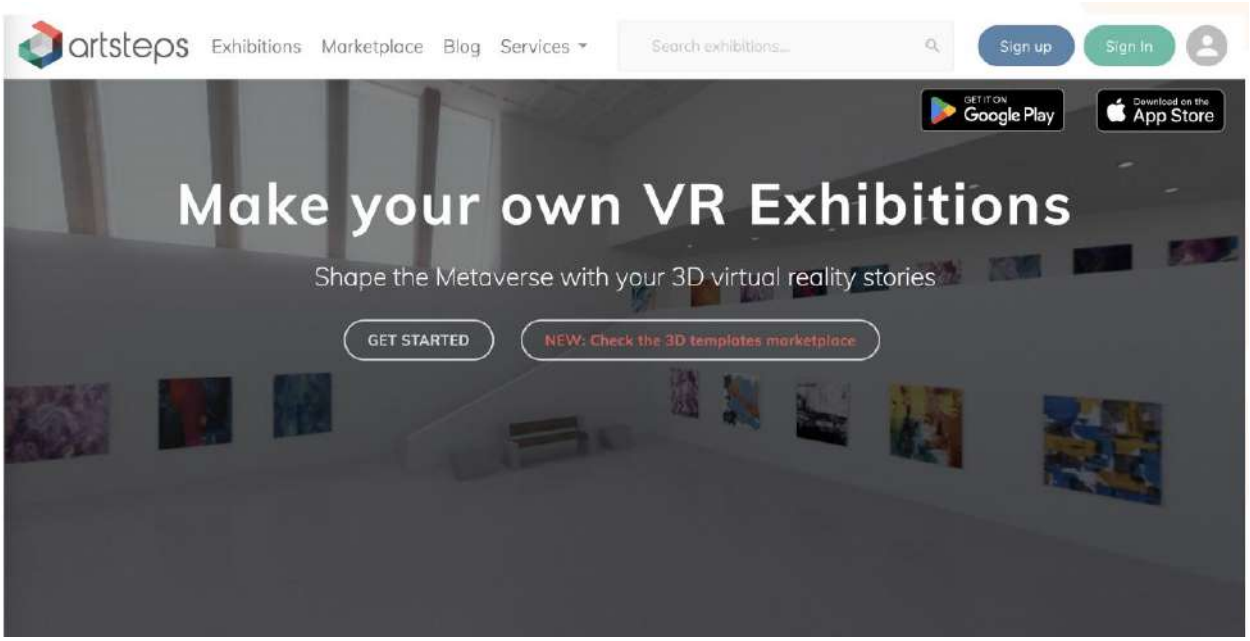
Object of the didactic intervention: Exhibition in a virtual environment of works created by students on the theme of verbal violence against women

School grade targeted by the activity: the activity pairs well with civics and can be done by students of any grade in upper secondary school

Student age: 14 - 19

Context: With the use of a free virtual reality and/or augmented reality program, in this case Artsteps, the pupils have to create an exhibition which they will then demonstrate to other pupils. The program is easy to use and has intuitive features.

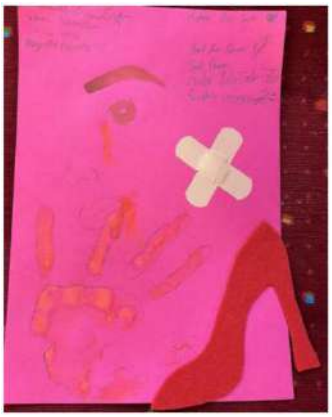
Accessible through the link: https://www.artsteps.com/



The conception of an exhibition path guided by a topic relating to civic education such as verbal violence against women becomes above all a moment of creative confrontation in which students can express their ideas, experiences and opinions. Furthermore, the creation of a final product that is configured as a student creation is very motivating.

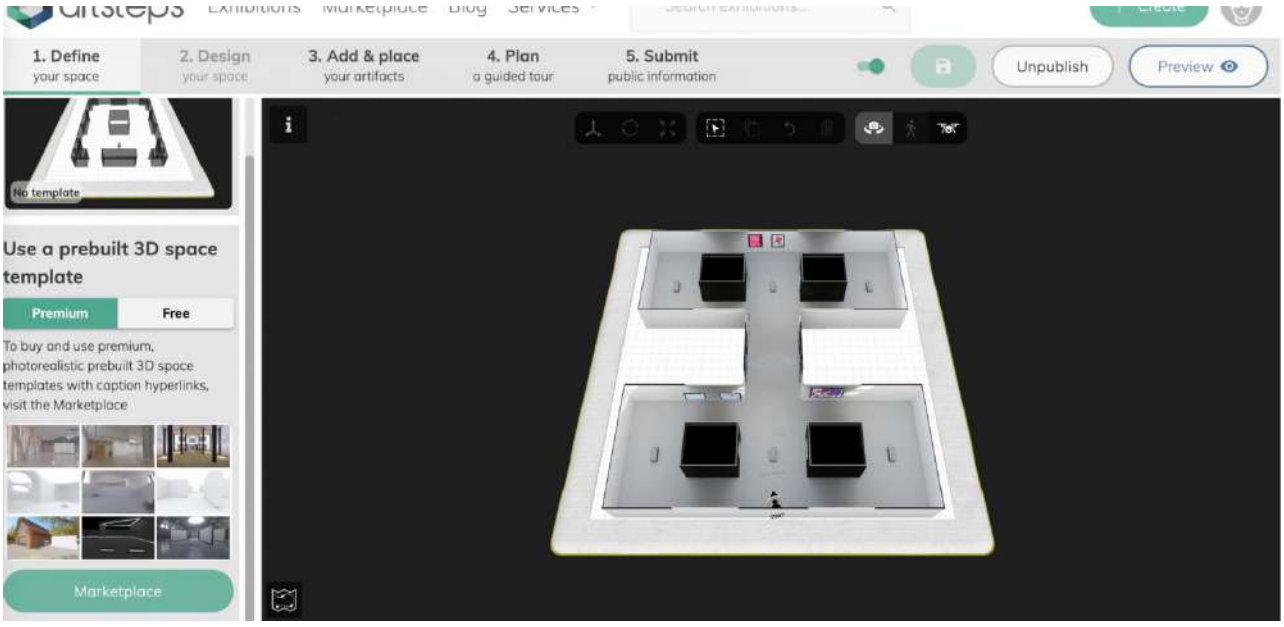
After discussing the topic in the plenary, we will move on to the individual creation of the works to be exhibited. Pupils, playing the role of artists/creators, must give their own interpretation of the theme and can create audio-visual products such as paintings, poems, very short stories, videos, etc.

Esemp

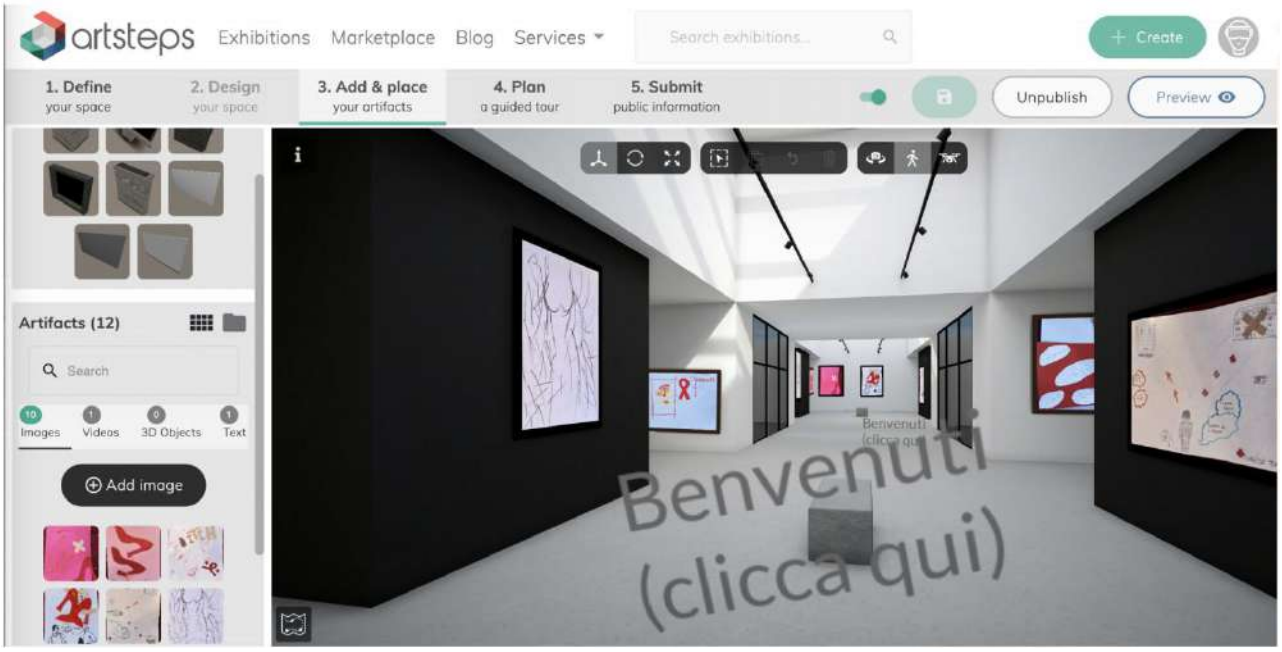


Following the realization of the individual products, the pupils will proceed with a group work, the number of pupils for each group may depend on the total number of pupils involved. In the example illustrated here the pupils were divided into groups of 5 pupils. Through the comparison in the group you will have to log into the program after activating an account and then start by clicking the button create a new project. The first step will be to choose an exhibition environment among those offered by the free version of the Artsteps program which allows partial customization.

The display environment can be chosen and customized in the 1.*Define menu*. The second Design menu - which allows you to draw the entire environment - is not accessible in the free version



The previously created products can then be inserted into the created environments and transformed into digital files (image in jpg or similar format, mp3 audio or mp4 video). For this activity you need to access the *3.Add and place menu*. The digital files of the products are first loaded into the program and then are available to be placed within the exhibition environment.



After having finished setting up the virtual space, the program offers the possibility to customize a guided tour or to go directly to publication. The product can also be shared through a public link that allows anyone with the link to access the virtual environment. After having finished, the students present their works in the way that suits them best.

Link to use the example is attached: https://www.artsteps.com/view/64085156f64d01b7739d84c7

Goals:

- solicit critical thinking, express opinions
- confrontation with the other and with society
- devise a final product that is in line with a guiding topic
- create audio-visual works, paintings, written products, etc. to exhibit
- learn about virtual/augment reality programs and create virtual environments
- acquire digital skills combined with humanistic activities according to the principles of the STEAM method
- present and explain to other students the works on display and usable through a captivating environment such as virtual reality

Schematic escription

ATTIVITA'	MOTIVAZIONE	COMPITO	DURATA
Scegliere percorso afferente ai contenuti didattici (a seconda la disciplina)	Fase creativa, altamente inclusiva, intervento libero	Presentare idea, motivare scelta, decidere quale scegliere	60 min.
Realizzare in gruppo o individualmente prodotti da mostrare (dipinti, poesie, installazioni, ecc)	Libera espressione,	Creare un prodotto artistico	120 min
Inserire le opere all'interno di un ambiente virtuale	Confronto con programmi di realtà virtuale, acquisizione di competenze digitali	Lavoro su piattaforme digitali di ambienti virtuali	120 min
Presentazione del prodotto finale ad altri studenti	Imparare a presentare un'opera	Saper esporre le proprie realizzazioni	60 min
VALUTAZIONE: la valutazione è data prevalentemente dal feedback ottenuto durante la fase dell'esposizione autovalutazione attraverso momento di confronto dopo l'esposizione	Non c'è bisogno di verifiche ulteriori come test o produzioni scritte	/	60 min

reflections and evaluation:

- the activity offers space for transversality according to the topic chosen (example: role of women, totalitarianisms, multiculturalism, sustainability, diversity, etc.)
- the assessment with the greatest impact for the students will be the comments and feedback from the other students to whom the work will be exposed
- a comparison between the students who have created the project at the end of the course is important so that there is greater awareness of how what has been created has been perceived and understood.

resources:

- computer and/or smartphone
- useful material for the realization of the works

47- Title: historical figure

Area of interest: VR/AR

Object of the didactic intervention: to create the avatar of a historical character who introduces himself

School level to which the activity is aimed: the activity is adaptable to every school age group

Age of students: 6-19

Context: The activity begins with a research on a historical character assigned by the teacher to individual pupils or groups.

Subsequently, the students will create texts in the first person, from the point of view of the historical character, containing the information that the student considers to be of greater relevance and interest. In the example illustrated, the character does not indicate the surname because at the end of the presentation she asks to guess who she is. After this first phase, we continue with the use of a digital environment to create virtual realities. The program proposed here, Voki, is useful for creating animated avatars and the free version allows the use of many features.

Each student must first create her own account using the Log In button (top right) and then using the Sign Up function.

Subsequently, the pupils will have to create an avatar, possibly similar to the historical character they present. In this regard, access the CREATE menu (top left) and start by choosing the face (see image 1).

In the paid version you can choose famous characters. This will be followed by the choice of some modifiable details such as glasses, hair and clothing (see image 2) and then move on to choosing the background (see image 3).

Imagem 1:

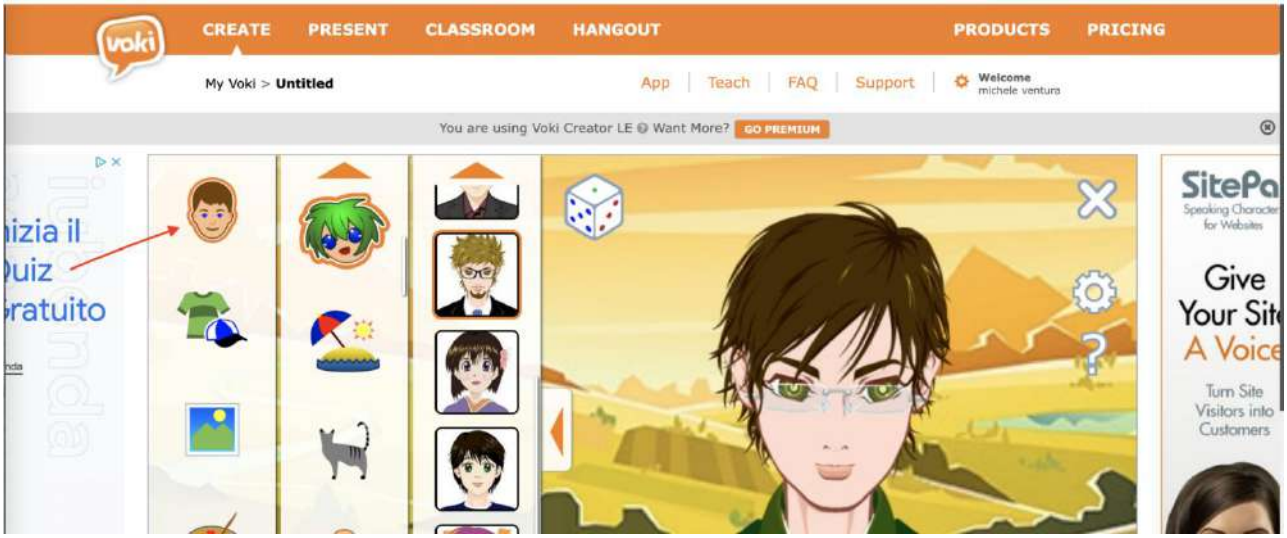


imagem 2:

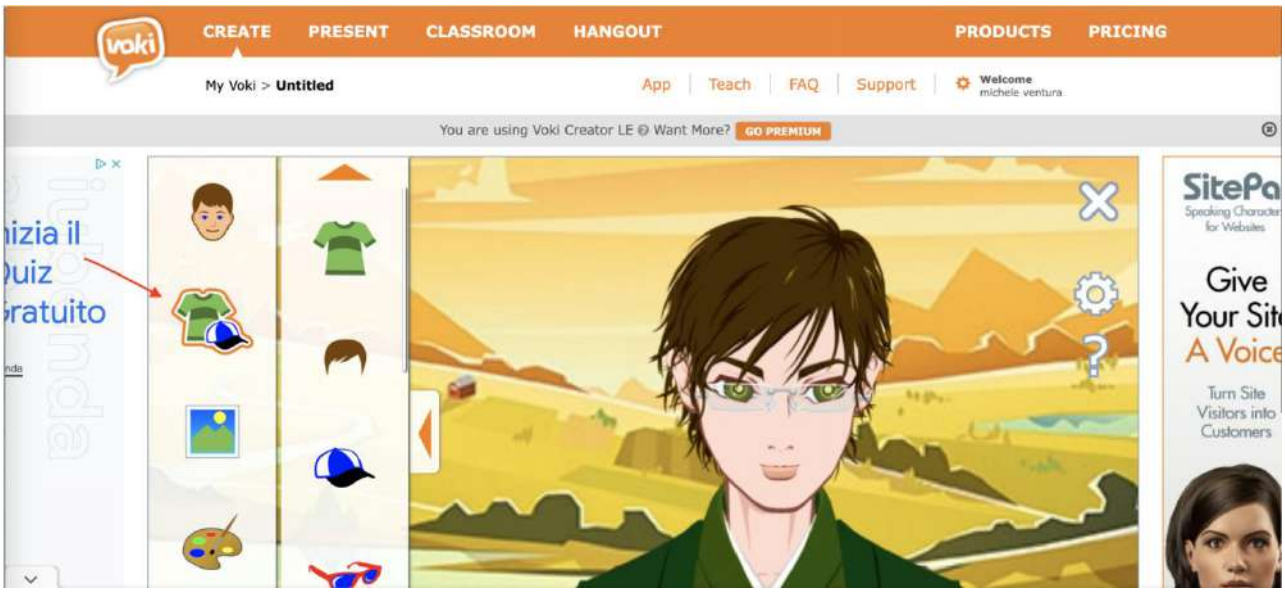
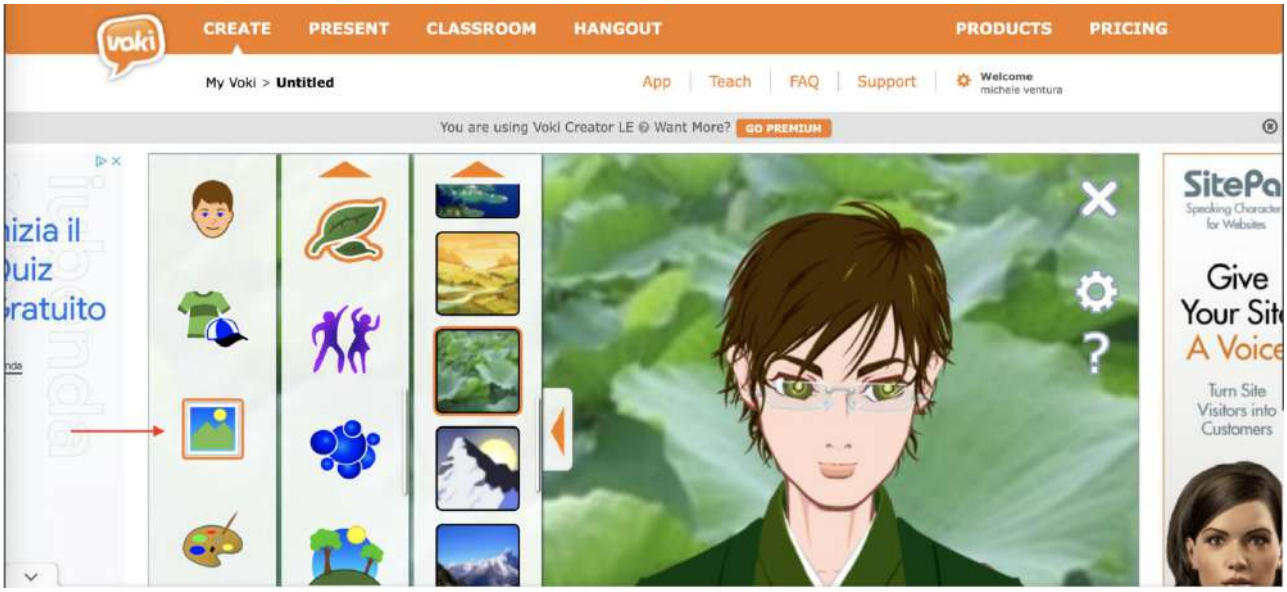


imagem 3:



The program is very intuitive and allows you to create avatars that resemble the characters represented even with the free features. The last step is the most significant. Through the audio insertion function (bottom left speaker) the pupils can insert an audio. The audio can be recorded at the moment, it can be inserted as an mp3 file already recorded or it can be created with an artificial voice by entering text (maximum 600 characters) in a text box that opens after clicking on the speaker. The latter solution provides for the choice of language and gender of the avatar

Once the work has been completed and saved, the pupils can share it either through the link or directly on social networks.The link is attached to use an example of avatar representing Guglielmo Marconi:

https://tinyurl.com/25vywrzo

Goals:

- search for information and be able to transform it into an interesting text, storytelling
- management of research, editing and use of the digital environment in a peer-to-peer context - creativity in the development of the final product
- creation of an audio-visual product in a virtual environment
- learn about virtual/augment reality programs and create avatars
- acquire digital skills combined with humanistic activities according to the principles of the STEAM method

Schematic description

ATTIVITA'	MOTIVAZIONE	COMPITO	DURATA
Ricercare in internet informazioni su un personaggio storico assegnato e scrivere un testo in prima persona che contenga le informazioni di maggiore rilevanza	Fase di raccolta informazioni e produzione di un testo; creatività e autonomia	Scrivi un testo in prima persona dal punto di vista di X, dopo aver ricercato le informazioni più interessanti	60 min.
Creare un avatar simile al personaggio su piattaforma per creazione di avatar animati, Voki	fase realizzativa, creatività, utilizzo di strumenti digitali, altamente motivante	Crea l'avatar del tuo personaggio e inserisci l'audio del tuo testo	60 min
Presentazione del prodotto finale ad altri studenti	Imparare a gestire un momento di peer-to-peer	Condividi il tuo avatar attraverso il link	60 min
VALUTAZIONE: la valutazione può essere divisa sui singoli elementi che compongono l'attività, dalla qualità della ricerca, alla redazione del testo, alle competenze digitali sviluppate in fase realizzativa del prodotto finale. autovalutazione attraverso momento di confronto dopo l'esposizione	/	Esprimi un'opinione sul tuo prodotto finale dopo aver visionato gli altri	60 min

reflections and evaluation:

- the use of virtual/augmented reality to acquire historical knowledge has a strong positive impact since learning is supported by a combination of stimuli, from auditory to visual.
- The assessment can have different facets and concern creativity, storytelling competence, digital competence, acquired historical knowledge
- for the realization there is a need for a computer with a good connection and/or smartphone

48- Title: the virtual philosophy

Area of interest: VR/AR

Object of the didactic intervention: to create the avatars of philosophers and place them within an environment

School level to which the activity is aimed: the activity is adaptable to every school age group

Age of students: 6-19

Context: The activity begins with a research on a philosopher assigned by the teacher to individual pupils or groups. Subsequently, the students will create texts containing the information that the student deems most relevant and useful in order to create a small combined test. After this first phase, we continue with the use of a program to create avatars. The program proposed here, Voki, is useful for creating animated avatars and the free version allows the use of many features.

Each student must first create her own account using the Log In button (top right) and then using the Sign Up function.

Subsequently the pupils will have to create an avatar, possibly similar to the philosopher they present. In this regard, access the CREATE menu (top left) and start by choosing the face (see image 1).

In the paid version you can choose famous characters. This will be followed by the choice of some modifiable details such as glasses, hair and clothing (see image 2) and then move on to choosing the background (see image 3).

immagine 1:

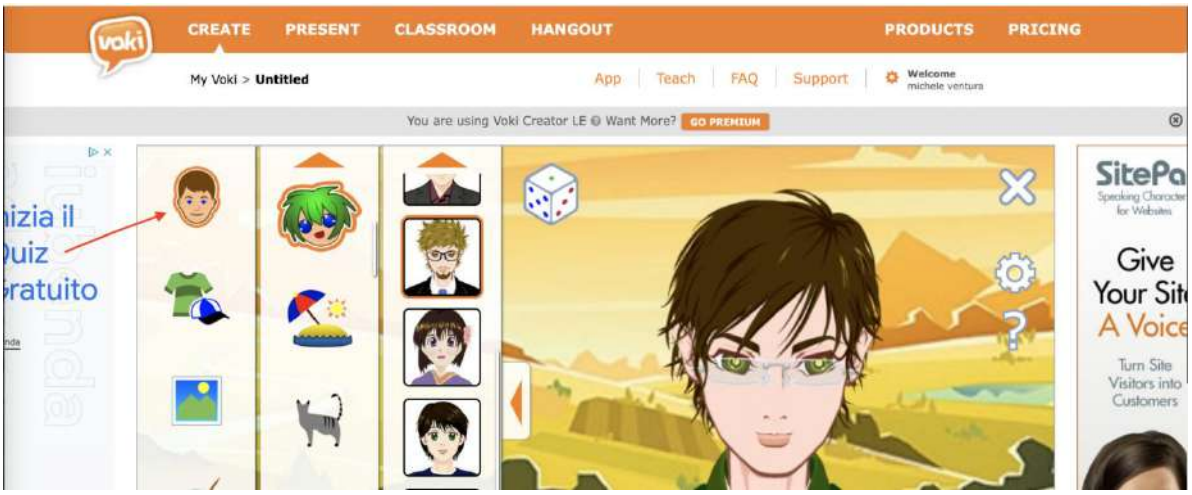


immagine 2:

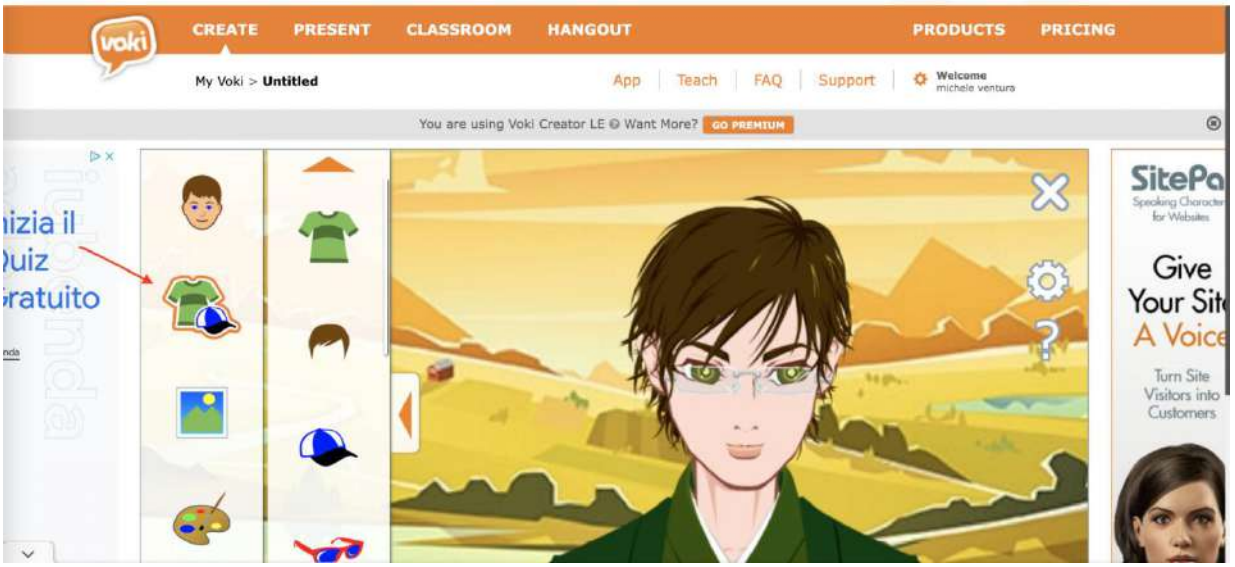
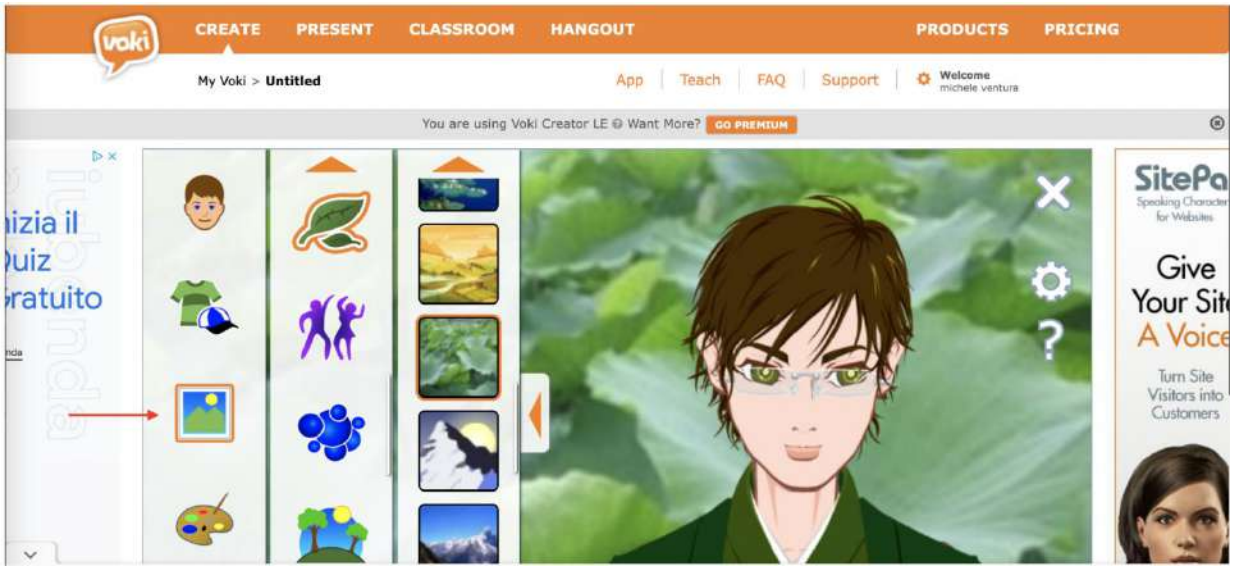


immagine 3:

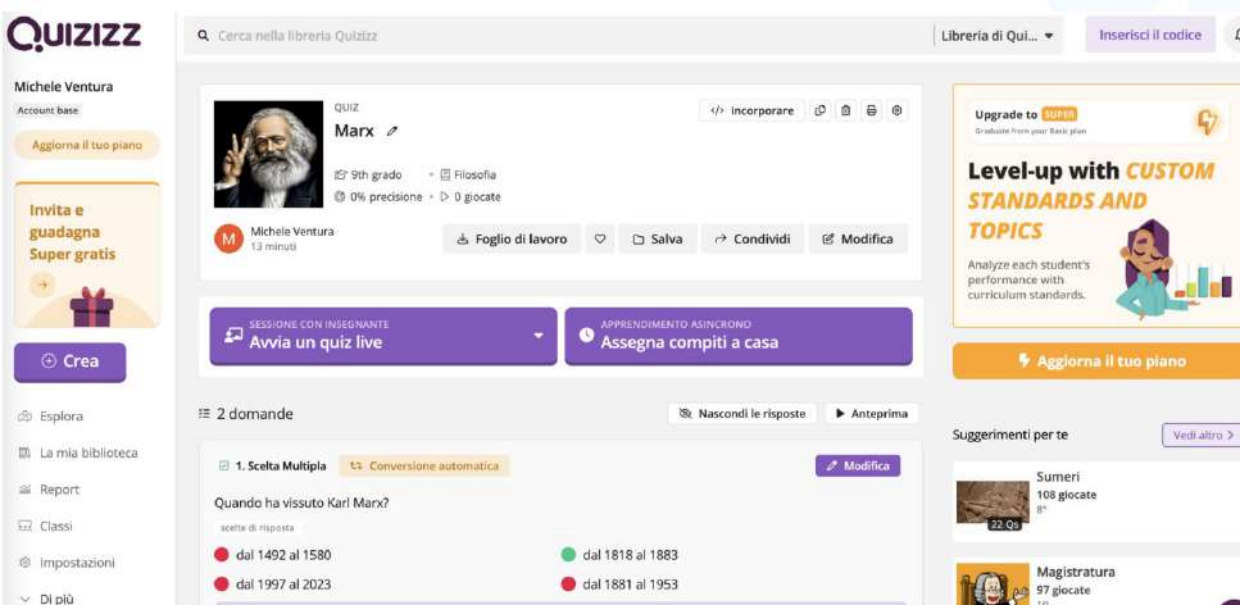


The program is very intuitive and allows you to create avatars that resemble the characters represented even with the free features. The last step is the most significant. Through the audio insertion function (bottom left speaker) the pupils can insert an audio. The audio can be recorded at the moment, it can be inserted as an mp3 file already recorded or it can be created with an artificial voice by entering text (maximum 600 characters) in a text box that opens after clicking on the speaker. The latter solution provides for the choice of language and gender of the avatar.

Once the work has been completed and saved, the pupils can share it either through the link or directly on social networks.

Attached is a link to use an example of an avatar representing Marx: https://tinyurl.com/25raq8r3

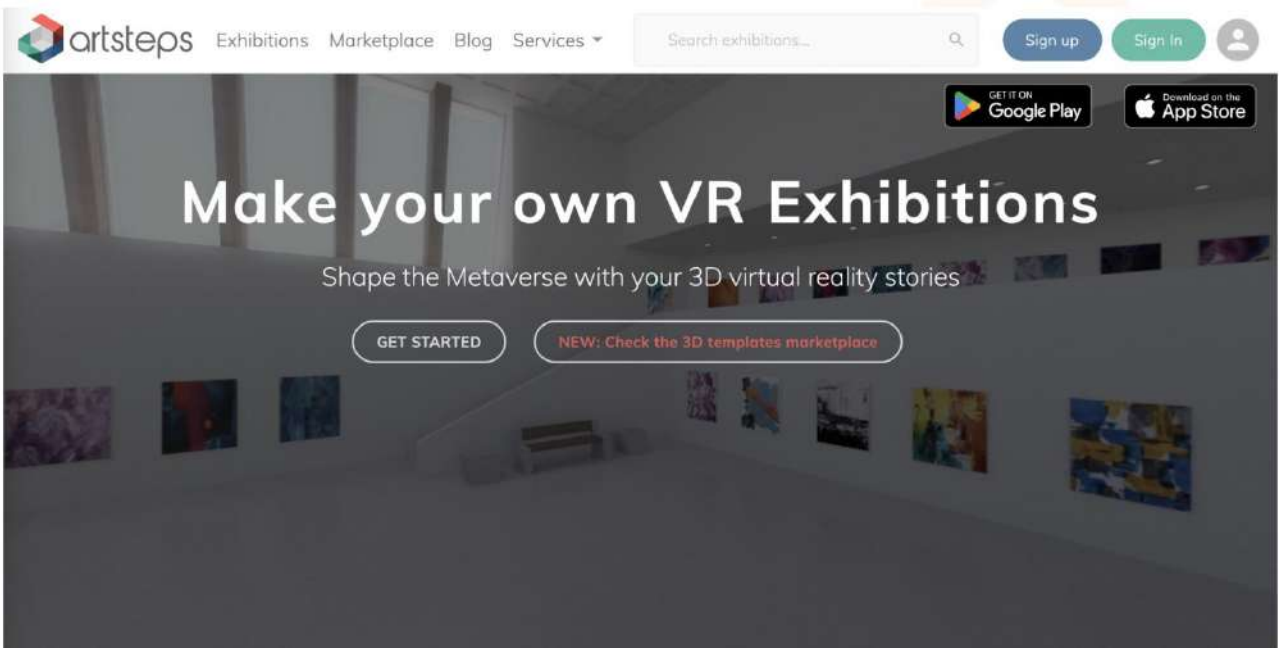
Subsequently, the pupils, with the supervision of the teachers, will create tests combined with the information contained in the previously created animation. In this case, the free version of Quizizz was used, a platform for creating quizzes, which provides the possibility of playing in multiplayer and in real time.



The test linked below should be understood as an example for illustrative purposes which at the moment does not allow adequate use:

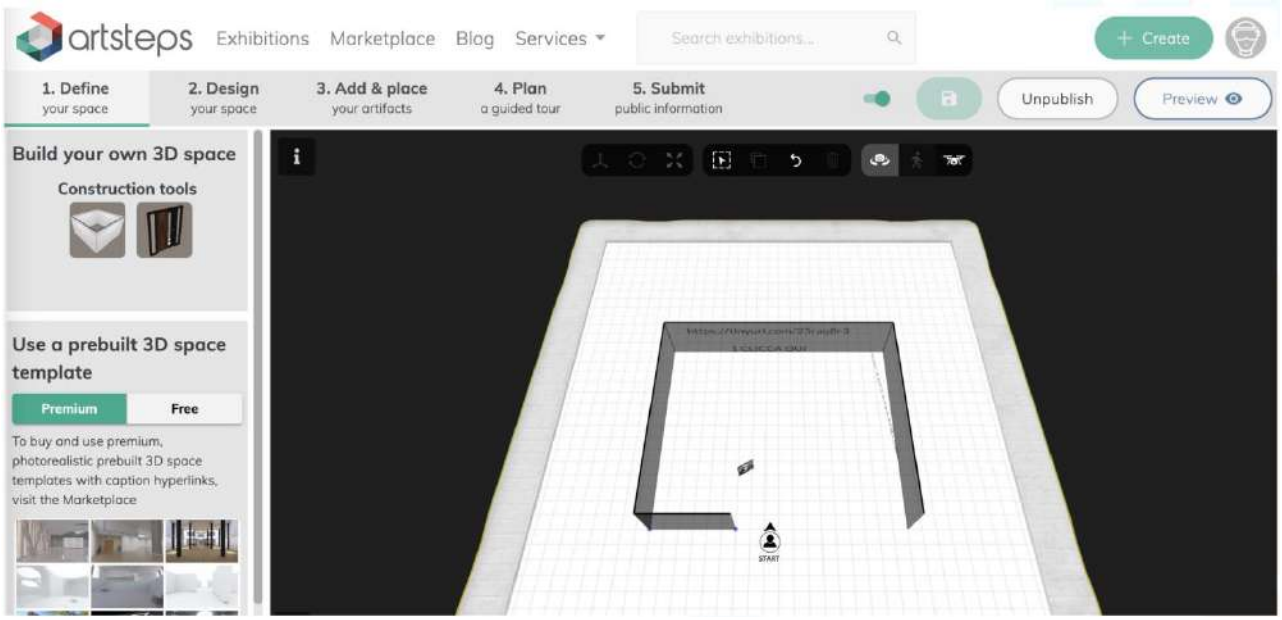
https://quizizz.com/admin/quiz/64d39c862b574700094856ef?source=quiz_share

In this case both links (animated avatar and quiz) will be used to be inserted into another virtual reality platform, namely Artsteps. The program is easy to use and has intuitive features. Accessible through the link: https://www.artsteps.com/

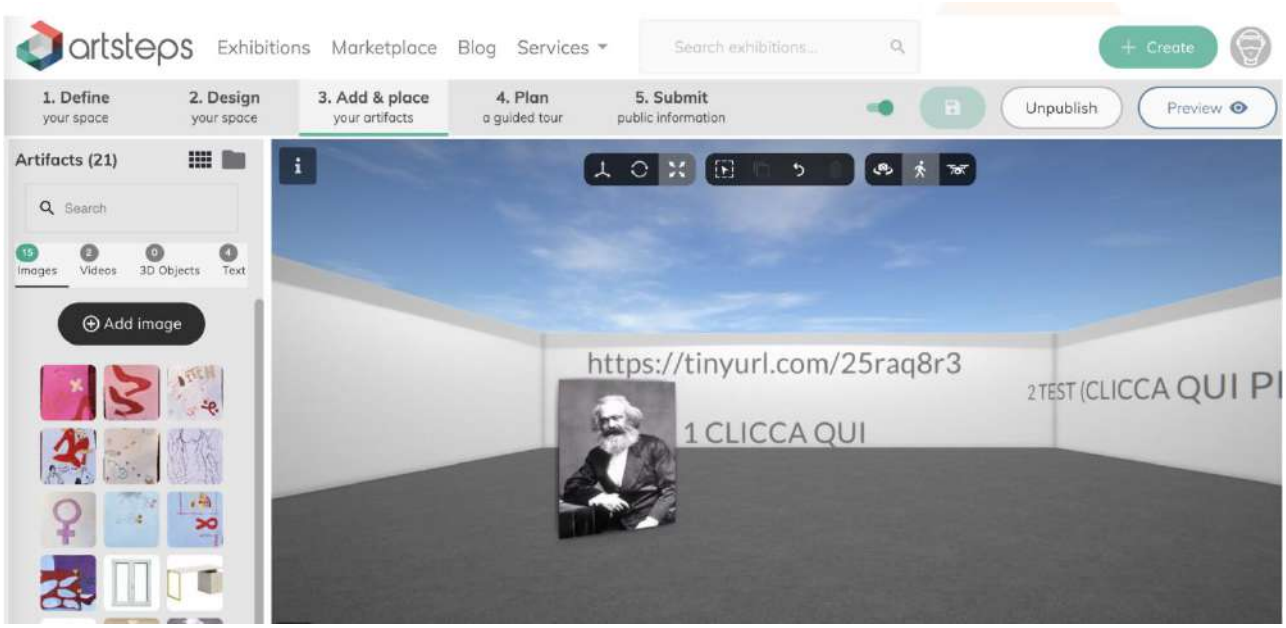


The program is accessed after activating an account, then a new project is created by clicking on the create function. The first step will be to choose an exhibition environment among those offered by the free version of the Artsteps program which allows partial customization.

The display environment can be chosen and customized in the *1.Define menu.*



Within the created environment, the products previously created and transformed into digital files are inserted (image in jpg format or simple text for the links to be inserted). For this activity you need to access the *3.Add and place menu*. The digital files of the products are first loaded into the program and then are available to be placed within the exhibition environment.



Link to use the example described:https://www.artsteps.com/view/64d38be1b5723e043e0927df

Goals:

- search for information and be able to transform it into an interesting text, storytelling
- management of research, editing and use of the digital environment in a peer-to-peer context
- combined use of different programs to create elements that can enrich virtual reality
- creativity in the elaboration of the final product

- creation of an audio-visual and interactive product in a virtual environment
- learn about virtual/augment reality programs, create avatars and quizzes
- acquire digital skills combined with humanistic activities according to the principles of the STEAM method

Schematic description

ATTIVITA'	MOTIVAZIONE	COMPITO	DURATA
Ricercare in internet informazioni su un filosofo assegnato e scrivere un testo che contenga informazioni importanti su cui strutturare un test	Fase di raccolta informazioni e produzione di un testo; creatività e autonomia	Scrivi un testo sul filosofo X dopo aver ricercato le informazioni più importanti	60 min.
Creare un avatar simile al personaggio su piattaforma per creazione di avatar animati Voki	fase realizzativa, creatività, utilizzo di strumenti digitali, altamente motivante	Crea l'avatar del tuo personaggio e inserisci l'audio del tuo testo	60 min
Estrapolare le informazioni più importanti e creare un test a mo' di quiz con l'utilizzo del programma Quizizz	fase realizzativa, creatività, utilizzo di strumenti digitali, altamente motivante	Crea un quiz di 10 domande sul filosofo X utilizzando Quizziz	30 min

Creare un ambiente virtuale su piattaforma Artsteps e collocare all'interno di questo ambiente i link realitvi all'avatar animato e al quiz creati in precedenza	fase realizzativa, creatività, utilizzo di strumenti digitali, altamente motivante	Crea un ambiente virtuale con Artsteps e inserisci i prodotti realizzati precedentemente	30 min
Presentazione del prodotto finale ad altri studenti	Imparare a gestire un momento di peer-to-peer	Condividi attraverso il link	60 min
VALUTAZIONE: la valutazione può essere divisa sui singoli elementi che compongono l'attività, dalla qualità della ricerca, alla redazione del testo, alle competenze digitali sviluppate nelle diverse fasi di realizzazione del prodotto finale. autovalutazione attraverso momento di confronto dopo l'esposizione	/	Esprimi un'opinione sul tuo prodotto finale dopo aver visionato gli altri	60 min

reflections and evaluation:

- the use of a virtual/augmented reality to acquire knowledge in the field of philosophy has a strong positive impact since there is a combination of stimuli, from auditory to visual, to support learning.
- The assessment can have different facets and concern creativity, storytelling competence, digital competence, acquired historical knowledge
- for the realization there is a need for a computer with a good connection and/or smartphone

49- Title: Virtual Reality (VR) to promote tourist itineraries

Area covered: VR/AR

Subject: Implement the project work entitled “Immersive Touristic Route”, on the VR platform, Edmondo.

Context: Implement this Learning Scenario with students of the CEF course (Bar, Hospitality and Tourism), articulating with VR, using the Edmondo platform, making it possible to create an immersive world on a tourist route, to the student's taste, in the Municipality of Mafra , of which the school is a part, including places to visit and local cuisine.

Goals:

Plan a tourist itinerary, including places to visit and gastronomy in the Municipality of Mafra;

Introduce the notion of VR and types of devices;

Knowing the history of VR and some examples of its application;

Create an account on the VR platform, Edmondo;

Create an immersive world appropriate to the theme, in the VR platform, Edmondo;

- o Create an avatar and customize appearance and view
- o Create Prims and customize as to their shape, texture, color, etc.
- o Insert digital content, such as photographs, sounds and videos, appropriate to the theme, in the platform of

RV, Edmondo;

Reflect on the potential of the VR platform, Edmondo, in carrying out tourist itineraries,

analyzing the project works presented.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Introdução à noção de Realidade Virtual e tipos de dispositivos História da realidade virtual Apresentação de alguns exemplos de aplicação	Conhecimentos sobre a RV	Apresentação dos conteúdos Visualização, análise e reflexão dos vídeos sobre a aplicação de realidade virtual	**30 minutos**

de realidade virtual			
Planeamento de um roteiro turístico, incluindo locais a visitar e gastronomia no Concelho de Mafra	Trabalho de pesquisa no Google e captação de imagens e vídeos originais	Realizar no Google Docs o planeamento do roteiro turístico realizando um trabalho de pesquisa de informação no motor de pesquisa Google. Captação de imagens e vídeos sobre o tema (fora da sala de aula)	**3 horas**
Apresentação da plataforma Edmondo e inscrição dos alunos na plataforma	Exploração da plataforma Edmondo		**30 minutos**
Criação de um avatar e aplicação das suas propriedades: a aparência e o seu modo de visualização			**30 minutos**
Criação de Prims e personalizar quanto à sua forma, textura, cor, etc.			**2 horas**
Inserção de conteúdos digitais, tais como, fotografias, sons e vídeos, adequado ao tema			**1 hora**
Refletir sobre as potencialidades da plataforma de RV, Edmondo, na realização de roteiros turísticos.		Apresentação dos trabalhos projecto e debate sobre os aspectos positivos e os aspectos a melhorar	**3 horas**

Reflection and evaluation:

- Promote a moment of debate and sharing of ideas about the potential of the VR platform, Edmondo, for the realization of tourist itineraries, as well as its application in any other context and which way influences the way we communicate.
- The evaluation of the implementation of this learning scenario is carried out as follows:
    - o Direct observation grid: record commitment, spirit of help, cooperation and autonomy, during carrying out the project;
- Evaluation of the project and its presentation;
    - o Direct observation grid on participation in the debate, referring to the positive and negative aspects aspects to improve in the project.
    - o Completion of a form by the referees on the effectiveness and constraints in the implementation of this work project.

Resources:

- Computer
- Internet
- Google Docs
- VR Platform, Edmondo
- Photographs, sounds and videos
- Examples of virtual reality applications:
  - Sulzau hop://slw.indire.it:8002/Sulzau/128/108/77
  - LAB 40 hop://slw.indire.it:8002/Lab%2040/160/16/23
  - AZUREMYST hop://slw.indire.it:8002/Azuremyst/128/108/77
  - METIDE hop://slw.indire.it:8002/Metide/128/108/77

50- Title: Familiarization with Virtual Reality (VR)

Addressed area: VR/AR

Subject: Defining Virtual Reality and exploring the educational potential of so-called "virtual worlds"

Context: In this 12th grade Computing Applications B class, it is intended that students become familiar with the term "Virtual Reality" and have the opportunity to explore/know the so-called "virtual worlds", providing moments of sharing and reflection with students. in the classroom.

Goals:

▪ Define and describe what Virtual Reality (VR) is, its main characteristics and how it is used at the moment.

▪ Identify different types of devices used for VR experiences, such as reality glasses virtual, sensor gloves, tracking devices and controls.

▪ Discuss the advantages and disadvantages of using VR in different fields, such as education, health, entertainment, advertising and training.

▪ Explore the educational potential of VR, including how it can be used to enhance learning, engage students and increase knowledge retention.

▪ Present some examples of VR application in the educational field, such as interactive classes in VR, virtual labs among others.

▪ Challenge students to visualize/explore educational VR applications and evaluate how the technology can be used to enhance the learning process.

▪ Encourage discussion and debate about the use of VR in education, including implications for the future of education and how the technology can influence students, teachers and society at large.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Definição de Realidade virtual. Identificação de diferentes tipos de dispositivos usados para experiências de RV. Vantagens e desvantagens da utilização da RV.	Familiarização com o mundo VR.	Apresentação de conteúdos e reflexão acerca da temática.	**45 minutos**
Visualizar/explorar aplicações de RV educacional		- Visualizar aplicações de RV. Reflexão do professor e dos alunos.	**45 minutos**

Reflection and evaluation:

Students will be challenged to reflect in groups about the VR world with the visualization of “virtual worlds” already developed, taking into account the implications for the future of education and the way technology can influence students, teachers and society in general.

Resources:

- computer
- Internet access
- like virtual reality glasses
- cell phone

51- Title: CHALLENGES FOR THE IMPLEMENTATION OF EPR@LC "logo magnet in 3D"

Addressed area: Modeling 3D Editing Software (Tinkercad) and 3D Modeling and Printing.

Subject: Create and Test a Learning Scenario

Context: Students from Clube da Robótica must produce a personalized magnet with the logo of the Erasmus+ project "The school of the Future".

Goals:

Understand and explore the editing and modeling software - Tinkercad;

Create the product - Magnet - appealing to students' creativity.

Install and configure 3D Printer software -3D printer functions.

Implementation:

Platform experimentation:

Construction activities of 3D figures;

Transformation of jpg file (Erasmus+ Logo) into STL file;

Creation of the final product.

3D printer configuration;

Installation of filaments.

Printing of the final product.

Sharing the Final Product with the members of the Erasmus+ Project.

NARRATIVE

ATIVIDADES	MOTIVAÇÃO	TAREFA	DURAÇÃO
Apresentação da plataforma Tinkercad	Entender como modelar utilizando Tinkercad online. Saber como usar a plataforma	Criar Produto no Modelador	2 horas
Configuração da Impressora 3D	Compreender o funcionamento da Impressora 3D	Imprimir produto final	5 horas

Purpose of the EPR Learning Scenario:

- ✓ Promoting the ability to diagnose, characterize, analyze and solve different situations;
- ✓ Promoting autonomy, teamwork, a sense of responsibility and professionalism;
- ✓ Production of a product.
- ✓ Skills developed: with this project students develop:
- ✓ Technical Skills: Modeling and 3D Printing;
- ✓ Relational Skills: communication; collaboration; leadership; teamwork and cooperation;
- ✓ Motivate to participate in Erasmus Projects;
- ✓ Organizational Skills: time management and meeting deadlines and critical spirit.

Reflection and evaluation:

When students are challenged to create a simple project in Tinkercad and print the final product, it favors collaborative work, allowing the expression of their own ideas and the implementation of peer dynamics, in addition to fostering habits of participation in international projects.

Scenario rating:

Observation: observe the students' behavior while carrying out the activities proposed in the scenario, assessing their ability to work in a team, to apply acquired knowledge and to solve problems.

Purpose of the EPR Learning Scenario:

Promoting the ability to diagnose, characterize, analyze and solve different situations;

Promoting autonomy, teamwork, a sense of responsibility and professionalism;

Production of a product.

Skills developed: with this project students develop:

Technical Skills: Modeling and 3D Printing;

Relational Skills: communication; collaboration; leadership; teamwork and cooperation;

Motivate to participate in Erasmus Projects;

Organizational Skills: time management and meeting deadlines and critical spirit.

Reflection and evaluation:

When students are challenged to create a simple project in Tinkercad and print the final product, it favors collaborative work, allowing the expression of their own ideas and the implementation of peer dynamics, in addition to fostering habits of participation in international projects.

Scenario rating:

Observation: observe the students' behavior while carrying out the activities proposed in the scenario, assessing their ability to work in a team, to apply acquired knowledge and to solve problems.

52- Title: 3D Printing - Prusa Slicer

Addressed area: 3D printing

Topic: Prusa Slicer support and 3D printing

Context: The purpose of this scenario is to teach participants how to use PrusaSlicer - a tool to prepare STL files for 3D printing on Prusa printers. The scenario focuses on introducing participants to the basic functions of the program and preparing print-ready 3D models.

Goals:

- O Familiarization with how the program works and importing models
- O Preparing models for printing
- O Editing and modifying templates
- O Preparation of 3D printers
- O Application of the models made

NARRATIVE

ACTIVITIES	MOTIVATION	TASK	DURATION
Presentation on how the program works and the history of its creation	Understand the origin of the program	Developing knowledge about 3D printing	60 min
Program installation and configuration	Learn the installation steps	Installing the Prusa Slicer	20 min
Discuss the differences between types of printers	Ability to compare device performance	Analysis of the construction and appearance of printers and their operating elements	30 min
Preparation and printing of ready-made templates	Use the knowledge gained to correctly print the model	Importing the finished model, preparing it for the printer and starting to print the model	35 min

Reflection and evaluation:

Reflection and Evaluation: The PrusaSlicer Scenario is intended to guide users through the step-by-step process of preparing a 3D model for printing using this software. The main objective of the scenario is to provide users with the knowledge and skills needed to effectively use the PrusaSlicer and obtain the best 3D printing results.

Resources:

- Computer
- Prusa Slicer software
- 3D printer

53- Title: Virtual reality in the promotion of educational centers

Addressed area: VR/AR

Subject: The use of VR for virtual school trips

Context: This scenario presents the use of a virtual reality (VR) platform to visit a school, which could be an interesting and innovative idea. Thanks to this solution, you can give prospective students, parents, foreign students and interested parties the opportunity to get to know the school in an interactive and attractive way.

Goals:

- o An approximation of the atmosphere in the installation
- o Allowing interaction with the school environment
- o Optimize the time spent on familiarizing yourself with the building layout
- o Attract the attention of a broader group of stakeholders
- o Increase the openness and accessibility of the school and present its modernity

NARRATIVE

ACTIVITIES	MOTIVATION	TASK	DURATION
Introduction to the theme of virtual realities and their applications	Understand how VR works and its impact on current technology	Analysis and reflection of the introduction to the theme	45 min
Introducing the origins of VR and the Edmondo platform	Familiarization with how the platform works	Download the appropriate browser, connect to the platform and register	40 min
Knowing the virtual world	Experience how virtual reality works	Checking the functions provided by the platform	50 min
Presentation of premises for the use of VR for virtual tours of educational centers	Development of virtual reality applications	Analysis of currently available and operational examples and platforms that offer such solutions	40 min

Reflection and evaluation:

This scenario was built to introduce the topic of introducing a VR rig on a school field trip. This app can be a great way to introduce potential students and their families to what your school has to offer. It is also an interesting form of innovation in the field of school recruitment and communication.

Resources:

Computer

Software Firestrom Viewer

Internet

54- Title: Advanced Use of Arduino

Addressed area: Arduino - Thinkercad Platform, Electronic Systems

Topic: Using Arduino to build advanced devices

Context: This scenario presents a different perspective on using Arduino. Arduino can be used to create an air quality monitoring device. Sensors that measure levels of pollutants such as nitrogen dioxide, particulate matter and ozone can be connected to the Arduino to collect data and display it. This scenario allows you to prepare this device.

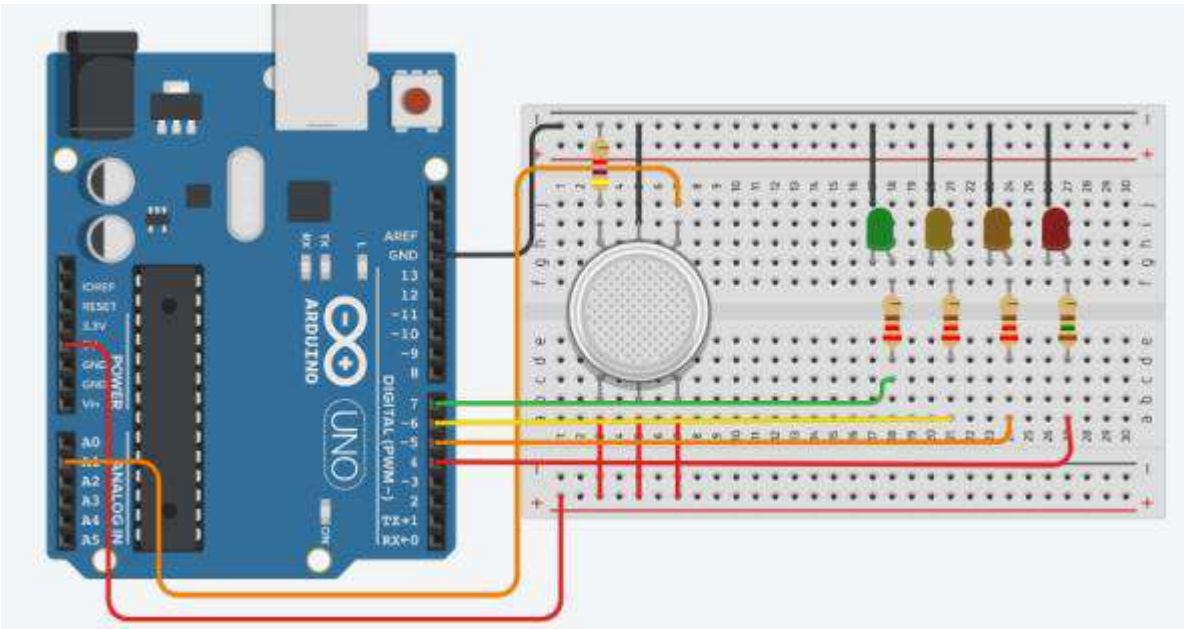
Objectives:

- o Raising awareness of environmental issues
- o Develop design skills o Solve real problems
- o Promote innovative technological solutions for environmental protection
- o Learn to draw conclusions using the information collected

NARRATIVE

ACTIVITIES	MOTIVATION	TASK	DURATION
Discussion of current ecological problems in the world	Understand the importance of activities that affect the environment around us	Search for solutions, discuss them and suggest alternatives	30 min
Presentation of the air quality monitoring device and its construction	Know the principle of operation and functioning of this type of devices.	Analysis of the construction of the device and the functioning of its individual components, as well as their functions	45 min
Mechanical assembly of the device	Handmade physical part of the device	Assembly of individual device components	50 min
Device programming, testing and collection of readings	Application of the device in practice and air quality tests	Device programming and testing	80 min

Assembly of the final circuit in Tinkercad:



Developed code:

```
#define GAS_PIN A1
#define LED_GREEN 7
#define LED_YELLOW 6
#define LED_ORANGE 5
#define LED_RED 4

void setup(){
    pinMode(LED_GREEN, OUTPUT);
    pinMode(LED_YELLOW, OUTPUT);
    pinMode(LED_ORANGE, OUTPUT);
    pinMode(LED_RED, OUTPUT);
    Serial.begin(9600);
}

void loop(){
    int value = analogRead(GAS_PIN);
    value = map(value, 300, 750, 0, 100);

    digitalWrite(LED_GREEN, HIGH);
    digitalWrite(LED_YELLOW, value >= 30 ? HIGH :
LOW);

    digitalWrite(LED_ORANGE, value >= 50 ? HIGH :
LOW);

    digitalWrite(LED_RED, value >= 80 ? HIGH : LOW);

    delay(250);
}
```

Reflection and evaluation:

This scenario was built to introduce you to the topic of air quality monitoring. Discussing the effects of air pollution on health and ecosystems helps to highlight the importance of the problem, and the element of designing and programming a device capable of raising awareness of the problem helps to tackle environmental pollution openly.

Resources:

Computer

Arduino IDE software;

1 Arduino Uno R3 and USB cable;

4 LEDs

5 resistors

1 gas sensor

55- **Title**: Make the name of your school in Braille

Learning Areas and Criteria: Mathematics, Languages, Design Technology, Computing

Equipment List

The student will develop knowledge From the context of the written	The students will understand the principles Braille language basics of Braille design	The students will draw CAD models for define the dimensions

Mathematics	English/Languages	Design	Technology Computing

Students will use calculations Mathematicians to annotate an Drawing with dimensions	Students will develop one understanding of 3D printers and how they operate	Students will manufacture Braille models through from 3D printing

the teacher needs

- 1 x display screen
- 1 x 3D printer
- 1 x PLA Filament
- 1 x Computer with slicing software for 3d printer

The student needs

- 1 x computer with Internet access
- 1 x pen / pencil

Make your School Name in Braille - Pres

Os

Presentation

At the beginning of class, load the presentation on the screen and go through the slides with the students. The presentation should last approximately 10 minutes and is intended to incorporate group discussions about braille and 3D printing. You can expand the presentation text any way you like - here are some points you might want to use:

1. In the section “Braille is a written form of language”, check if your students know the process of reading braille for the blind. Explain how they swipe from left to right across the raised dots.

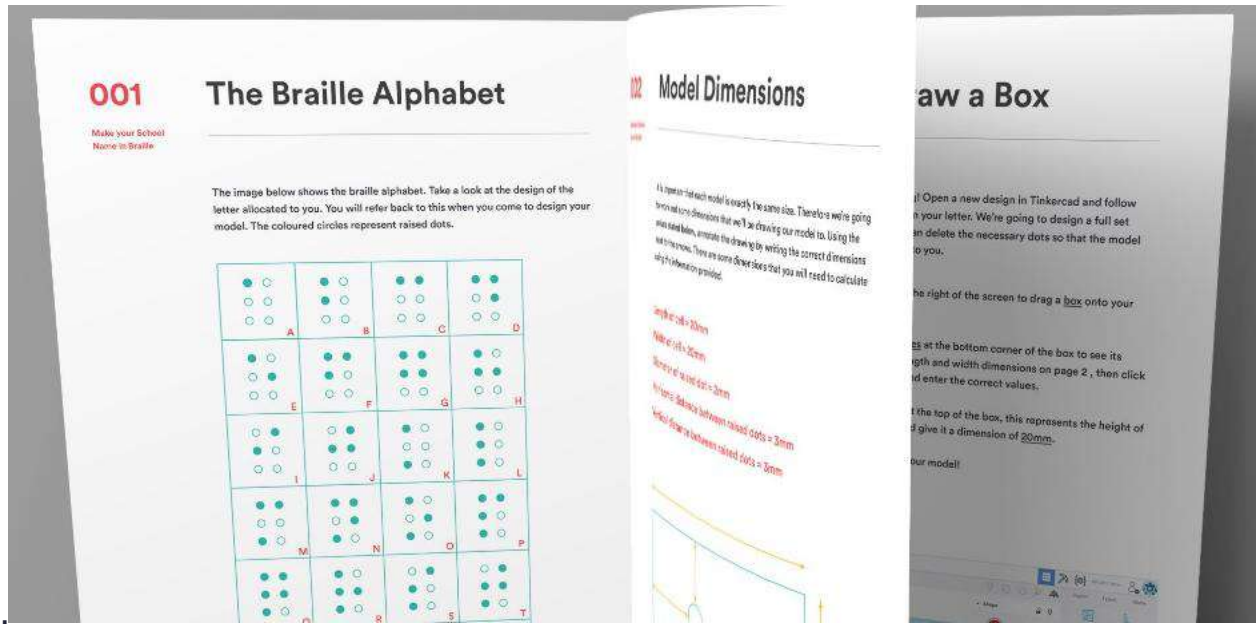
2. In the “Braille can be found in many places” section, let your students say where they think braille is used. Tell them how braille is used on public restroom doors, elevator buttons, in books, etc.

3. In the section “Go to Page 1 of the Student Workbook”, the diagram shows the word “hello”. Challenge your students to figure out the answer as quickly as possible and tell them to shout out the answer.

4. In the section, let's 3D print everyone's design, talk about the components of a 3D printer. You can use your 3D printer and point out the various parts and talk about how they work.
At the end of the presentation, assign a different letter of your school's name to each student. Don't worry if you have more students than letters in your school name. You can assign students the same letter and just 3D print one of them. The main part is that they have an opportunity to design in CAD.

Student Support Book

Upon completion of the presentation, students will go through the workbook to design their allocated letter in Tinkercad. They will use the dimensions provided in the workbook to ensure that each design is the same size. Remember to let them know the folder on the school's server where they can save their projects. You can also provide students with the tutorial video for extra guidance. Give students about 40 minutes to omplete the instructions in the workbook



3D printing

You will act as the facilitator during this section of the lesson, moving around the classroom helping students. To enable you to support your students, take a good look at the workbook yourself before class. This will ensure that you know the steps in the workbook to help your students. If you're unsure about any of the steps, email hello@weareprintlab.com and we'll be happy to help.

To help you further, there is a teacher training section further on where you will walk through the entire design process in Tinkercad.

By the end of this section, each student will have drawn a different chart and exported an STL, ready to load into their slicing software.

Students who finish the tutorial early also have the opportunity to design additional features for the model, such as support for placing all 3D printed models.

3D printing

The final part of the class involves a 3D printing demonstration by the teacher.

At this stage, you should have a series of STL files designed by your students. Choose an STL and

demonstrate the following to your students:

1. how to upload files to the cutting software
2. basic slicer settings (e.g. layer height)
3. how to save GCode or GSD file

We recommend that you use PLA filament, a layer height between 0.1-0.2mm and a raft depending on the capabilities of your 3D printer. If you need further advice, please contact **hello@weareprintlab.com.**

*If your 3D printer is Polar Cloud enabled, Tinkercad designs can be sent directly to the 3D printer.

The process is shown in this video tutorial.

Finally, set up your 3D printer and talk about the 3D printing process. After the class is over, the student can send the rest of the STL files for printing. Load as much as you can onto the construction of your cutter so you don't have to print many separate files. As a homework assignment, ask students to write a short report on the potential they see in 3D printing for creating braille signs and models.

We recommend that you use PLA filament, a layer height between 0.1-0.2mm and a raft depending on the capabilities of your 3D printer. If you need further advice, please contact hello@weareprintlab.com.

*If your 3D printer is enabled for Polar Cloud, Tinkercad designs can be sent directly to the 3D printer.
The process is shown in this vídeo tutorial.

Finally, set up your 3D printer and talk about the 3D printing process. After the lesson is finished, you can send the rest of the STL files to print. Load as much as you can onto your cutter's build plate so you don't have to print out a lot of separate files. As a homework assignment, ask students to write a short report on the potential they see in 3D printing for creating braille signs and models.

Rating criteria

Students can be evaluated according to the following criteria:

- How well did the students' 3D model accurately represent the allocated braille letter?
- How accurate was the 3D model created by the student? Do the measurements meet those indicated in the workbook instructions?
- Review the homework report created by the student. Do they fully understand the functional aspects of braille and the impact braille has on society? How well did the student understand the potential of 3D printing to create braille?

Alternative 1: For Younger/Beginner Students

If your students are new to CAD and 3D printing, you can complete the task using the following steps:

STEP 1 | Presentation

Make the presentation as indicated in the original lesson plan

STEP 2 | Student Workbook

In this section of the lesson, provide each student with a handout and assign them a letter to draw. Rather than letting them follow the instructions on their own, mirror your computer on a large screen and follow the workbook step-by-step so students can follow their actions.

STEP 3 | 3D printing

Start the 3D printing process as directed in the original lesson plan

If your students already have a good understanding of braille and are competent in CAD and 3D printing, you could run a project where students create braille signage for different areas of your school. In this case, you can follow the steps below:

STEP 1 | set summary

Begin the lesson by explaining to students that they will be designing braille signage for different areas of their school. Give them 10 minutes to identify areas of your school that could benefit from braille signage. Ask students to walk around the school building, writing down their thoughts, ideas and measurements if necessary.

STEP 2 | Design

In this section of the lesson, give students 40 minutes to design their braille signage. Encourage them to sketch their ideas before transferring them to CAD software. You can also provide students with the student workbook and tutorial video so they can refer to the braille alphabet and design instructions.

STEP 3 | 3D printing

After students complete their designs, they must prepare and slice their own 3D print-ready STL files. Start 3D printing some of the models during class and, as a group, discuss the benefits of 3D printing for creating braille.

STEP 4 | Analysis/Development (homework or additional class)

As a homework assignment or supplementary class, ask students to develop a proposal (in the form of a short report or presentation) on how to solve the problem of a lack of braille signage in public spaces, using 3D printing as a manufacturing method. For example, your proposal could involve local community schools conducting braille workshops and developing a model that can scale nationally and globally. Your proposal should also detail several criteria, including how much it might cost to produce braille signage, who pays for the materials, and how to ensure the products are usable by blind users.

56- Title: Make your own stationery

Objectives:

I can define the opportunities and challenges with 3D printing consumer products

I can use research and investigation skills to define a suitable stationery product to design for a large retailer

I Can generate multiple sketch ideas for a stationery product

I Can generate an accurate CAD model of a pen shell

Intro & Context:

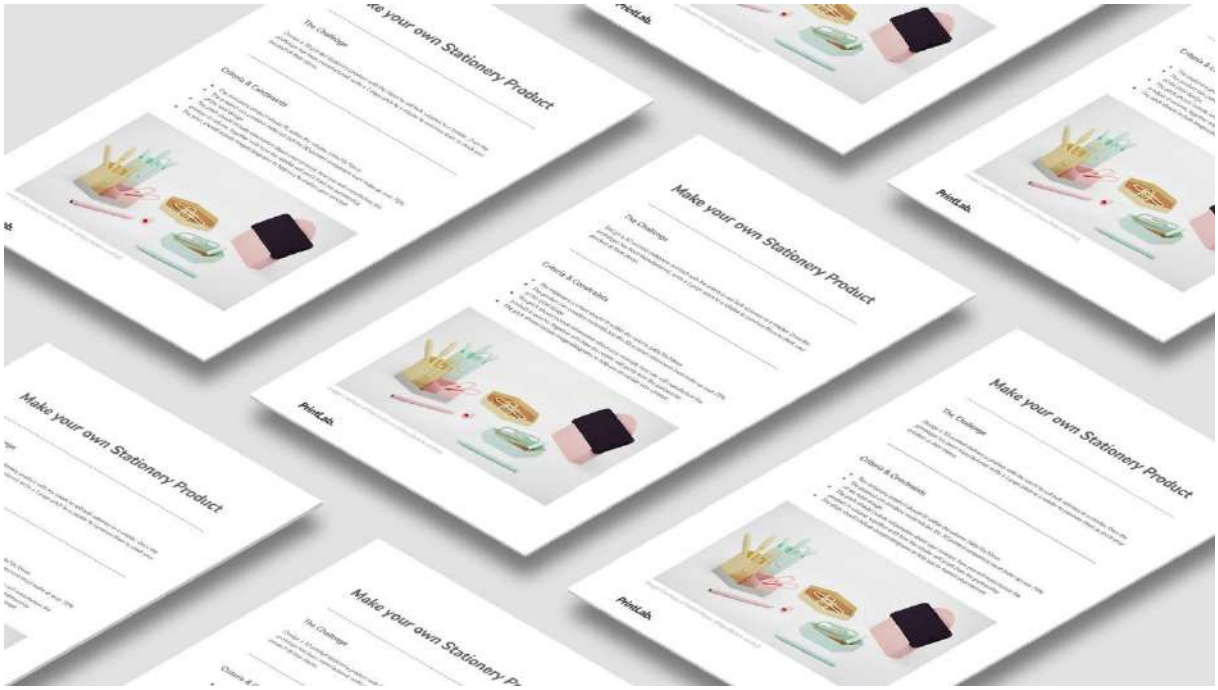
To begin the lesson, provide students with an overview of the lesson and how they will design a stationery product to sell to a major retailer.

Proceed to play the explainer video to provide students with an overview of distributed manufacturing. Continue playing the case study video to give students a deeper look at how Batch.works.

Ask students what they think are the opportunities and challenges with 3D printing consumer products and have an informal discussion.

Research & Debate of Ideas

Distribute a design challenge worksheet to each student and follow the criteria listed. Allow students to ask questions at this stage about what is required of them. Inform students that for the next 20 minutes they are to research existing products, Brainstorming their product ideas, and create several sketches of assorted designs. During the research phase, you can provide the link to the Batch.works website - https://batch.works/.



Development of CAD Skills |

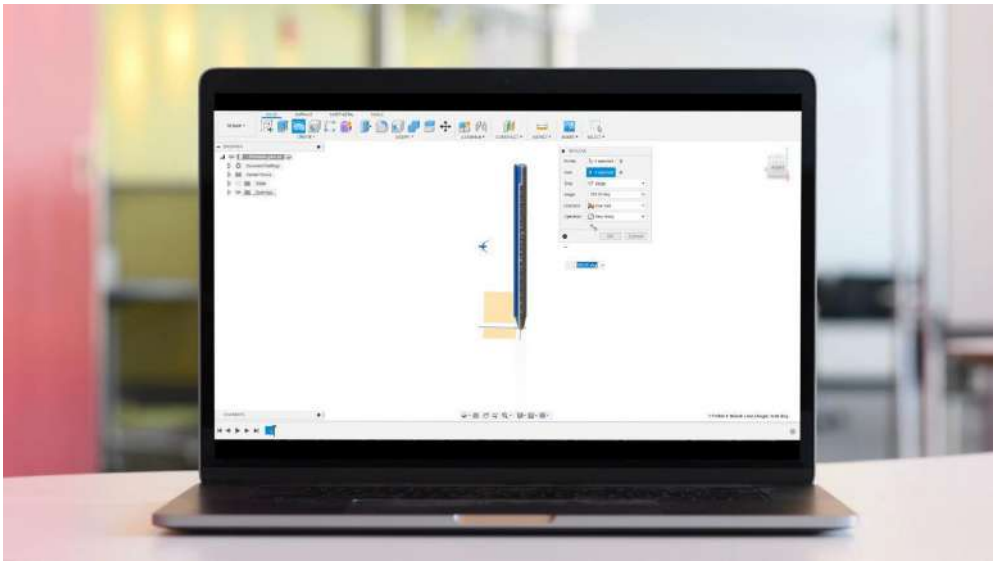
To end the lesson, direct students to the CAD tutorial video on the PrintLab Student Portal to design the pen shell. The skills learned in the tutorial will help them when it comes to designing their own unique products. Before the end of the lesson, start a 3D print of one of the pens and carry it over to Lesson 2.

Model Demo |

At the beginning of class, show students the 3D-printed pen shell. Ask a volunteer to extract the cartridge from a Bic Cristal ballpoint pen and fit it into the pen housing. Pass the functional pen around the class for everyone to see.

Model CAD |

Give students about 45 minutes to select a final design from their ideas and transfer it into the CAD software.



Objectives

I can develop a 1-page “pitch” creative pitch to convince a retailer to stock my product

Product Proposal |

Provide students with their 3D printed models along with the self-assessment rubric. Ask them to select a relevant retailer and develop a 1-page pitch to convince them to stock your products in their stores. Remind students to refer to the design challenge criteria along with rubric information. If students finish their pitch during class, ask them to review your product and suggest improvements. This class can also be extended by asking students to develop more iterations of their designs.

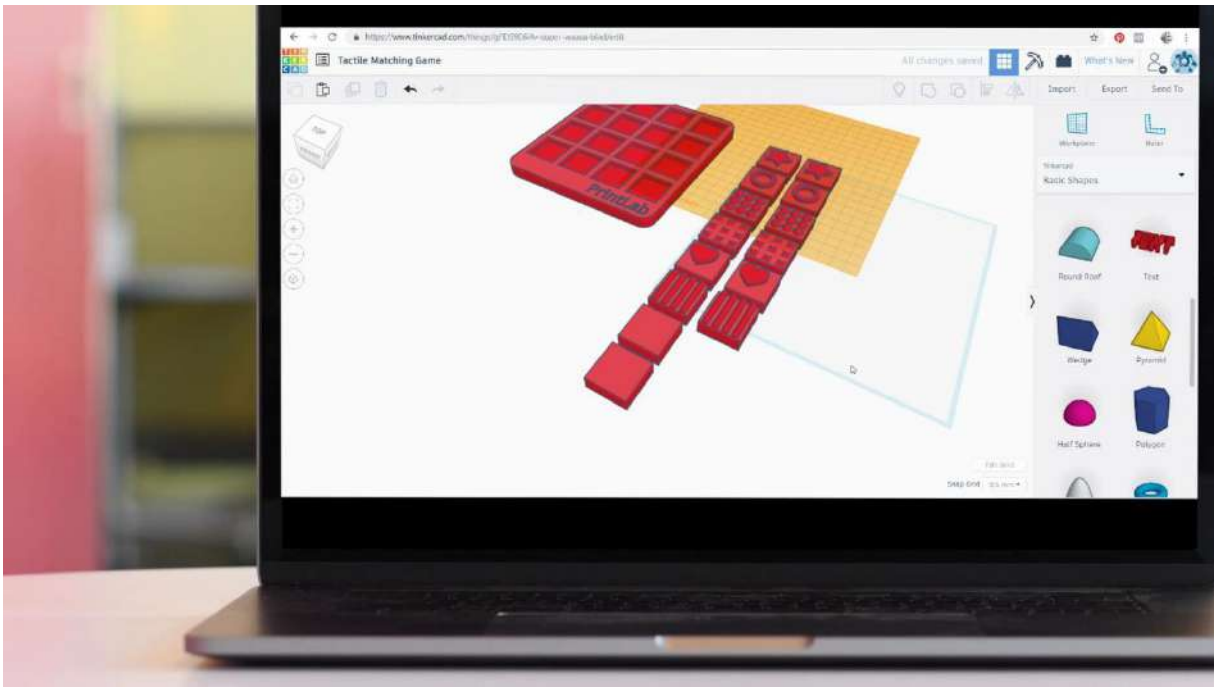
Introduction and Demo |

At the beginning of the lesson, play the explanatory video and pass the 3D-printed example model. Ask students the following questions in an informal discussion:

- How do you think the game is played and who plays it?
- What are the benefits of such a game?
- How would you improve this particular game design?
- What are the benefits of using 3D printers to create tactile matching games?

Desenvolvimento de Competências CAD |

For the rest of the lesson, inform students that they will be going through a skill development tutorial to create an example tactile matching game. Direct them to the PrintLab Student Portal to access the video tutorial on their individual computers. After about 45 minutes, students should have learned the basic skills needed to design their own unique models.



Departure Guide | 5 minutes

At the end of class, ask students to write:

- 1 idea for a tactile game that differs from the example

Lesson objectives

- Can I define the term 'digital footprint'
- I understand the benefits and dangers of online feedback and collaboration
- I can generate probing questions to help me determine criteria for a tactile game
- I can participate in responsible and respectful online research and collaboration

Brief |

At the beginning of Lesson 2, distribute a guide to each student. Review the summary on page 2 as a class to ensure all students understand the challenge, criteria, and restrictions. Explain the following points:

- Students will work in teams of 3-5 (select number depending on your preference)
- The project will involve team and individual work
- At the top of each section of the workbook, you will be informed if the activity should be carried out in a team or individually
- For individual activities, each student must write or draw in their own workbook
- For team activities, students must select one person's workbook as the 'Main Workbook' and write or draw in this workbook for all team activities

Online Collaboration Activity |

Explain to students that the first step is to research what makes a tactile game usable and enjoyable. The best way to do this is to gather information by asking questions of a real audience. Audiences may include visually impaired social media groups, local organizations, or people you know. Before students begin their survey, follow the steps below to ensure they know how to act responsibly and respectfully when interacting with others online.

Ask each student to write down what they think are the benefits of collecting feedback from people online and collaborating with them for research purposes. Give students 1 minute to write their answers.

Ask about 5 students to share their responses, and encourage the class to provide feedback and ask questions. Ask each student to write down what they think are the dangers of collecting feedback from people online and collaborating with them for research purposes. Give students 1 minute to write their answers.

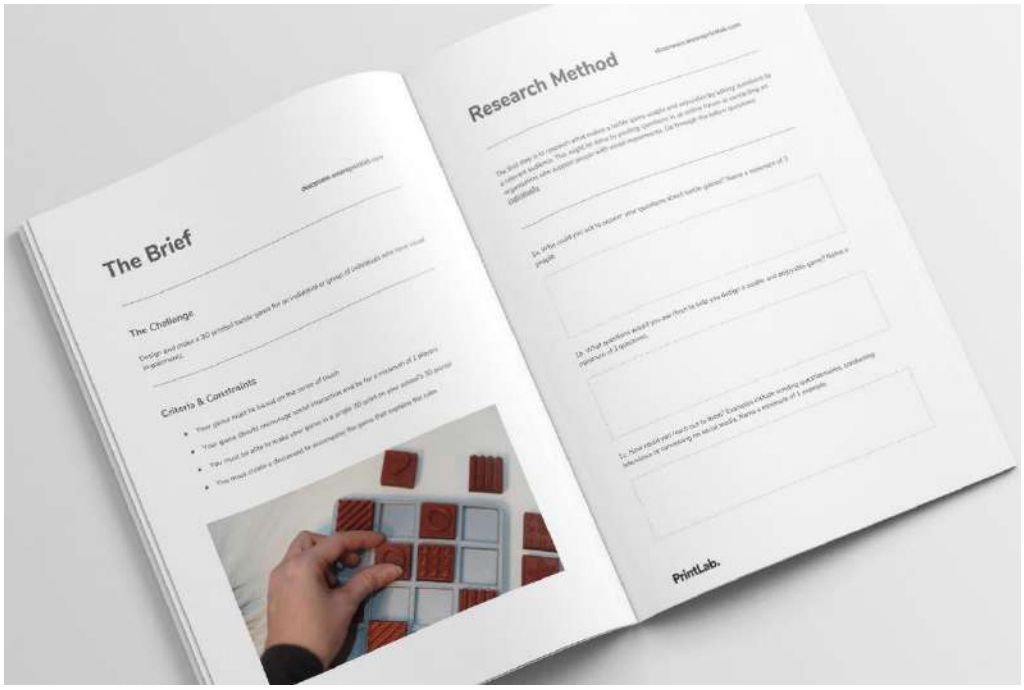
Ask about 5 students to share their answers and encourage the class to provide feedback and ask questions.

Ask each student to write how they can be responsible and respectful when collecting feedback from people online and collaborating with them for research purposes. Give students 1 minute to write their answers. Ask about 5 students to share their responses, and encourage the class to provide feedback and ask questions.

Finally, explain how someone's 'digital footprint' refers to all of the online information about a person posted by that person or others, intentionally or unintentionally. Make sure students are clear about this definition and that it should be considered when they are participating in an online activity.

Search Method |

Ask students to look through the 'Research Method' section of the workbook individually to brainstorm ideas that help them discover what makes a tactile game usable and enjoyable.



Search Implementation |

Put students into teams of 3-5. These will be the teams they will stay on for the entire project. Ask teams to go through the 'Search Results' section of the workbook, where they will:

- Discuss each individual's research ideas
- Decide on a research method as a team
- Implement the search method

Draft the survey results (this can skip to Lesson 3. For example, if students post questions in an online forum, they may not get answers right away).

Lesson objectives:

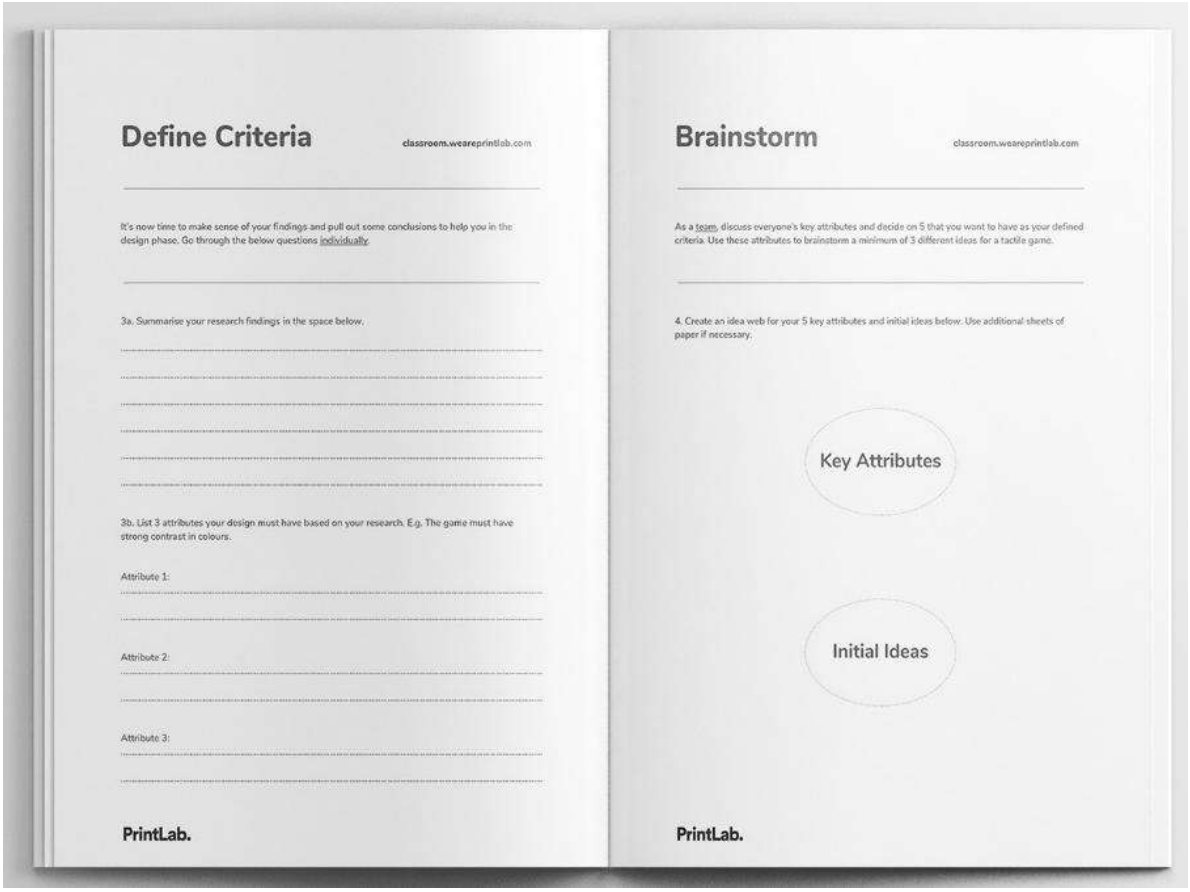
- I can summarize search results in my own words
- I can use my research findings to define a set of design criteria/key attributes
- I can work simultaneously as an individual and as part of a team to generate design ideas for a tactile game
- I can work collaboratively within my team to design and 3D print a haptic game

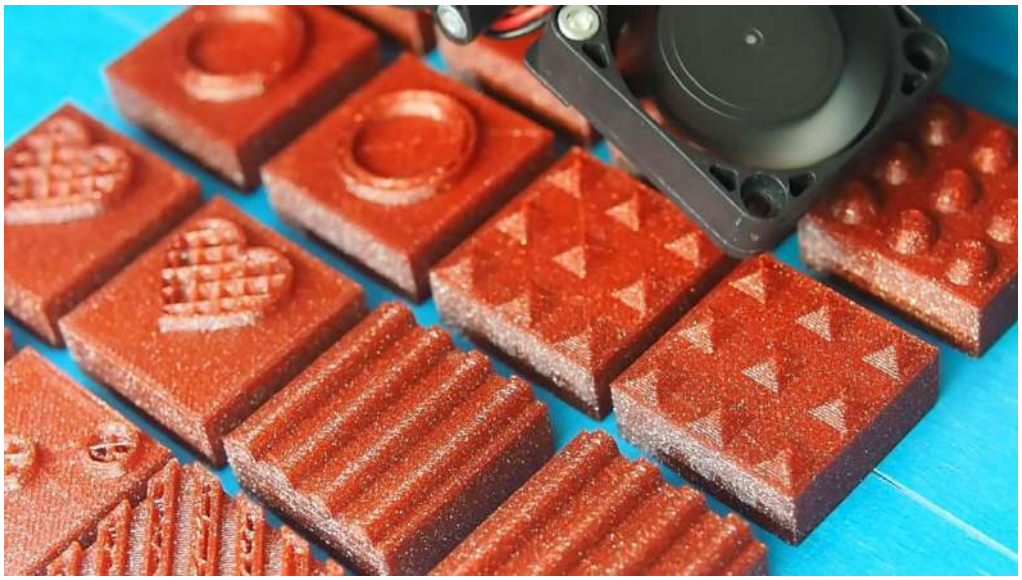
Define, design and make |

- Over the next 2 lessons, allow teams to follow the guide from the 'Define Criteria' section up to and including the 'Final Idea' section at their own pace.
- Remind them that by the end of Lesson 4 they should have finalized a haptic game design to send to the 3D printer.
- Therefore, they must work collaboratively to ensure they meet their own deadlines.

The workbook will guide students in:

- Define your own design criteria/key attributes
- Brainstorming and sketching out ideas for your tactile game
- Analyze all ideas and reduce them to a single final design
- Design and 3D printing of the final project
- Make sure all templates are printed before Lesson 5.





Lesson objectives:

- I can develop a set of instructions to accompany our tactile game
- I can use clear, non-offensive, and respectful language in my instructions

Play |

Give each team their tactile game and give them 15 minutes to review and play their games.

57- Title / Addressed area: 3D Modeling and Printing

Subject: Create and Test a Learning Scenario in the context of 3D Modeling and Printing

Involved agents: 7th grade students, Information and Communication Technologies (ICT) teacher and Portuguese teacher.

Context: As Poetry is part of the syllabus of Portuguese and ICT 3D Modeling, the teachers launched a challenge to the students, with the theme: "Poetry in 3D". With the guidance of the teachers, the students analyzed the poems in the Portuguese class and in the ICT classes they were challenged to express them through an artifact, using the Tinkercad tool and printing it on a 3D printer.

Goals: - Develop students' initiative, responsibility, autonomy, creativity and critical thinking. - Cooperate in group activities. - Safely use computer equipment and respective tools. - Adopt safe and responsible behavior when using software. - Know and work with the 3D modeling program, Tinkercad, exporting it to an STL file. - Prepare the file for the 3D printer. - Use the 3D printer to print the object.

Competence areas of the students' profile:

A - Languages and texts.

B - Information and Communication.

C - Reasoning and problem solving.

D - Critical thinking and creative thinking.

E - Interpersonal relationship.

F - Personal development and autonomy.

H - Aesthetic and artistic sensitivity.

I - Scientific, technical and artistic knowledge.

J - Consciousness and mastery of the body

Essential learnings:

- Drawing objects, using appropriate 3D modeling techniques and materials, with a view to adequate solutions to a problem or project.

- Integrate content from different types of media, to produce and modify, in accordance with known standards and guidelines, creative digital artifacts, to express ideas, feelings and specific purposes.

NARRATIVE

ACTIVITIES	MOTIVATION	TASK	DURATION
demonstration of impression of a project.		Printing of prepared projects on tinkercad	150 min
Activity evaluation		Completing a self-evaluation and project evaluation form.	
Presentation /disclosure of the project.		Exhibition of works carried out in the school lobby.	50 min

ACTIVITIES	MOTIVATION	TASK	DURATION
project show designed in 3D.	Presentation of projects carried out in 3D modeling, shape to motivate students to the creation of others projects.	Brainstorming about “Poetry in 3D”, using the tool - Mind Mapping, with the aim of coming up with ideas for artifacts, which students can create in Tinkercad and 3D print, to represent the poems they read and analyzed in the Portuguese subject	**30 min**
visualization of 3d printer in operation.	vision of 3d printer a print, to capture the students' interest for the materialization of your projects. ..		**50 min**
Presentation of Tinkercad tool. video viewing about the Tinkecad tool.		Registration on the Tinkercad platform. Development of projects in Tinkecad, chosen by each student/group.	**150 min**

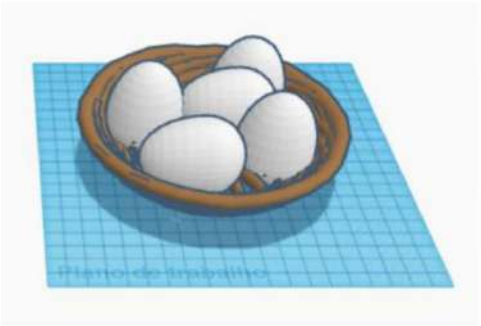
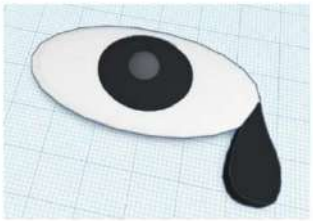
Exhibition of 3D projects and visualization of the printer in operation



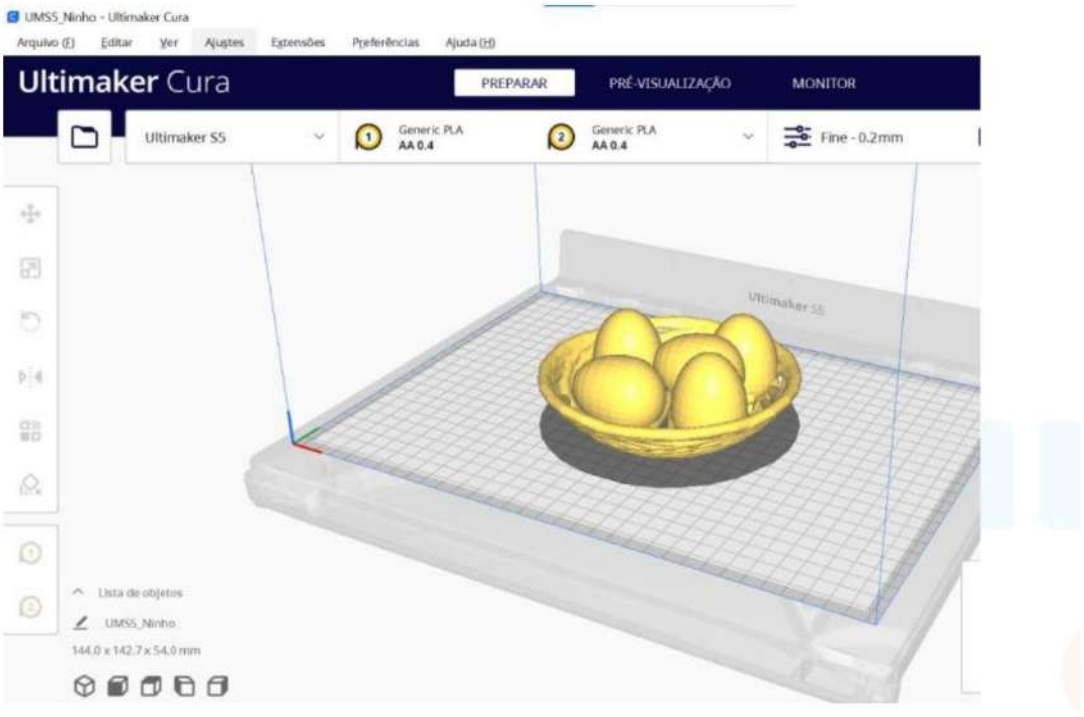
Brainstorming, about “poetry in 3D”, using the tool - Mind Mapping

MindMapping.com

Examples of projects developed in Tinkecad, under the theme: “Poetry in 3D”.


Prepare the Project for Printing



Reflection and evaluation:

Due to time constraints (the students only have ICT classes 50m per week), it has not yet been possible to print the objects that the students have created in 3D, nor to carry out the self-assessment and final evaluation of the projects. So far, the students have shown enthusiasm in carrying out the project and are highly motivated. They have achieved the objectives proposed in this learning scenario and developed the defined skills. After printing the 3D projects, an exhibition will be prepared in the school lobby with the artifacts produced and the respective poem.

With regard to the evaluation of the "Poesia em 3D" project, students will fill out a self-assessment form.

Your answers will be analyzed and made known to the class. As the project was developed in conjunction with the Portuguese subject, the two teachers will carry out the evaluation of the projects, according to the evaluation criteria that were defined and made known to the students. A reflection on the learning scenario that was defined and applied will also be elaborated, highlighting the strengths and weaknesses, and what could be improved.

Resources:

- 3D printed artifacts.
- Mind Mapping Tool.
- Classroom Platform.
- Tinkercard Tool.
- Computer, - Internet for access to platforms, tools and creation of forms.
- 3d printer

58- Title: Automatic lighting system with Arduino and sensors

Addressed area: Tinkercad, Arduino and sensors

Subject: Create an automatic lighting system using Arduino, a photoresistor and the PIR sensor

Context: Through the use of the Tinkercad platform, students build an automatic lighting system that works very similarly to light systems with motion sensors on the market. Basically they detect movement through a PIR sensor (motion sensor) and turn on the connected lights for a certain period of time. In this scenario, two different types of lighting are used, an LED strip and an incandescent lamp controlled by a relay. The duration during which the lighting stays on is defined by the students. At the end of this period, the light automatically turns off. The use of the photoresistor serves for the system to work only in conditions low light.

Goals:

Use a circuit simulation platform (Tinkercad). Understand the use of the Arduino board and its various ports and components. Use a simulation environment (Tinkercad). Create a circuit using jumpers, a breadboard, a relay, a photoresistor, a PIR sensor, a lamp, an LED strip and a power source. Connect the Arduino board to a computer and use the Arduino IDE to program it. Understand the concept of libraries and how to import them into the IDE. Program the circuit, involving programming, logic and electronics knowledge so that it works as described.

NARRATIVE

ACTIVITIES	MOTIVATION	TASK	DURATION
board presentation Arduino and its different ports. Presentation of tinkercad platform (simulation environment). Presentation of basic components (sensors, motors, resistors).	Acquire knowledge about Arduino and its capabilities. Understand the advantages of using a simulation environment. Understanding the potential of Arduino modularity using sensors and activators.	information search in video format on the Arduino board. Creation of registration in Tinkercad platform.	**50 min**
Use of a photoresistor in order to register on serial monitor the values obtained.	Understand the usefulness of a motion sensor. Understand how to control a led through the PIR sensor.	Create a circuit that turn on an activating led the PIR sensor.	**50 min**
Using a sensor PIR to light a LED.		Registration on the Tinkercad platform. Development of projects in Tinkecad, chosen by each student/group.	**150 min**
Use of a relay to control a incandescent lamp.	Understand how a relay works. Understand how to control activation of a lamp through a relay.	Create a circuit that control a lamp through a relay.	**50 min**

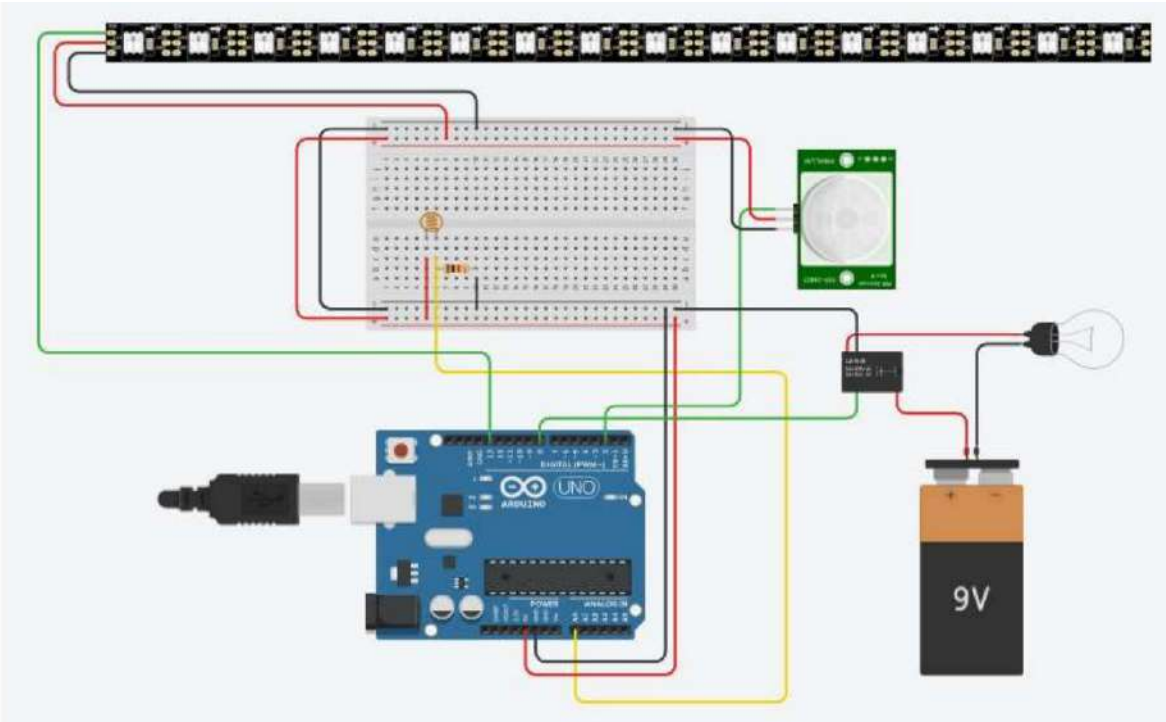
Reflection and evaluation:

The learning scenario will be presented as a challenge to the students of the Programming and Robotics Club. This scenario is built based on the idea of involving students in researching the necessary information, taking into account their context and needs. The development of the scenario results in a dynamic process, since the scenario is divided into parts so that, at each step, students are able to develop skills to solve the following tasks, leading to constant experimentation and reflection, promoting the creation of new challenges and the development and consolidation of new knowledge.

Resources:

- ✓ Computer;
- ✓ Arduino Board;
- ✓ Breadboard;
- ✓ Connection wires;
- ✓ Resistance;
- ✓ Photoresistor;
- ✓ PIR sensor;
- ✓ SPDT relay;
- ✓ Lamp;
- ✓ NeoPixel Range 16;
- ✓ 9V Battery or Power Supply.

Circuit proposal:



Programming proposal:

Texto | 1 (Arduino Uno R3)

```
#include <Adafruit_NeoPixel.h>
#define PIN 13 //pin de input da fita
#define NUMPIXELS 16 //número total de leds na fita

Adafruit_NeoPixel fita(NUMPIXELS, PIN, NEO_GRB + NEO_KHZ800);

int SensorLuz = A0;
int SensorPIR = 2;
int Relay = 8;
int PIRVal = 0;
int LuzVal = 0;

void setup()
{
  fita.begin();
  pinMode(SensorLuz, INPUT);
  pinMode(SensorPIR, INPUT);
  pinMode(Relay, OUTPUT);
  Serial.begin(9600);
}

void loop()
{
  fita.clear();
  LuzVal = analogRead(SensorLuz);
  PIRVal = digitalRead(SensorPIR);
  if (LuzVal < 600) {
    Serial.println("< 600");
    if (PIRVal == HIGH) {
      for(int i=0; i<NUMPIXELS; i++) {
        fita.setPixelColor(i, fita.Color(255, 255, 0));
      } fita.show();
      digitalWrite(Relay, HIGH);
      delay(5000); // Wait for 5000 millisecond(s)
    } else {
      for(int i=0; i<NUMPIXELS; i++) {
        fita.setPixelColor(i, fita.Color(0, 0, 0));
      } fita.show();
      digitalWrite(Relay, LOW);
      delay(1000); // Wait for 1000 millisecond(s)
    }
  } else {
    for(int i=0; i<NUMPIXELS; i++) {
        fita.setPixelColor(i, fita.Color(0, 0, 0));
      } fita.show();
    digitalWrite(Relay, LOW);
    Serial.println(LuzVal);
    delay(1000); // Wait for 300 millisecond(s)
  }
}
```

59- Title: Illuminated dividers

Addressed area: Arduino

Subject: Divisors and multiples of a number

Context: Through working with the Arduino, with connection to various electronic components, sensors programmed using the Arduino IDE, students acquire knowledge and consolidate knowledge of Mathematics, using logic and implementing new innovative methodologies.

Objectives:

Understand how to use the arduino board, the analog and digital ports and where we can connect other components such as leds, resistors and also understand how we can program it using the arduino IDE. Create a circuit using resistors, leds, jumpers (wires), a breadboard and a power source, programming it to see what happens after understanding the logic of your programming. Create a circuit, to solve the proposed problem, and do the programming we need to make it work involving knowledge of programming, logic and electronics.

NARRATIVE

ACTIVITIES	MOTIVATION	TASK	DURATION
board presentation arduino explain the different parts of this board (doors). show projects developed with the arduino board	acquire some knowledge about the potentialities of arduino its use	reading some information about the arduino board and research on the Internet	**50 min**
reading some information about the arduino board and main functions	Steps to start use arduino IDE	download the arduino IDE and respective installation	**15 min**
meet some components (LEDs, resistors, etc.)	understand how you should include them in the circuit	perform the first assembly (blinking LED)	**35 min**

Program the circuit first montage of so the LED red light up if the generated no. randomly for multiple of 2	Understand how to create a circuit using arduino and other components or tinkercad online	Create a project with circuit working.	**50 min**
Expand the circuit way to signal the multiples of 3 and 5 (LEDs yellow and green) and none of the above(blue LED)	Understand how to create a circuit using arduino and other components or tinkercad online	Create a project with circuit working.	**100 min**

Reflection and evaluation:

Students will be challenged to create a circuit that identifies the multiples of 2, 3 and 5 of a generated number randomly. They must collaborate with each other, programming their own ideas and ideas in the Arduino IDE. implement peer dynamics. They must solve the problem and carry out programmed activities.

Resources:

- computer
- arduino board, leds, resistors, breadboard, connection wires
- arduino IDE - tutorial and guide Suggestion: You can use Tinkercad if you don't have the arduino board and the various components.

Login | Tinkercad - https://www.tinkercad.com/login

60- Title : CHALLENGES FOR THE IMPLEMENTATION OF EPR@LC "traffic light - 3leds"

Addressed area: Arduino

Subject: Simulator of a traffic light (3 leds) with Arduino

Context: With the growing importance of technologies in today's society, it becomes increasingly relevant for students to have the opportunity to develop skills in programming and robotics. This scenario allows promoting learning through problem solving, practical projects and group activities. It is intended that, as a group, students build a traffic light simulator, using an Arduino board and some electronic components.

Goals:

- Foster students' interest in science and technology, especially in the area of programming and robotics;
- Develop practical skills in programming and robotics;
- Stimulate critical thinking, creativity and problem solving;
- Encourage teamwork and collaboration among students.

NARRATIVE

ACTIVITIES	MOTIVATION	TASK	DURATION
Presentation and operation of the board arduino	view examples made with Arduino Getting to Know the Arduino Board	View and analyze the available materials (activity guide, videos, electronic components, tools).	**50 minutos**
Assembly of the circuit in Arduino board	understand how a circuit works - arduino Develop skills programming practices stimulate thinking critical, creative and Problem solving	Identify and download the programs necessary for programming the simulation of the operation of a traffic light. Perform programming.	**100 minutos**
Product presentation Final. Delivery of files to Moodle Platform	Encourage students to develop projects practical, from design to implementation, to apply the concepts learned.	Present and share information about the process of assembling, programming and installing the programs necessary for programming the Arduino board, using digital means of communication and collaboration.	**50 minutos**

Reflection and evaluation:

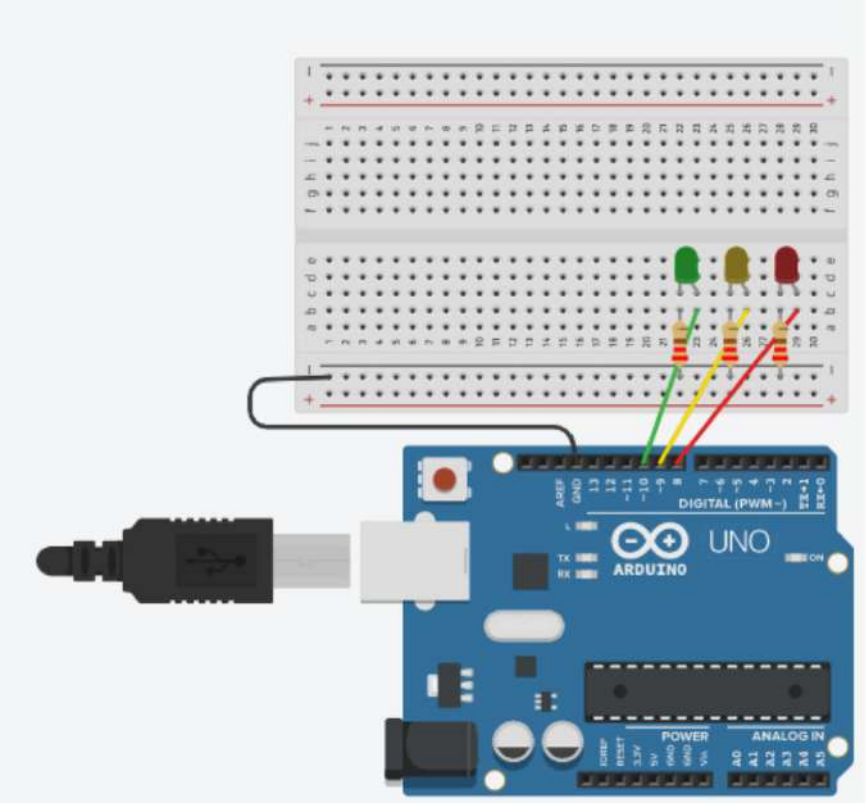
Collaborative work promotes students' autonomy, responsibility and critical spirit. The assessment of learning will be carried out through direct observation of the dialogue established with the students, and

must include the assessment rubrics. After the presentation of the work, the different groups will evaluate the work carried out by their colleagues. Students carry out their self-assessment and peer assessment using forms (Google Forms).

Resources:

- Computer;
- Breadboard;
- An Arduino board;
- 3 LEDs (red, yellow, green);
- Jumper wires;
- 3 resistors of 220 Ω (ohm).

Schema and Code:



Code:

```
void setup() {
  pinMode(8, OUTPUT); //Led vermelho
  pinMode(9, OUTPUT); //Led amarelo
  pinMode(10, OUTPUT); //Led verde
}

void loop() {
  //acende a luz verde durante 5 segundos
  digitalWrite(10, HIGH);
  delay(5000);

  //apaga a luz verde e acende a amarela durante 3 segundos
  digitalWrite(10, LOW);
  digitalWrite(9, HIGH);
  delay(3000);

  //apaga a luz amarela e acende a luz vermelha durante 5 segundos
  digitalWrite(9, LOW);
  digitalWrite(8, HIGH);
  delay(5000);
}
```

61- Title: - Simulating a car's parking sensors.

Addressed area: Arduino

Subject: Create an Arduino circuit with sensors and program it.

Context: Within the scope of the Programming Languages discipline, students develop a project where they apply the knowledge acquired in this course and articulate with the Computer Architecture course, with the Creating a circuit in Arduino. Arduino IDE programming allows students to resort to a new application of the programming language, in a more practical context, articulating the logic of programming and operation of electronic components used, such as sensors and actuators.

Objectives:

In Robotics, the general objective is to experience the construction of circuits using the Arduino board and some sensors. In Programming, the general objective is to allow the development of control of interactive systems, using the C programming language. Specifically: - Understand how to use the Arduino board; - Understand how and when to use the different ports (analog and digital); - Understand the basic concepts of electronics; - Create the circuit using sensors, actuators and jumpers interconnected by a breadboard; - Understand the different ways of supplying the circuit according to needs; - Correctly apply the C language according to the tasks to be carried out; - Correctly use the functions associated with the Arduino IDE.

Purpose of work:

It is intended that the system emit a sound that increases in frequency when the car approaches the obstacle, and that an LED signals “parking complete” when the car is at the ideal distance. In the serial monitor obtain the value of distance to the obstacle and information about the parking status.

NARRATIVE

ACTIVITIES	MOTIVATION	TASK	DURATION
board presentation arduino Explanation of the ports existing Highlight the RX pins and TX show some examples of projects	acquire knowledge about the use of arduino as well as potential typologies projects	Students, in groups of 2, carry out research on board practices of the arduino and analyze its structure (analog, digital ports, feed, grnd, etc) Discussion between peers and with the teacher.	**50 minutos**
Installation of the IDE arduino Explanation of the structure of a program Explanation of the main functions	understand the analogy between the arduino IDE and a program like C language	Search and download the arduino IDE; Install the software; Make the analogy between the arduino IDE and the software/structures of a typical C language software; Open a sample project and analyze the code they already recognize;	**25 minutos**
know components to use	understand how they work jointly with the arduino	Consult documentation on the components to understand how work; Download the necessary libraries	**25 minutos**
assemble the circuit	understand how they are mounted the different components physically	Proceed with the assembly and connections of each component; Create code for each component and test	**100 minutos**
present to the class Assessment	understand the activity developed self-regulation	Each group presents their approach to the class. Teacher and peer evaluation	**50 minutos**

Reflection and evaluation:

Students physically implement a circuit using the Arduino board and program it in the Arduino IDE. There is a discussion about their greatest difficulties, what they liked the most and what suggestions they would give to complement the project. The assessment focuses on the presentation to the class, the teacher's assessment of the resolution of the situation and the assessment of their peers.

Resources:

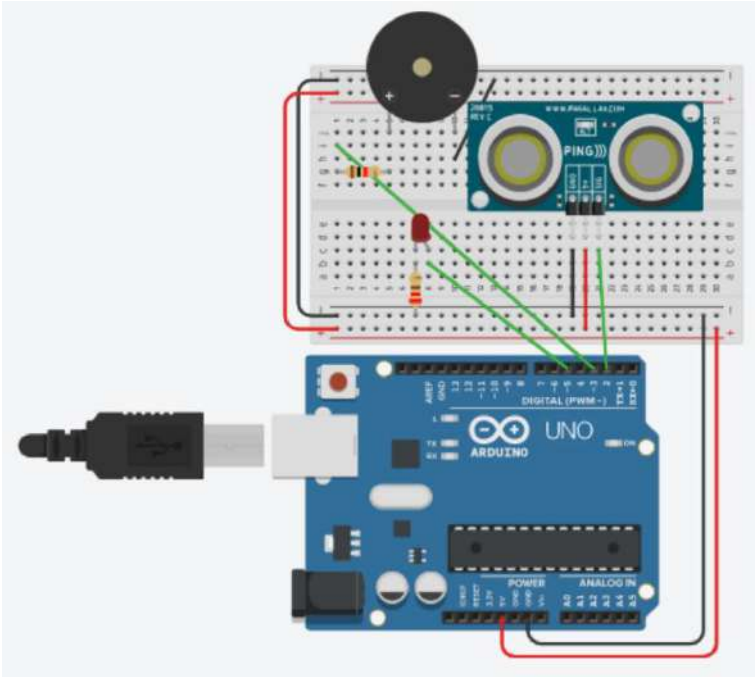
- computer;
- arduino board, sensors, actuators, breadboard, jumpers, others;
- arduino IDE software;
- tutorials;
- support guide

Note: If the student does not have the physical equipment to practice at home or create independently, he can always register at https://www.tinkercad.com/ and use the platform

Students' opinion:

Overall, the students expressed their satisfaction with the activity, referring to enjoying applying programming with the arduino as it was “more practical and they saw the result which is more real”. They also liked to share what they learned in Physics and Chemistry about electric current and resistance. Some students reported that they “understood better with the circuit”.

Circuit:



Code:

```
int distancia = 0;

int tom = 0;

int som_map = 0;

long readUltrasonicDistance(int triggerPin, int echoPin)
{
  pinMode(triggerPin, OUTPUT);  // Clear the trigger
  digitalWrite(triggerPin, LOW);
  delayMicroseconds(2);
  // Sets the trigger pin to HIGH state for 10 microseconds
  digitalWrite(triggerPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(triggerPin, LOW);
  pinMode(echoPin, INPUT);
  // Reads the echo pin, and returns the sound wave travel time in microseconds
  return pulseIn(echoPin, HIGH);
}

void setup()
{
  Serial.begin(9600);
  pinMode(3, OUTPUT);
  pinMode(5, OUTPUT);
}


void loop()
{
  distancia = 0.01723 * readUltrasonicDistance(2, 2);
  som_map = map(distancia, 0, 1023, 30, 120);
  tom = (120 - som_map);
  Serial.print(distancia);
  Serial.println("cm");
  if (distancia < 100) {
    tone(3, 440 * pow(2.0, (constrain(int(tom), 35, 127) - 57) / 12.0), 1000);
    if (distancia < 40) {
      digitalWrite(5, HIGH);
      Serial.println("Estacionamento concluido");
    }
  } else {
    digitalWrite(5, LOW);
    noTone(3);
  }
  delay(10); // Delay a little bit to improve simulation performance
}
```

Reflection and evaluation

Collaborative work promotes students' autonomy, responsibility and critical spirit. Programming with Arduino offers several advantages: it is accessible to anyone interested in learning programming or creating electronic projects, can be used in a wide variety of projects, Arduino programming is relatively easy to learn and does not require much programming experience and is compatible with a wide variety of electronic components, which means it's easy to integrate different sensors, modules and other devices electronics in your projects.

The evaluation was made by its presentation, by the project developed on the Tinkercad platform and by the assembled electronic circuit.

The assessment of learning will be carried out through direct observation of the dialogue established with the students, and must include the assessment rubrics.
After the presentation of the works, the different groups will evaluate the work carried out by their colleagues.
-Students carry out their self-assessment and peer assessment using forms (Google Forms).

Students should create a circuit and program it using Tinkercad, explore the Tinkercad application, collaborate with each other and implement dynamics between peers. They will have to solve problems and carry out programmed activities.
Tinkerd – Circuits allows students to simulate online real electronics environments together with programming. Challenges will be proposed, of different degrees of difficulty, so that students through collaborative work, succeed in solving the problem, which will culminate in the operation of the circuit.

In the educational dynamics of the classroom, students were encouraged to share their solutions and reflect on possible optimizations. The project to be developed must comply with the guidelines for creating the circuit, which involve both the schematic and the programming code.
Creativity and innovation are valued and encouraged throughout the learning process.

I highlight a project for programming and robotics citizenship, in the sense of making students aware of noise control at school and the associated advantages both in terms of levels of attention and concentration in the classroom and in other school spaces, as well as in relation to hearing health and respect for others.
Examples were addressed for reflection on the importance of silence: Bar, Canteen, situation of group work, etc. This project has already been implemented and tested within the scope of the Computer and Robotics Club.

In other example, the students were able to see the practical application of the scatterplot that is studied in the disciplines of mathematics and physics, with the creation of a circuit through an online simulator and even worked the results in the spreadsheet. This teaching model offers our students interdisciplinary learning, that is, the approach of several areas simultaneously, which allows students to understand their relationship and how these different areas of learning are present in everyday life.
The assessment is made by visualizing the commitment and insight of the students in the activity of exploring the Tinkercad program and the respective construction of solids, qualitative assessment, and by the result obtained in the Quizz of the Intuitivo platform, quantitative assessment. Students and teachers considered that the use of Tinkercad was an asset for the observation of geometric solids, allowing students to solve their major difficulties in relation to volume and the imagination of solids and objects in 3D.

Counting edges, faces and vertices or even imagining the geometric figure of the faces of the geometric solid, students reveal difficulties especially when they do not visualize the solid.

With the Tinkercad program, students are able to move the work plane, which facilitates the various perspectives of seeing the solid and/or object, an image that most students have immense difficulties in imagining.

In other learning scenario we use the Problem Solving Learning methodology PLB, which promotes active student-centered learning, confronting them with complex real-world problems. Students are led to problematize, reflect and attribute meaning to their learning, as they find the answers to the problems presented to them.

In this sense, this methodology, in addition to favoring essential skills for lifelong learning, stimulates critical thinking, collaboration, creativity and communication. The students of the 11th grade professional robotics course were challenged to research, investigate and reflect on the circuits and application of the arduino and sensors to share this knowledge with the 3rd cycle '7th and 8th grades'.