SciCon Toolkit

Erasmus+ Project Science connect

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Title

SciCon Toolkit

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EDITORIAL NOTE

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Contents

Introduction

The Science Connect project is a didactic innovation project that wants to change students' perspective on the study of science, and implicitly change the way teachers teach these subjects.

Within the project, we developed a new methodology, which includes theoretical aspects, applications for the study of sciences, didactic scenarios and models for evaluating laboratory activities.

Through this Toolkit we want to contribute to the modernization of science teaching/learning/assessment in high school education, through the lens of a much greater and more practical involvement of students in the educational process.

This set of teaching tools presents different pedagogical approaches applicable to the study of STEM and STEAM, which can be used in the educational process, especially with various mobile devices, without avoiding the use of a computer, or with a minimum of equipment, usually materials that can be found in most houses. Our goal was to encourage teachers to integrate virtual laboratories, creating 3D applications, video analysis, visual programming elements and blocks, Arduino, as an alternative to traditional laboratories, often outdated, unattractive and even dangerous for students and teachers. The inclusion of these elements, as well as brief presentations of different types of teaching scenarios, facilitate the design of engaging learning activities. We considered that we must promote student-centered activities in flipped classes, as well as common activities in the peer-to-peer learning system.

We aimed to present some general considerations about adapted STEM and STEAM learning, and how we can use freeware with educational potential innovatively in the learning process.

Our goal is to provide teachers and trainers, in general, with a set of design knowledge and ideas that can develop a new design and evaluation perspective for virtual labs. The materials, software and methods presented are tools to facilitate these practices, used to extend the innovative study of STE(A)M in or out of school, within an education system that can easily move from online to offline, from in the classroom to outside the classroom. In our perspective, what we developed during the CORONAVIRUS1-19 pandemic must be exploited, making the transition between different educational systems a natural activity, within the reach of both teachers and, above all, students. We need them to supplement the resources of schools, to extend the learning process outside the walls of the classroom, to prepare students for active life after graduation.

METHODOLOGY FOR THE LEARNING SCENARIOS

STEM → STEAM → STREAM

STEM (SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS):

4 disciplines integrated into a new educational paradigm

based on real and authentic applications

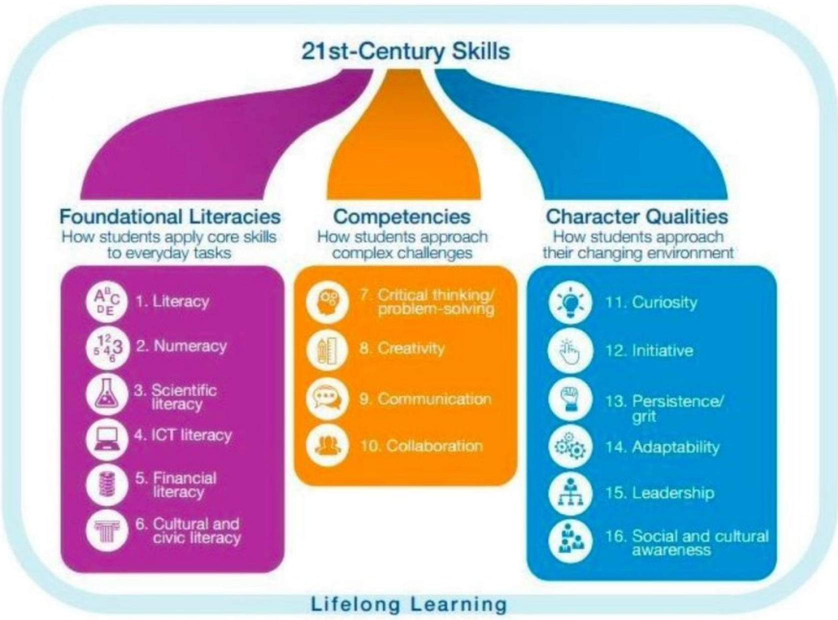
⇩

STEAM:

adding an A for ART it means adopting an interdisciplinary approach

STUDENTS ARE ENCOURAGED TO TAKE A SYSTEMATIC AND EXPERIMENTAL ATTITUDE, AS WELL AS TO USE IMAGINATION AND MAKE NEW CONNECTIONS BETWEEN IDEAS. STUDENTS CAN PLAY WITH THE CONCEPTS OF AESTHETICS AND WITH THE SENSORIAL AND EMOTIONAL COMMITMENT, IN THE CONTEXT OF A CRITICAL REFLECTION, A LOGICAL INVESTIGATION OR A CREATIVE PRODUCTION ON THE WORLD AROUND THEM

A SCIENTIST, A MATHEMATICIAN OR A DESIGNER IS A CREATIVE AND INNOVATIVE THINKER WHO SOLVES PROBLEMS SO INCLUDING THE ARTS IN STEM WOULD HELP STIMULATE CREATIVE THINKING, PROBLEM SOLVING AND INNOVATIVE THINKING



THE TERM «TINKERING» WAS DEVELOPED BY THE EXPLORATORIUM OF SAN FRANCISCO BASED ON MIT EXPERIENCES AND RESEARCH AND IS A NEW EDUCATIONAL METHODOLOGY FOR LEARNING IN STEM WITH A STRONG POTENTIAL FOR THE DEVELOPMENT OF INNOVATION, CREATIVITY AND MOTIVATION. TODAY IT IS CONSIDERED AS A VERY EFFECTIVE WAY OF INVOLVING PEOPLE WITH DIFFERENT LEVELS OF EXPERIENCE AND INTEREST IN EXPLORING CONCEPTS, PRACTICES AND PHENOMENA RELATED TO SCIENCE

STEAM

⇩

STREAM:

«R» is for Reading or literacy, promotes critical thinking and creativity.

By introducing reading as a core element of discovering new knowledge, STREAM provides a well rounded learning experience.

WHAT DIFFERENTIATES THE STUDY OF STEM FROM TRADITIONAL SCIENCE AND MATHEMATICS IS THE DIFFERENT APPROACH.

THE PURPOSE OF THIS APPROACH IS TO SHOW STUDENTS HOW THE SCIENTIFIC METHOD CAN BE APPLIED TO EVERYDAY LIFE.

STEM ALLOW STUDENTS TO LEARN COMPUTATIONAL THINKING BY FOCUSING ON REAL-WORLD APPLICATIONS IN A PROBLEM-SOLVING PERSPECTIVE.

READING IS INCLUDED IN THE DISCIPLINES TO BE PROTECTED, THUS EVOLVING FROM STEM OR STEAM TO STREAM - WITH THE ADDITION OF THE R FOR READING.

THE IDEA IS THAT READING IS STILL AN ELEMENT THAT DEVELOPS A CRITICAL SENSE THAT CONTRIBUTES TO THE SUCCESS OF EACH STUDENT. READING AND WRITING ARE THE FOUNDATIONS OF COMMUNICATION, WHATEVER DISCIPLINE IS TAUGHT.

TEACHER

THE ROLE OF THE TEACHER IS TO MONITOR THE ACTIVITIES AND SUPPORT THE CHILDREN.

THE TEACHER DOES NOT TRANSMIT THE LESSON DIRECTLY THROUGH

A THEORETICAL AND FRONTAL LESSON BUT LEADS THE STUDENTS THROUGH GUIDED EXPERIMENTAL ACTIVITIES

THE TEACHER DOES NOT CORRECT THE ERRORS AND DOES NOT INTERVENE DURING THE COURSE OF THE LABORATORY ACTIVITIES BUT GUIDES THE STUDENTS WITHOUT PROVIDING THE ANSWERS.

STUDENT

• OBSERVE A PHENOMENON AND ASK QUESTIONS

• FORMULATE A HYPOTHESIS AND A POSSIBLE EXPLANATION OF THE PHENOMENON

• DO AN EXPERIMENT TO SEE IF THE HYPOTHESIS IS RIGHT

• ANALYZE THE RESULTS

• REPEAT THE EXPERIMENT ALSO IN DIFFERENT WAYS

• COME TO A CONCLUSION AND FORMULATE A RULE

STRENGTHS

• LACK OF ADEQUATE FACILITIES
• INSTRUMENTATION NOT ALWAYS ACCESSIBLE AND, IF EXISTING OBSOLETE
• SAFETY ISSUES
• THE STUDENT IS PUT IN A DANGEROUS SITUATION
• HIGH MOTIVATION
• POSSIBILITY TO DE-CONTEXTUALIZE TEACHING IN OTHER SPACES OUTSIDE THE SCHOOL

CRITICAL ISSUES

• LACK OF ADEQUATE FACILITIES

• INSTRUMENTATION NOT ALWAYS ACCESSIBLE AND, IF EXISTING OBSOLETE

• SAFETY ISSUES

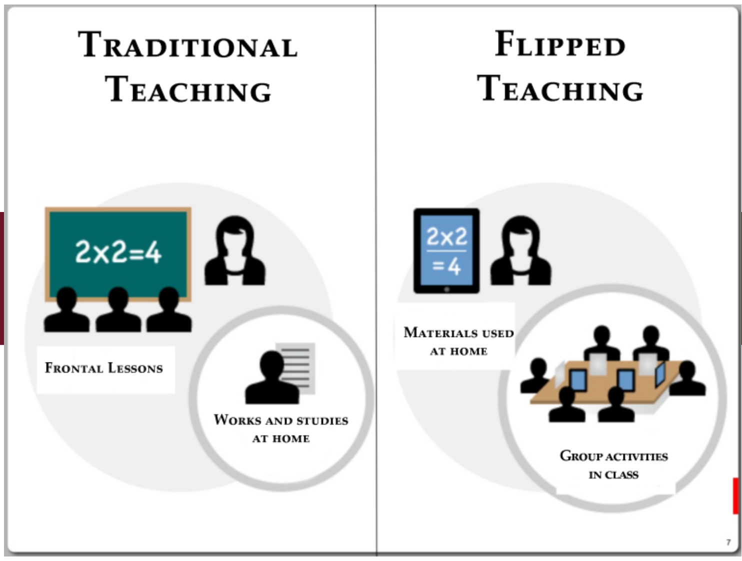
FLIPPED CLASSROOM

Flipped Classroom

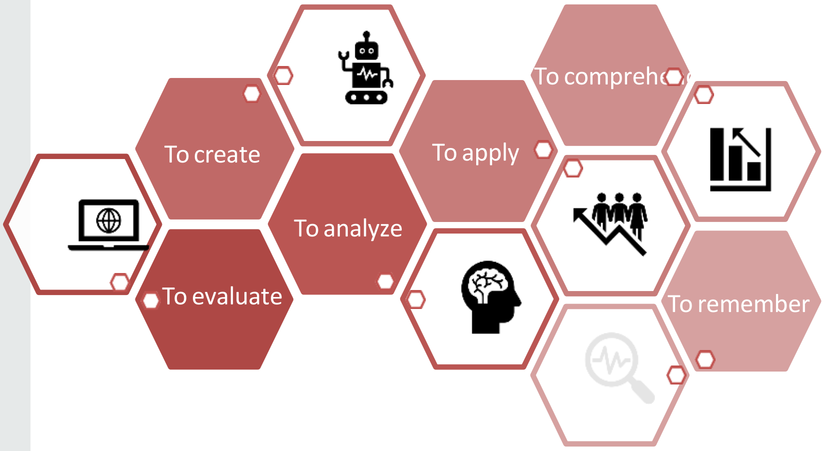
A new educational approach

At home, the students check the didactic resources created by the teacher (papers, videos, images, audio). This allows students to learn some notions about the new topics even before they get to class.

In class, the teacher does not explain in a frontal way but organizes activities in pairs or groups to reinforce, clarify or actively apply what has been learned at home.



INTERDISCIPLINARY SKILLS



BENEFITS

Teacher

- He can provide more support in the classroom;
- He can spend time in class for practical activities in groups.

Students

- They can have more control over the learning process.

Traditional Flipped Classroom

Teacher

- He prepares the materials for use at home;
- He has the students carry out homework and activities related to the knowledge acquired at home;
- He coordinates debates, avoids doubts and encourages the

Students

- At home, they check didactic resources and study it;
- In the classroom, they do their homework together with their classmates, under the supervision of the teacher.

Inquiry Flipped Classroom

Teacher

- He prepares the materials for use at home: such as a video with a peculiar phenomenon;
- He facilitates discussion, provides feedback, clarifies concepts.

Students

- They debate about the issues under the guidance and moderation of the teacher to explain the phenomena.

Student-created contents

Teacher

- He prepares the materials for use at home;
- He divides the students into groups in class;
- He facilitates the work, provides food for thought, resolves impasse situations;
- He can use the materials used for other flipped sessions

Students

- They can create didactic contents, such as videos, posters, podcasts, according to the teacher's instructions.

TEAL

TEAL

Technology-Enhanced Active Learning

BENEFITS

- to combine frontal lesson, simulations and laboratory activities with technologies;
- to design spaces with specific characteristics, modular furnishings that can be reconfigured as needed;
- to create interconnection between different technologies and instruments;
- to stimulate peer review, networked research, debate on issues, and their re-elaboration through a shared networked synthesis.

Teachers

- Encourages
  - Hands-on experimentation in small groups (3 or 5 students)
  - Discussion;
  - Problem solving, active research, collaborative (workflow) and peer-to-peer learning
- Proposes
  - Exercises aimed at developing one or more products to be shared with the classroom group (videos, podcasts, posters, ppt).
- Evaluate
  - With a scheduled explicit program at the beginning of the activity

Students

Are facilitated

- To emancipate from passive reception of notions;
- To develop communication skills in a collaborative context;
- To strengthen new research models;
- To co-construct a peer learning process;
- To deepen expressive and critical skills;

Are supported

- By the teacher's intervention and assessment

CLASSROOM SETTING

THE CLASSROOM IS ARCHITECTURALLY ARRANGED ON THE BASIS OF:

- HOW IT IS INTENDED TO ENABLE STUDENTS

TO INTERACT WITH EACH OTHER AND WITH THE TEACHER;

- WHICH PEDAGOGICAL MODEL IS TO BE FOLLOWED;

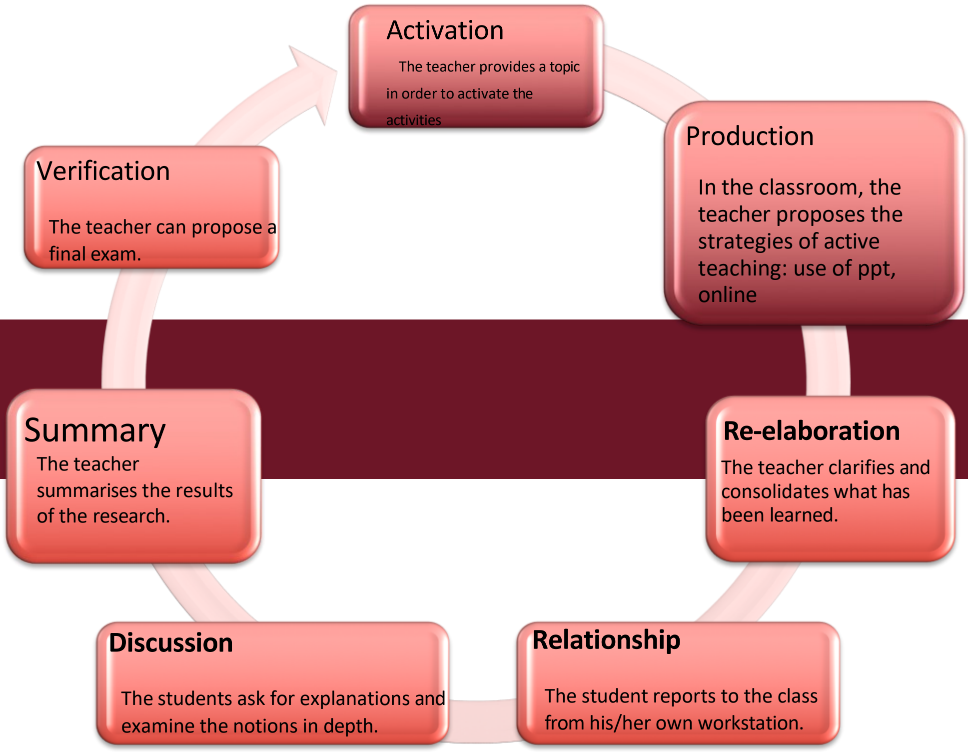
-THE STUDENTS WORK IN GROUPS OF 3 OR 5 PERSONS;

-THE ODD NUMBER OF STUDENTS IN EACH GROUP FACILITATES THE DEVELOPMENT OF AN AGREEMENTBETWEEN THE PARTIES INVOLVED;

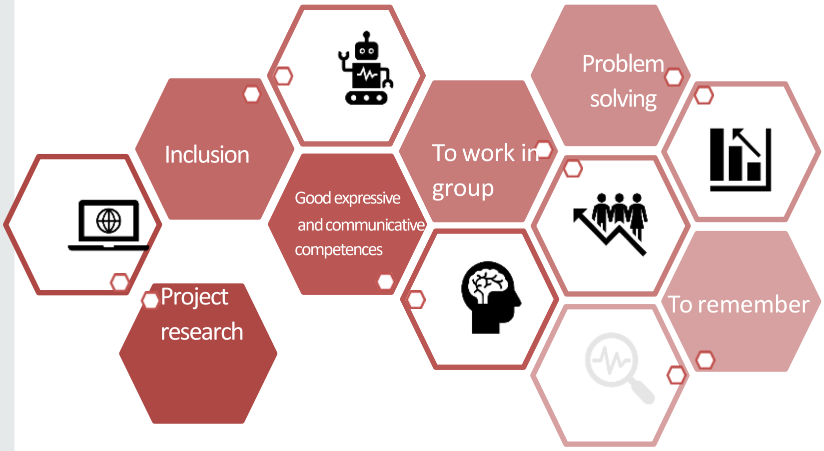
-THE TEACHER HAS A CENTRAL POSITION, BUT HE MOVES FREELY

- TO MONITOR THE INTERNAL DYNAMICS OF THE GROUPS AND RESPOND TO PROBLEMS AND REACT.

Steps of the educational method



INTERDISCIPLINARY SKILLS



IBL: INQUIRY BASED LEARNING

IT IS LEARNING BASED ON INQUIRY, THE METHOD OF EVERY SCIENTIFIC RESEARCHER!

STUDENTS CAN INVESTIGATE DIFFERENT PROBLEMS, DEPENDING ON WHETHER THESE PROBLE
TOTALLY OR PARTIALLY UNKNOWN OR KNOWN TO THEM..

CONFIRMED INQUIRY	**THE SUBJECT OF THE INVESTIGATION HAS ALREADY BEEN EXPLORED IN ALL ITS FEATURES**
STRUCTURED INQUIRY	**INVESTIGATION OF A PROBLEM PARTIALLY KNOWN BY STUDENTS, THE TEACHER SUGGESTS A PROCEDURE TO ARRIVE AT THE CORRECT CONCLUSIONS**

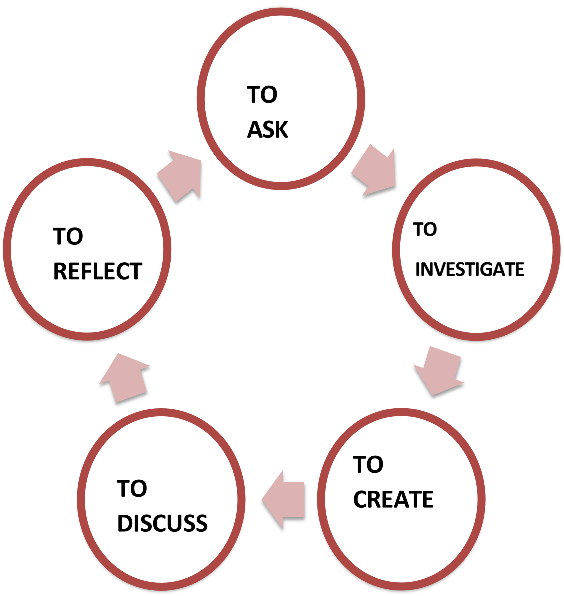
OPENED INQUIRY

STUDENTS CHOOSE BOTH THE PROBLEM AND THE METHOD OF INVESTIGATION

GUIDED INQUIRY

SURVEY ON A COMPLETELY NEW PROBLEM FOR STUDENTS, THE TEACHER DOES NOT SUGGEST THE PROCEDURE BUT PERFORMS THE ROLE OF

IBL



A MODEL THAT COMES INTO THE IBL AND IS APPLICABLE TO FLIPPED CLASSROOM IS THE LEARNING CYCLE OF 5E.

THE 5E SHARE THE PHASES IN WHICH THE SURVEY IS DEVELOPED.

IBSE: INQUIRY BASED SCIENCE LEARNING

The European Commission has also promoted the teaching methodology based on inquiry for teaching and learning science.

This is IBSE: Inquiry Based Science Learning.

By following this teaching methodology, students behave like researchers:

they make conjectures, verify them, learn from their mistakes and build a solid foundation of knowledge.

They are teaching methods that require more time than the classic ones of the frontal lesson but which have clearly superior results on the education and training of our students.

IBSE: INQUIRY BASED SCIENCE LEARNING

A MODEL THAT COMES INTO THE IBL AND IS APPLICABLE TO FLIPPED CLASSROOM IS THE LEARNING CYCLE OF 5E.

THE 5E SHARE THE PHASES IN WHICH THE SURVEY IS DEVELOPED:

The "engage" phase

IT IS THE FIRST PHASE, IT TAKES PLACE IN THE CLASSROOM AND THE TEACHER STIMULATES THE STUDENTS.

HOW DOES...? INTRODUCE THEM TO THE TOPIC THEY WILL WORK ON, TRYING TO INTRIGUE THEM AND REVIVE PREVIOUS KNOWLEDGE RELATED TO THE TOPIC. STUDENTS ARE EXPECTED TO ASK QUESTIONS AND THEIR OPINIONS EMERGE ABOUT THE TOPICS THEY ARE ABOUT TO DISCUSS.

The "explore" phase	IT IS THE SECOND PHASE, NAMELY THAT OF EXPLORATION: IT CAN BE CARRIED OUT IN THE CLASSROOM, IN THE LABORATORY, OUTDOORS, INDIVIDUALLY OR IN GROUPS. STUDENTS EXPLORE THE SUBJECT OF THEIR WORK WITH EXPERIENCES THAT ARE AS CONCRETE AS POSSIBLE, COLLECT DATA, NOTE THEIR OBSERVATIONS. THE TEACHER ACTS AS SUPERVISOR AND INTERVENES ONLY IN EMERGENCIES.
The "explain" phase	IT IS THE THIRD PHASE THAT USUALLY TAKES PLACE AT HOME. IT IS THE MOMENT OF THE FIRST INVERSION OF THE FLIPPED CLASSROOM, THAT IS THE ONE IN WHICH THE STUDENT INVESTIGATES THE TOPIC HE HAS EXPLORED IN THE CLASSROOM. STUDENTS AT HOME, IN GROUPS OR INDIVIDUALLY RE-ELABORATE THE DATA COLLECTED DURING THE EXPLORE PHASE. HOW DO THEY DO IT? THE TEACHER CAN PROVIDE THEM WITH GUIDELINES GIVING PARTICULAR SITES TO VISIT THAT SHOULD GUIDE THEIR RESEARCH.
The "processed" phase	IT IS THE FOURTH PHASE: IT TAKES PLACE IN THE CLASSROOM, OR IN THE LABORATORY, INDIVIDUALLY OR IN GROUPS, DEPENDING ON HOW THE "EXPLORE" PHASE WAS TACKLED. HERE THE STUDENTS DISCUSS WHAT THEY HAVE EXPLORED AT HOME, RE-ELABORATE THEIR KNOWLEDGE, DEEPEN THE SUBJECT WITH THE INFORMATION GATHERED BY THEIR CLASSMATES, PRODUCE A PAPER TO PRESENT THEIR CONCLUSIONS AND THEIR FINDINGS TO THE TEACHER AND THE CLASS.

IS THE FIFTH AND FINAL PHASE.

EVALUATION IS DONE IN THE CLASSROOM AND CAN BE A SELF-ASSESSMENT BY THE STUDENTS OR A DISCUSSION WITH

The ”evaluate" phase

SITUATED LEARNING EPISODES

The unit with SITUATED LEARNING EPISODES is divided into 3 phases:

PREPARATORY, OPERATIVE AND RESTRUCTURING, implementing the reversal of the traditional frontal lesson.

In each phase, both the teacher's actions and those of the students are identified, bringing them back to a specific didactic logic.

The SITUATED LEARNING EPISODES, based on a careful design by the teacher (Lesson Plan), offers students experiences of situated and meaningful learning, which lead to the creation of digital artefacts, favoring a personal appropriation of the contents.

SLE

TEACHER: TUTOR, DIRECTOR AND FACILITATOR TOWARDS STUDENTS; DESIGNER, PLANNER

STUDENT: ACTIVE LEARNING DURING THE SL PHASES; COMMITTED IN THE CONSTRUCTION OF ITS OWN KNOWLEDGE BOTH IN THE INDIVIDUAL (PREPARATORY) AND COOPERATIVE (OPERATIVE) PHASE; LIVES CREATIVE MOMENTS OF DIGITAL CREATION

SLE

- DYNAMIC AND FLEXIBLE CLASSROOM WITH SET-UP OF SMALL GROUPS
- PRESENCE OF PERSONAL DEVICES
- COOPERATIVE LEARNING

DIGITAL STORYTELLING

DIGITAL STORYTELLING

TEACHERS AND STUDENTS CAN TRANSMIT OR EXEMPLIFY CONTENT THROUGH NARRATIVES AND METAPHORS COMBINIG A WEB BASED TECHNOLOGY WITH STILL OR MOVING IMAGES, A VOICE OVER (RECORDED OR WRITTEN), A SOUNDTRACK (SOUNDS / MUSIC) AND WITH NARRATOLOGICAL ELEMENTS DESIGNED FOR PUBLIC ENJOYMENT

DIGITAL STORYTELLING

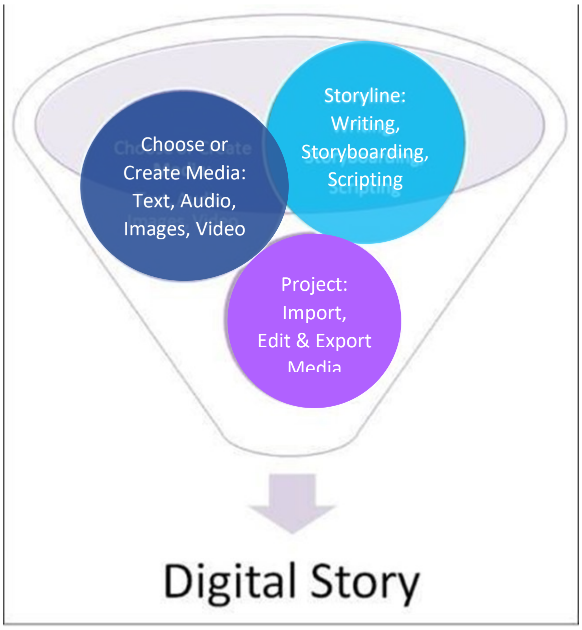
RESPECT THE CONSTRUCTION OF A VISUAL NARRATIVE FOLLOWING THE RULES OF A GOOD STORY FOR THE CONTENT RETURNS AN EFFECTIVE COMMUNICATION

BENEFITS

- THE HIGHLY GRATIFYING CHARACTER OF A NARRATIVE APPROACH;
- IT OFFERS A SIMPLER ACCESS TO ABSTRACT AND COMPLEX CONCEPTS, WHICH MADE EXTENSIVE USE OF MYTHS (STORIES) IN HIS DIALOGUES, HE KNEW WELL;
- OWN CAPACITY OF THE NARRATIVE MECHANISM, SUPPORTED BY MULTIMEDIA ELEMENTS, TO GENERATE HERMENEUTIC -INTERPRETATIVE PROCESS AND SIGNIFICANT CONCEPTUAL CORRELATIONS;
- MEMORIZING THE STORY ON A COGNITIVE LEVEL
- THE HIGHLY GRATIFYING CHARACTER OF A NARRATIVE APPROACH;
- IT OFFERS A SIMPLER ACCESS TO ABSTRACT AND COMPLEX CONCEPTS, WHICH MADE EXTENSIVE USE OF MYTHS (STORIES) IN HIS DIALOGUES, HE KNEW WELL;
- DEGREE OF INVOLVEMENT AND THE CONSEQUENT STRENGTHENING OF THE MOTIVATIONAL VARIABLES AND THE COMMITMENT THAT THE NARRATION OFFERS;
- ABILITY TO CONVEY MEANINGFUL AND IMPACTFUL MESSAGES, STRUCTURED ACCORDING TO A LOGIC OF CAUSE AND EFFECT;
- A STORY GENERATES OTHER STORIES, ACCORDING TO THE MECHANISM OF INTER-TEXTUALITY, FAVORING THE COLLABORATIVE EXCHANGE OF KNOWLEDGE, DIALOGIC CONFRONTATION, THE CRITICAL SPIRIT AND THE SEARCH FOR NEW INTERPRETATIONS AND POINTS OF VIEW ON A PROBLEM AND / OR THEME;
- ABILITY OF THE NARRATIVE APPROACH TO FOSTER NETWORKED KNOWLEDGE (CONNECTIVE KNOWLEDGE) AND COMBINATORIAL CREATIVITY (COMBINATORIAL CREATIVITY)

DIGITAL STORYTELLING

THE IMAGE BELOW ILLUSTRATES WHAT ARE THE ELEMENTS THAT FORM A "DIGITAL HISTORY" AND MAKE IT A "GOOD STORY", AND IS USEFUL FOR A GENERAL UNDERSTANDING OF THE CHARACTERISTICS OF THE STORYTELLING



EVALUATION PROCESS

EVALUATION PROCESS

THE EVALUATION PROCESS IS IMPORTANT IN TRAINING ACTIVITIES TO EVALUATE THE EFFECTIVENESS OF THE COURSE AND THE LEARNING IMPROVEMENT OF STUDENTS

IN SCICON PROJECT, WE PROPOSE TO USE A PRE TEST BEFORE THE TRAINING ACTIVITITIES WITH STUDENTS AND THE POST ACTIVITY AFTER THE COURSE.

USUALLY, WE HAVE TO DESIGN TWO EVALUTATIVE TESTS TO USE IN DIFFERENT TIME DURING THE TRAINING ACTIVITIES

SUGGESTIONS DURING THE EVALUATION ACTIVITY

DO	DON'T
EXPLAINING THE PROJECT BRIEFLY	SUGGESTING ANSWERS OR INFLUENCING THE CHOICE
READING PRIVACY INFORMATION	INTRODUCING THE QUESTIONNAIRE AS A COMPETENCE TEST (IT COULD INDUCE PERFORMANCE ANXIETY, COPY TEC.)
MOTIVATING STUDENTS TO COMPETE ALL FIELDS OF THE QUESTIONNAIRE SINCERELY	READING ANSWERS OF STUDENTS ALOUD VIOLATING STUDENT ANONIMITY
SUPPORTING STUDENTS TO UNDERSTAND QUESTIONS, ALSO REFORMULATIONG THEM OR USING SIMPLER AND MORE UNDERSTABLE TERMS	
ALLOWING SUFFICIENT TIME FOR COMPILATION	

EVALUATION TOOLS: QUESTIONNAIRE

EVALUATION TOOLS: QUESTIONNAIRE

THE EVALUATION QUESTIONNAIRE IS STRUCTURED IN 4 AREAS:

1. QUESTIONS ABOUT THE TOPICS/THEMES OF THE COURSE (EACH TEACHER WORKS ABOUT SPEFICIC TESTS FOR STUDENTS)
2. QUESTIONS ABOUT DIGITAL TOOLS USED DURING THE PROJECT
3. QUESTIONS ABOUT SOCIOEMOTIONAL COMPETENCES
4. QUESTIONS ABOUT SOFT SKILLS INVOLVED IN THE TRAINING ACTIVITY: DURING EACH TRAINING ACTIVITY

WORKING GROUPS

FOR PROJECTS DEVELOPED IN GROUPS, EACH PARTNER PARTICIPATES TO BRAINSTORMING ACTIVITY INTO THE GROUP TO PROPOSE SOME TEST EVALUATION, CONNECTED TO SOFT SKILLS INCLUDED IN THE PEDAGOGICAL PATHS.

FORM OF DIDACTICAL PATH

LESSON TOPIC

SUBJECT NAME

DIDACTICAL OBJECTIVES (defining the didactical objectives)

EXPECTED RESULTS (defining the soft and socioemotional skills connected to the path)

TIMING AND DEADLINE

METHODOLOGIES (Describing methodologies and activities to do during the course throught them to teach the lesson topic and the time required)

THEORETICAL BADE PRINCIPLES OF FLIPPED CLASSROOM AND INQUIRED BASED SCIENCE EDUCATION

Flipped classroom

1. Choose the theme;
2. Search for and select the classroom teaching material (video and text);
   Alternatively, the teacher can make video lessons on the topics to be covered;
3. To divide the material into a number of teaching units (sub-topics) as many meetings as planned;
4. Upload the material to the site or to a shared Google Drive folder;
5. Launch the theme in the classroom by viewing an introductory video;
6. In class verify the understanding of /argument/s (through brainstorming, quiz, shared map building etc.);
7. Subdivide the class into pairs or small groups to each of which the teacher will assign an authentic task or a practical/creative activity;
8. Simultaneously with the assignment of the task delivery of a checklist of self-evaluation that will guide from the beginning the boys in the performance of the assigned activity;
9. Teacher evaluation and self-evaluation by children.

WHAT THE TEACHER DOES

• The teacher is a simple facilitator
• Promotes a climate of listening, trust and empathy
• Select and/or prepare useful teaching materials
• Shares material and experiences with other teachers

WHAT THE STUDENT DOES

• He is the heart of its learning process
• He sets objectives in agreement with the teacher
• He develops sense of responsibility
• He learns to work in a group
• He learns to evaluate yourself

CLASSROOM SETTING

• BYOD (bring your own device)
• Island counters for group work
• The teacher joins the benches to support the children and does not place behind the chair

Inquiry-Based Science Education

IBSE, is the acronym of Inquiry-Based Science Education, or scientific education based on investigation. The IBSE is not a single pedagogical method, but rather an approach to the teaching and learning of Sciences.

The method consists of several phases (National Research Council, 2000):

1. Being involved by scientifically significant (investigable) questions;
2. Collects experimental evidence (direct and/or indirect) to answer questions;
3. Developing and explaining evidence;
4. Assessing explanations on the basis of known scientific theories and by comparing peers;
5. Communicating and arguing explanations.

WHAT THE TEACHER DOES:

1. Guides students in building their own learning by organizing activities that stimulate interest and curiosity;
2. Makes the class to work in small groups;
3. Observes and listen to students as they interact;
4. Asks questions to redirect student investigations when necessary;
5. Encourages students to explain;
6. Use students' previous experiences as a starting point to explain new concepts.

WHAT THE STUDENT DOES

1. Learns to ask scientifically significant questions;
2. Conduct experiments on the given topic;
3. Develops possible explanations based on the evidence collected;
4. Evaluates the explanations gathered also in the light of alternatives (by comparison of peers or known scientific knowledge);
5. Submits and argues the explanations.

CLASSROOM SETTING

- Science laboratory or place for conducting experiments;
- Desks arranged to work in small groups;
- The teacher wanders between the desks.

APPRAISAL QUESTIONS AFTER STEM EXPERIMENTATION

This evaluation tool should be given to all students at the end of the STEM trial and consists of two areas: the first concerns the assessment of learning, The second concerns the degree of student satisfaction with the experience. Questionnaires will be filled in anonymously

Following the STEM training experience, what do you think you have improved or learned? /as a result of the formative experience on stem how much you agree with these statements

	At all	Little	Enough	Much
I have better understood some concepts or theories in the scientific field				
I've learned to do experiment				
I learned to take videos				
I learned some basic software features				
I have developed more interest and curiosity in scientific subjects				
I discovered a passion for science				
I can relate better to the teacher				
I have improved my expressive ability in front of my classmates				
I do more teamwork during group work				
I confront and discuss willingly with my companions				

	At all	Little	Enough	Much
I can connect the theoretical notions learned in class with the surrounding reality				
I can make more sense of real phenomena by providing a scientific explanation				

CUSTOMER SATISFACTION ON STEM EXPERIMENTATION

The presentation of the STEM trial path was:

- extremely effective
- very effective
- little effective
- not at all effective

The sequence of subjects covered was:

- consistent
- inconsistent

The time devoted to each topic was:

- consistent
- inconsistent

How do you evaluate the total duration of the journey in relation to the topics covered:

- insufficient
- sufficient

The content of the route met his expectations:

- for nothing
- little
- enough
- very

What is your overall assessment of the classrooms in which the lessons of this course took place: (acoustics, visibility, logistics, etc.):

- extremely suitable
- very suitable
- poorly suited
- unsuitable

You think that the presence of the teachers (or tutor of the classroom) was:

- extremely helpful
- very helpful
- little useful
- not at all useful

You are satisfied with the work done by the teachers (class tutor):
☐ yes
☐ no
if no, becouse:____
____

How it assesses the quality of the teaching material used during the course:

☐ extremely satisfactory
☐ very satisfactory
☐ not satisfactory
☐ not at all satisfactory

He used the course platform:
☐ yes
☐ no
if no, because (section III):____
____

What is your opinion on the platform realized for this course:

☐ extremely satisfactory
☐ very satisfactory
☐ not satisfactory
☐ not at all satisfactory

What is your opinion on the accessibility of the interface of the platform dedicated to this course:
☐ excellent
☐ good
☐ sufficient
☐ insufficient

You found the arguments presented in this path:

☐ extremely interesting
☐ very interesting
☐ not interesting
☐ not interesting at all

The path has given rise to new educational needs:

☐ no
☐ yes

If yes, what? ____
____

Your overall assessment of the course is (organization, teaching, satisfaction of training needs, etc.)

(from 0 to 4)**:**

0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

1. **Suggestions and indications that you intend to formulate for the organization of other courses (max 2 answers):**

2. changes to route schedules ☐
   greater differentiation of the topics addressed ☐
   more in-depth analysis of the issues addressed ☐
   more space for drills ☐
   other (please specify) ____

____

SOCIOANAGRAPHIC INFORMATIONS

AGE:…………………………

SEX

☐ MALE

☐ FEMALE

☐ I DON'T WANT TO SPECIFY

KIND OF SCHOOL:

☐ primary school
☐ secondary school of first grade
☐ secondary school, high school
☐ secondary school, technical college

School's name:……………………..

Classroom: ……………………………….

Partner: ……………………………….

Learning Scenarios

Learning scenarios are made on Learning Design platform, https://www.ucl.ac.uk/learning-designer/.

We selected Learning Designer due to its versatile character, adaptability to learning scenarios that are not limited to a learning unit or classroom/laboratory. The application of these scenarios combines the student's individual work with group work or with the whole class, preparing the student for a post-school study in the real world. Corroborating the automatically provided statistics with the results of some student satisfaction questionnaires, relatively quick calibrations of the planned activity can be made.

Teachers have the opportunity to transfer their learning scenarios from one topic to another, with the necessary changes, taking what is useful (saves design time).

The scenarios, once made public, can be subjected to expert analysis, to be cleaned.

The teacher can build his own portfolio, which also represents a resource of online links for different educational stages.

The main argument for using these scenarios is the possibility of applying them in different contexts, respecting the suggestions offered in the theoretical benchmarks of STEM and STEAM learning.

From all the learning scenarios, we have included in this Toolkit only the most representative ones, in the opinion of the partners, from the point of view of the topic addressed.

Learning Design for: Projectile motion

Context

Topic: Kinematics, Dynamics

Total learning time:

Designed learning time: 3 hours and 30 minutes

Size of class: 10

Description: The learning activity is proposed as a complex activity. It is designed for a group of students, to use modern methods, other than those that are traditionally used in classrooms or school physics laboratories.
Students will perform a comparison between a video analysis of a practical model and an interactive simulation of a projectile motion. They will learn how to use a video-based analysis of movement using Tracker, for their video recording.

Mode of delivery: Blended

Aims

Students will discover movement laws for a projectile motion, based on their own practical, digital model, and theoretical studies.

Outcomes

Find out/discover (Knowledge): The motion laws

Identify causes of (Comprehension): Changing the movement state

Investigate (Application): Try to find solution for practical activities

Reflect (Evaluation): Have you discover something useful for your activity outside the school?

Teaching-Learning activities

Introduction to Tracker

Read Watch Listen *5 minutes* *25 Students* *Teacher present* *Online*

Students will watch the video attached for a short introduction to Tracker, a free video-based analysis and modelling tool. that can help them to investigate physical laws

Linked resources

Introduction to Tracker

Discuss *10 minutes* *10 Students* *Teacher not present* *Online*

Students will discuss the possibilities offered by Tracker and identify the advantages and limitations of using this software in class and outside of class, for the study of physical phenomena

Practice	*30 minutes*	*1 Student*	*Teacher present*	*Face to face (not online)*

After installing Tracker on their own laptops, from the link provided by the teacher, students will practice understanding specific tools of the software, based on videos attached.

Linked resources

- [Installing Tracker]
- [Tracker Quick Start]
- [Getting Started with Tracker]

Produce	*25 minutes*	*2 Students*	*Teacher present*	*Face to face (not online)*

In pairs, students will perform a video-based analysis of one of the movements found on the link given by the teacher.

Linked resources

- [Sample mecanics videos]

Create a practical model

Investigate	*20 minutes*	*Students*	*Teacher present*	*Face to face (not online)*

At home or in class, students search for models on the internet. They will start with the link given by their teachers

Linked resources

- https://www.youtube.com/watch?v=WpLFC_SOpXs

Collaborate	*10 minutes*	*3 Students*	*Teacher present*	*Face to face (not online)*

In groups, students will decide on the model they will use. They will make a list of suppliers needed and design their model.

Practice	*20 minutes*	*3 Students*	*Teacher present*	*Online*

Using their suppliers, in groups, they will try to make the best model for a catapult.
One student's team will record the process and the catapult in motion.
The projectile motion will be recorded several times, from different angles and with different projectiles

Produce	*20 minutes*	*3 Students*	*Teacher not present*	*Face to face (not online)*

In groups, students will try to find the best record for their movement.
The video will be cut off for the length they will decide to study

Analyse

Collaborate	*20 minutes*	*3 Students*	*Teacher not present*	*Face to face (not online)*

In groups, students will upload the created movie and will establish the parameter to be used

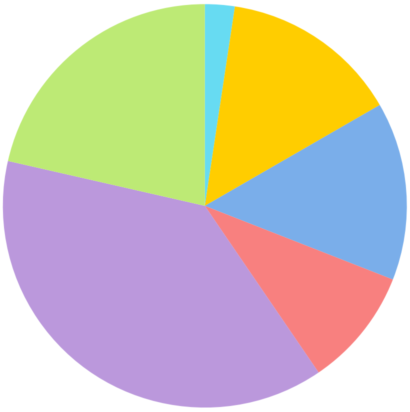
Practice	*30 minutes*	*3 Students*	*Teacher not present*	*Face to face (not online)*

In groups, students will start studying the trajectory using calibration tool, coordinates and tracks. They will study the plots for different coordinates.

Discuss	*20 minutes*	*3 Students*	*Teacher not present*	*Face to face (not online)*

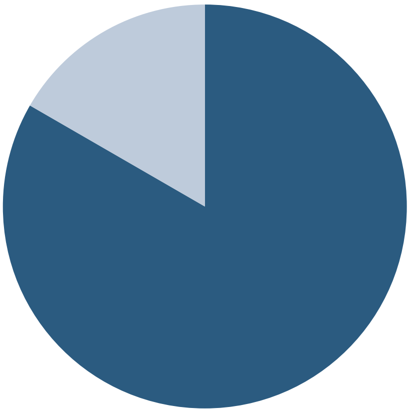
Using the records of their tracks and different plots, they will search for answers to the question "Why the x(t) is not the same as the y(t)?"
The second question y(x) seems to what".

Representations of the learning experience

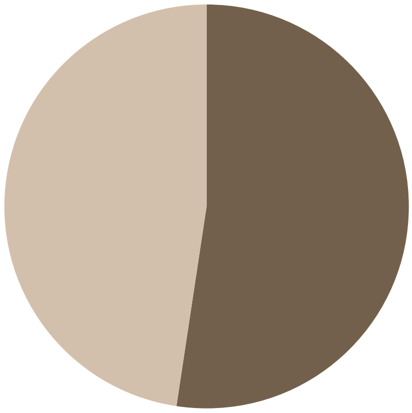


Learning through	minutes	%
Acquisition (Read, Watch, Listen)	5	2
Investigation	20	10
Discussion	30	14
Practice	80	38
Collaboration	30	14
Production	45	21

	minutes	%
Whole class	10	5
Group	145	78
Individual	30	16



	minutes	%
Face to face (not online)	175	83
Online	35	17



	minutes	%
Teacher present	110	52
Teacher not present	100	48

Learning Design for: Introduction to Scratch

Context

Topic: Block programming

Total learning time: 3 hours

Designed learning time: 2 hours and 56 minutes

Size of class: 30

Description: This is an activity for a first time approach to code.

Mode of delivery: Mixt

Aims

To get acquainted with a tool that allows to program with blocks
Learning how to work with the tool by debugging simple projects
Be able to do a small project

Outcomes

Knowledge: To learn how to do simple coding projects

Application: To do his own project

Comprehension: To understand, in a simple way what's computational thinking

Teaching-Learning activities

Introduction

Read Watch Listen	*6 minutes*	*2 Students*	*Teacher not present*	*Face to face (not online)*

Students see the video explaining the importance of coding
https://www.youtube.com/watch?v=nKIu9yen5nc

Linked resources

Why learn to program?

Practice	*30 minutes*	*2 Students*	*Teacher present*	*Face to face (not online)*

In pairs, students do the exercises of Hour of Code
http://learn.code.org/hoc/1
http://learn.code.org/s/1/level/47
http://learn.code.org/s/1/level/24
http://studio.code.org/s/frozen/stage/1/puzzle/1
The last one is special for girls

Linked resources

[Hour of Code]

Debugging

Read Watch Listen	*5 minutes*	*30 Students*	*Teacher present*	*Face to face (not online)*

Teacher explains what kind of program is Scratch and the philosophy behind it: free, projects sharing and remixing.
Students go to scratch online and create their one accounts.

Investigate	*30 minutes*	*2 Students*	*Teacher present*	*Face to face (not online)*

Students go to scratch online and create their one accounts.
They open the studio
http://scratch.mit.edu/studios/237914/
and begin to debug the projects in the studio.

Linked resources

[Debug activities]

Discuss	*15 minutes*	*30 Students*	*Teacher present*	*Face to face (not online)*

After the debugging activity, each group shares their results. As sometimes there can be more than a way to debug there can be a discussion about the best way to debug

Read Watch Listen		*Students*	*Teacher present*	*Face to face (not online)*

Create

Read Watch Listen	*5 minutes*	*30 Students*	*Teacher present*	*Face to face (not online)*

At this phase, students must be already able to create their own project.
The teacher gives the students a project: for instance, create a Christmas card

Teacher gives some orientations on the features the card must have: It must be dynamic, with more than a stage and more than an actor, greeting phrases and sound.

Produce	*30 minutes*	*2 Students*	*Teacher present*	*Face to face (not online)*

Students create their cards in pairs

Share and discuss

Read Watch Listen	*15 minutes*	*2 Students*	*Teacher present*	*Face to face (not online)*

Students follow each other's in Scratch platform and can see what each group has done

Collaborate	*20 minutes*	*2 Students*	*Teacher present*	*Face to face (not online)*

Each group can remix what the other groups have made in order to improve.

Discuss	*20 minutes*	*30 Students*	*Teacher present*	*Face to face (not online)*

After the remix activity, the teacher shows the class the results. Those groups that remixed the other's card explain way they did it.

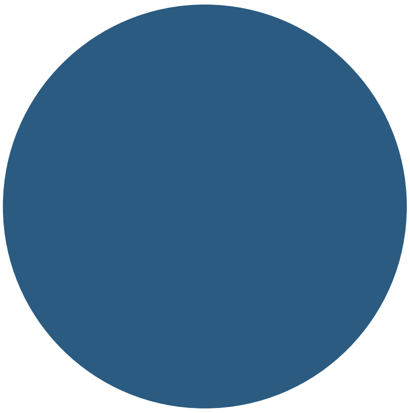
Notes

Some of my students' unfinished projects
http://scratch.mit.edu/studios/266360/

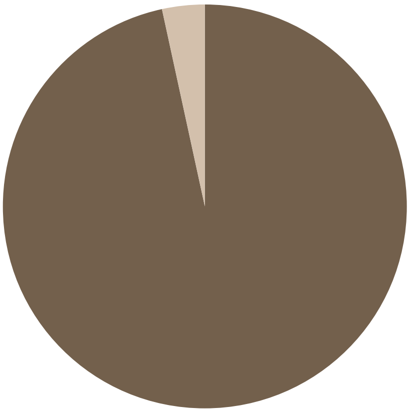
Representations of the learning experience

Learning through	minutes	%
Acquisition (Read, Watch, Listen)	31	18
Investigation	30	17
Discussion	35	20
Practice	30	17
Collaboration	20	11
Production	30	17

	minutes	%
Whole class	45	26
Group	131	74
Individual	0	0



	minutes	%
Face to face (not online)	176	100
Online	0	0



	minutes	%
Teacher present	170	97
Teacher not present	6	3

Learning Design for: Introduction to Algodoo

Context

Topic: Block programming

Total learning time: 3 hours

Designed learning time: 3 hours and 27 minutes

Size of class: 30

Description: This is an activity for a first-time approach Algodoo for virtual labs.

Mode of delivery: Blended

Aims

To get acquainted with a software that allows to create interactive 2D models Learning how to work with the software to create, modify and exploit a 2d model for a real device

Outcomes

Knowledge: To learn how to do simple 2D models and create a model for a simple mechanism

Application: To do their own project

Comprehension: To understand, in a simple way what's 2D models and their study

Teaching-Learning activities

Introduction

Read Watch Listen	*6 minutes*	*2 Students*	*Teacher not present*	*Face to face (not online)*

Students see the video explaining what Algodoo is and what for can be used it
https://www.youtube.com/watch?v=rK4JMlkRXOc

Linked resources

Why learn Algodoo?

Discuss	*1 minute*	*4 Students*	*Teacher not present*	*Online*

After watching the video, students will discuss how Algodoo can be used. They will make a list of their proposals that will be sent to the whole class

Practice	*30 minutes*	*2 Students*	*Teacher present*	*Face to face (not online)*

In pairs, and using the video tutorial attached, students will practice knowing the tools that Algodoo work with

Linked resources

[Basics Algodoo]

Debugging

Read Watch Listen	*5 minutes*	*20 Students*	*Teacher present*	*Face to face (not online)*

The teacher explains what kind of program is Algodoo and the philosophy behind it: free, projects sharing and remixing.
They go to http://www.algodoo.com/ and create their one account.

Investigate	*30 minutes*	*30 Students*	*Teacher present*	*Face to face (not online)*

Students go to http://www.algodoo.com/download/ , download the software and install it on their devices
They open the software and try to see how it works
http://scratch.mit.edu/studios/237914/
and begin to debug the projects in the studio.

Linked resources

[Examples]

Discuss	*15 minutes*	*30 Students*	*Teacher present*	*Face to face (not online)*

After the debugging activity, each group shares their results. As sometimes there can be more than a way to debug there can be a discussion about the best way to debug

Practice	*30 minutes*	*2 Students*	*Teacher present*	*Face to face (not online)*

Using the examples, students will create a simple interactive model in action

Create

Read Watch Listen	*5 minutes*	*30 Students*	*Teacher present*	*Face to face (not online)*

At this stage, students should already be able to create their own project.
The teacher gives the students a project: for example, create a catapult

The teacher gives some guidelines on the characteristics of the model: It must be dynamic, made of different materials, using springs and levers.

Produce	*30 minutes*	*2 Students*	*Teacher present*	*Face to face (not online)*

Students create their catapult in pairs

Share and discuss

Read Watch Listen	*15 minutes*	*2 Students*	*Teacher present*	*Face to face (not online)*

Students they share the created models and compare them as simplicity and performance

Collaborate	*20 minutes*	*2 Students*	*Teacher not present*	*Face to face (not online)*

Each group can remix what the other groups have made in order to improve.

Discuss	*20 minutes*	*30 Students*	*Teacher present*	*Face to face (not online)*

After the remix activity, the teacher shows the class the results.

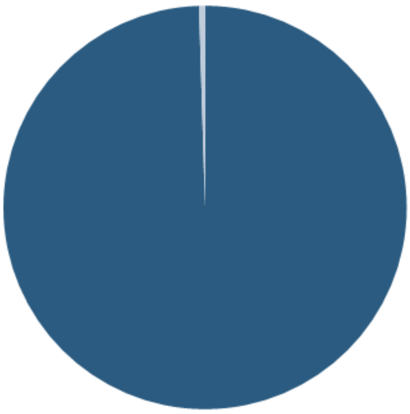
Notes

Some of my students' unfinished projects
http://scratch.mit.edu/studios/266360/

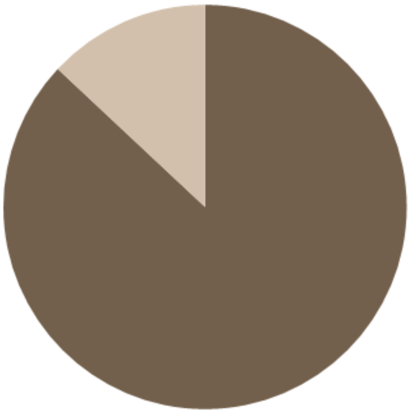
Representations of the learning experience

Learning through	minutes	%
Acquisition (Read, Watch, Listen)	31	15
Investigation	30	14
Discussion	36	17
Practice	60	29
Collaboration	20	10
Production	30	14

	minutes	%
Whole class	70	34
Group	137	66
Individual	0	0



	minutes	%
Face to face (not online)	206	100
Online	1	0



	minutes	%
Teacher present	180	87
Teacher not present	27	13

Learning Design for: Ozosistems,Movements in the human body

Context

Topic: Digestive and Circulatory systems

Total learning time: 4 hours and 30 minutes

Designed learning time: 4 hours and 30 minutes

Size of class: 28

Description: The 9th D class, is somewhat heterogeneous, it is a CLIL class where a dyslexic student and 3 students with foreign ancestry are included (1 Chinese and 2 Romanian). Students, boys and girls, have 14-15 years. The proposed scenario intends to be stimulating and innovative, favoring students' creativity and the development of digital skills and teamwork, while learning of movements associated with the functioning of the human digestive and circulatory systems using Ozobot in the subject of Natural Sciences, is acquired.

Mode of delivery: Blended

Aims

Study of movements associated with the functioning of the human digestive and circulatory systems using Ozobot in the discipline of Natural Sciences

Outcomes

Knowledge: Students recognize the knowledge learned about mechanical and chemical digestion and about blood circulation.

Comprehension: It has great importance in simulating and understanding the movements of the human body, since there are several phenomena that cannot be recreated in the laboratory.

Application: Programming Ozobot to demonstrate human body movements.

Application: students produce patterns that simulate the path of food and the circulation of blood in the human body

Evaluation: Peer assessment. Students assess their colleague’s work.

Teaching-Learning activities

Part I - Presentation of Ozobot and OzoBlockly, a visual programming language used to codeOzobots Evo and Bit

Read Watch Listen *15 minutes* *28 Students* *Teacher present* *Face to face* *(not online)*

Teacher explains how students can program Ozobot with OzoBlockly.

Linked resources

File: ozoblockly-getting-started.pdf

Collaborate *30 minutes* *4 Students* *Teacher present* *Face to face* *(not online)*

Students learn how to use the Ozobot. Students start coding Ozobot with Color Codes.

Linked resources

File: ozobot-color-codes-pocket-guide.pdf

https://www.youtube.com/watch?v=m5d4iXGbIGs

Practice *45 minutes* *1 Student* *Teacher present* *Face to face* *(not online)*

Students do some simple activities of programming challenges.

Linked resources

File: desafios (1 para cada participante).pdf

Part II - Movement of food along the digestive tract

Read Watch Listen *15 minutes* *28 Students* *Teacher not present* *Online*

Students review knowledge about the morphology and physiology of the digestive system.

Collaborate *15 minutes* *4 Students* *Teacher present* *Face to face* *(not online)*

The task they must carry out as a group is the following: make a sketch of the digestive tract, highlighting the mouth, esophagus, stomach, and small and large intestines; program the ozobot, using color codes, to demonstrate the path of food along the digestive tract and, if any,the transformations that have taken place in the mouth, esophagus, small intestine and large intestine.

Discuss	*15 minutes*	*28 Students*	*Teacher present Face to face (not online)*

Students brainstorming about a biology topic for their learning scenario.

Produce	*45 minutes*	*28 Students*	*Teacher present Face to face (not online)*

Students define a final path of food along the digestive tract with the ozobot in class.

Part III - Movement of blood during systemic and pulmonary circulation.

Read Watch Listen	*15 minutes Online*	*28 Students*	*Teacher not present*

Students review knowledge about the morphology and physiology of the circulatory system.

Collaborate	*15 minutes*	*4 Students*	*Teacher present Face to face (not online)*

The task they must carry out as a group is the following: make a sketch of the pulmonary andsystemic circulation; program the ozobot, using color codes, to demonstrate the path of arterial blood and venous blood, relating it to tissue hematosis and pulmonary hematosis phenomena.

Discuss	*15 minutes*	*28 Students*	*Teacher present Face to face (not online)*

Students brainstorming about a biology topic for their learning scenario.

Produce	*45 minutes*	*28 Students*	*Teacher present Face to face*

(not online)

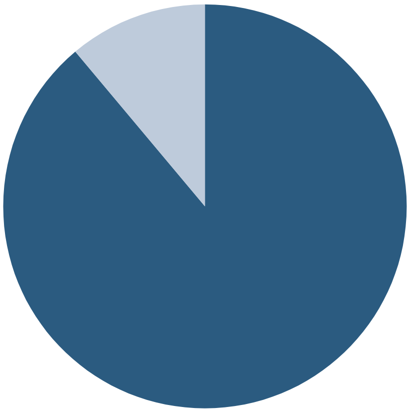
Students creating a final route of blood flow in pulmonary and systemic circulation with ozobotin class.

Representations of the learning experience

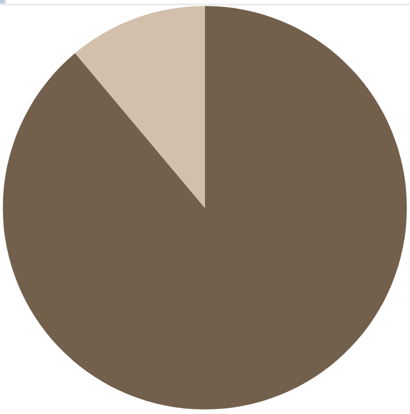
Learning through	minutes	%
Acquisition (Read, Watch, Listen)	45	17
Investigation	0	0
Discussion	30	11
Practice	45	17
Collaboration	60	22
Production	90	33

	minutes	%
Whole class	165	61
Group	60	22

Individual	45	17



	minutes	%
Face to face (not online)	240	89
Online	30	11



	minutes	%
Teacher present	240	89
Teacher not present	30	11

Learning Design for: The Driving Force of Magnets

Context

Topic: MAGNETS

Total learning time: 40 minutes

Designed learning time: 40 minutes

Size of class: 15

Description: The (North) and (South) poles are located inside the magnetic- objects. The poles inside the body are in irregular groups at the molecular level before the body is magnetized. When an object becomes magnetic, many of these groups in the body move in the same direction, contributing to the total magnetic field of the body. Thus, a single magnetic field and a complete magnetic polarity are obtained.

By the action of a magnetic force, the attracted substances are called paramagnetic, while the repelled substances are called diamagnetic, even though they are not magnetic themselves. Examples of paramagnetic substances are aluminum, barium and oxygen, and diamagnetic substances are mercury, gold, bismuth, silicon and similar substances.

Mode of delivery: Classroom-based

Aims

Magnets consist of negative and positive.
Opposite poles atract each other
Same poles repel each other,
By using opposite polarity the car will move as long as there is magnetic force. Will magnets with opposite poles propel the car forward? Yes, because the car becomes magnatized

Outcomes

Teaching-Learning activities

Read Watch Listen	*10 minutes*	*Students*	*Teacher present*	*Face to face (not online)*

Now we want to share an example how magnets are used in transportation EVERYWHERE. In a city which is called Kırklareli there is a road with this type of set up. This is how magnets can be used in place of fossil fuels to create movement force. Now we can watch the video.

Linked resources

MAGNİTEZED ROAD IN KIRKLARELİ

Discuss	*10 minutes*	*Students*	*Teacher present*	*Face to face (not online)*

Will magnets with opposite poles propel the car forward

Produce	*15 minutes*	*Students*	*Teacher present*	*Face to face (not online)*

At this point we took a video to Show the car movement by using the magnets which create the magnetic driving force. Using a ruller, we measured and marked the road distance from the starting point to the finish point. This distance mesures 138cm. We placed a car on the platform and place the negative pole of the magnet behind the car. Using the positive pole of the other magnet, it will bring car from the negative pole to the positive. We take the video and upload it to the tracker program and we get the data analysis .

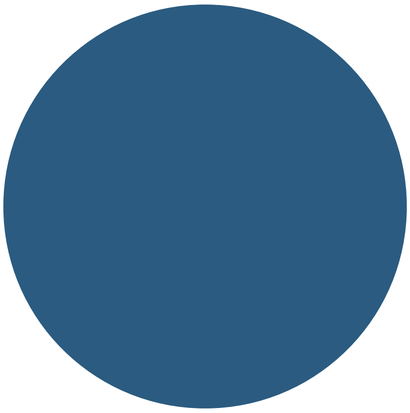
Practice	*5 minutes*	*Students*	*Teacher present*	*Face to face (not online)*

Q.1: Did the Magnets Change the Position of the Car ?
A.1: Yes. It changes because of the magnetic force.
Q.2: Has Friction Had An Affect On The Speed of The Car?
A.2: In this case friction did not affect the speed of the car. In a normal case friction will have a negative effect
Q.3: Does the car’s acceleration ever changes?
A.3: No. The force of the car stays the same because of the magnetic driving force.

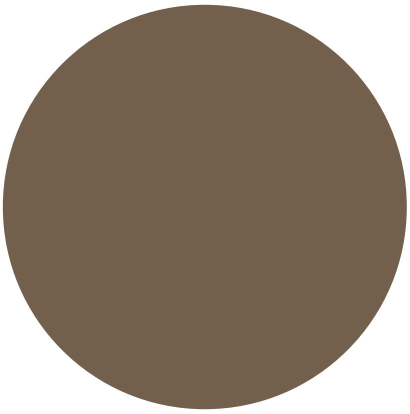
Representations of the learning experience

Learning through	minutes	%
Acquisition (Read, Watch, Listen)	10	25
Investigation	0	0
Discussion	10	25
Practice	5	13
Collaboration	0	0
Production	15	38

	minutes	%
Whole class	0	0
Group	0	0
Individual	0	0



	minutes	%
Face to face (not online)	40	100
Online	0	0



	minutes	%
Teacher present	40	100
Teacher not present	0	0

Learning Design for: Smart Chicken Coop

Context

Topic: Ozobot,Arduino,Tracker

Total learning time:

Designed learning time: 1 hour

Size of class: 15

Description: Smart Chicken Coop was a special project because Arduino, Ozobot and the Tracker program were used in this plan. Arduino was used for the Smart Feeder Door and the Smart Door of the Chicken Coop. Ozobot was dressed like a chick and used as the chick living in the Chicken Coop and the Tracker program was used to analize the Physics involved with the project, which Ozobot's color code speed programing helped provide the analysis and results.

Mode of delivery: Blended

Aims

programming
Tracker
Arduıno

Outcomes

Analysis: By taking video of Ozobot and using it with the Tracker program, the results were displayd. When the Ozobot procedure was finished, the Arduino procedure and the box were started. An Arduino instruction manual for the class was given. Since the written code or programming for the Arduino was provided, this helped prevent any mistakes from occurring. Because of how the placement of the color code speed command was used, each group would have different results.

Teaching-Learning activities

Smart Chicken Coop

Discuss	*15 minutes*	*Students*	*Teacher present*	*Face to face (not online)*

Students will discuss how a smart chicken coop can be created. For example, a story will be created by making a baby chick costume for Ozobot and then the path for Ozochick's daily routine will be made. This routine consisted of waking up, leaving the nest area, using the Smart Feeder with the help of Arduino, going outside the Chicken Coop by using the Smart Door, then, run around the area for a relaxation time and finally coming back to the nest to go to sleep.

Practice	*30 minutes*	*Students*	*Teacher not present*	*Face to face (not online)*

Students will play with ozobot.
Students will record their performing and will upload their videos.
Each team will present their work.

Produce *15 minutes* *15 Students* *Teacher not present* *Online*

Create a video from their recordings.
How to use Ozobot's programming in order to create the daily routine will be taught. The Chicken Coop template will be created and other materials will be used to start making the project's components. The color codes and calibration circle will be prepared for Ozobot's programming commands. These commands will be used in order to control Ozobot's speed. The robot will read the color command and performed the specific task. The Arduino programming is the second procedure of the project. The Arduino components will be needed in order to control the Smart Feeder for Ozochick and the Smart Door of the Chicken Coop. The Arduino will be built inside the project box. At the same time, Arduino and the Ozobot procedures will also being done. The Ozobot procedure is going to be the one to provide the information needed to be use in the Tracker program. An extra Chicken Coop template will be built to use as a display and demonstrate how to use the Ozobot for the project

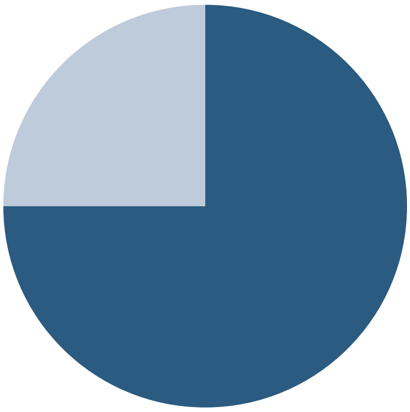
Notes

A story was created by making a baby chick costume for Ozobot and then the path for Ozochick's daily routine was made. This routine consisted of waking up, leaving the nest area, using the Smart Feeder with the help of Arduino, going outside the Chicken Coop by using the Smart Door, then, run around the area for a relaxation time and finally coming back to the nest to go to sleep

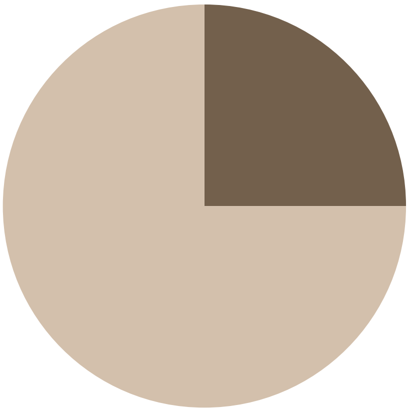
Representations of the learning experience

Learning through	minutes	%
Acquisition (Read, Watch, Listen)	0	0
Investigation	0	0
Discussion	15	25
Practice	30	50
Collaboration	0	0
Production	15	25

	minutes	%
Whole class	15	100
Group	0	0
Individual	0	0



	minutes	%
Face to face (not online)	45	75
Online	15	25



	minutes	%
Teacher present	15	25
Teacher not present	45	75

Learning Design for: Remote Control Arduıno Car

Context

Topic: Arduino, Tracker

Total learning time:

Designed learning time: 1 hour

Size of class: 15

Description: Remote Control Arduino Car is built in order to combine Arduino technology with Science. An Arduino Board, engines with wheels, a motor driver board to help control the engine wheels, cables, a power bank as the power source, a hand-held Remote Control and an IR Censor were used to build the car. Materials consisted mostly of electronic parts.

Mode of delivery: Blended

Aims

programming
Tracker
Arduıno

Outcomes

Analysis: Once the video data was gathered, the car's weight and the length measurement of the wooden ramp were entered in the Tracker program. This information is required in order to be able to take the necessary measurements for the Tracker program. These photos show the test results using the Tracker Program

Teaching-Learning activities

Remote Control Arduıno Car

Discuss	*15 minutes*	*Students*	*Teacher present*	*Face to face (not online)*

Student’s will discuss how The Arduino Car's speed will be affected when the ramp is raised at different height position

Practice	*30 minutes*	*Students*	*Teacher not present*	*Face to face (not online)*

When the car runs on any ramp height, the car's speed will slow down at any angle due to its weight and friction from the incline. When the car runs without any ramp height, the car's speed is constant and there is no reduction of speed.

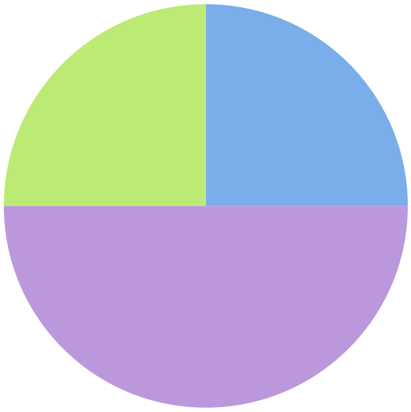
Produce *15 minutes* *15 Students* *Teacher not present* *Online*

A wooden ramp is used to help provide a total of 3 different incline positions. The first test position is done with the ramp at a flat position. The car's speed remained constant during this test. For the second test position a total of 4 bricks, made with foam, are used to achieve a specific height. For the final test, the ramp is raised by using a total of 8 foam bricks. This is the maximum height for the test.

Notes

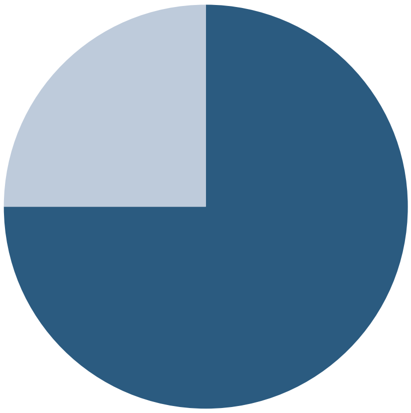
Once the video data is gathered, the car's weight and the length measurement of the wooden ramp are entered in the Tracker program. This information is required in order to be able to take the necessary measurements for the Tracker program.

Representations of the learning experience

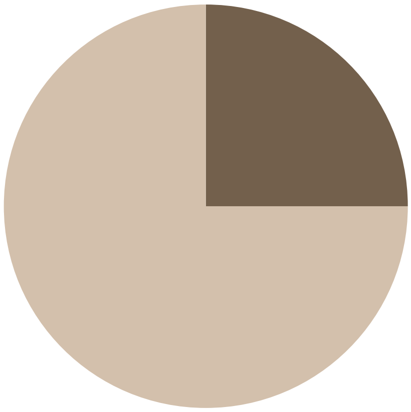


Learning through	minutes	%
Acquisition (Read, Watch, Listen)	0	0
Investigation	0	0
Discussion	15	25
Practice	30	50
Collaboration	0	0
Production	15	25

	minutes	%
Whole class	15	100
Group	0	0
Individual	0	0



	minutes	%
Face to face (not online)	45	75
Online	15	25



	minutes	%
Teacher present	15	25
Teacher not present	45	75

Learning Design for: Ding Dong

Context

Topic: How To Install a Single Button Doorbell

Total learning time: 40 hours

Designed learning time: 40 minutes

Size of class: 15

Description: Students age 12 to 16 work with a group of 5 to ınstall a single button electric doorbell by using the equipment (Fuse-Transformer-Chime-Button-Wiring-doorbell- bell wire)

Mode of delivery: Blended

Aims

- O1 To be able to draw the electric scheme
- O2 To learn how to install the wires to the board
- O3 To learn the principles of electromagnetism
- O4 To be able to follow the steps of an experiment from the begining to the end

Outcomes

Teaching-Learning activities

Collaborate	*10 minutes*	*Students*	*Teacher present*	*Face to face (not online)*

Teach the name of materials and how and why we use them to install an electric doorbell. Draw the electric scheme then the students draw the circuits and pipe scheme

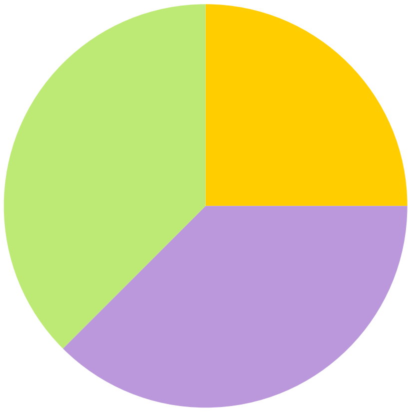
Practice	*15 minutes*	*Students*	*Teacher present*	*Face to face (not online)*

Give the directions to mount the materials to the board and to install wires
Test the circuit
The ones who install the doorbell now will teach the students by giving directions to the other to complete the task
Students shoot their video to teach others by giving directions to teach how to install the doorbell

Produce	*15 minutes*	*Students*	*Teacher present*	*Face to face (not online)*

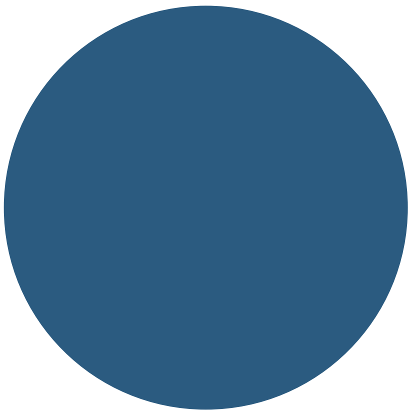
The activity be replicated in a blended learning environment. Students will shoot their own videos while they are working to install the doorbell. Others will watch the video and follow instructions to do the same project. The activity can be replicated in a remote learning scenario by watching the videos created by students.

Representations of the learning experience

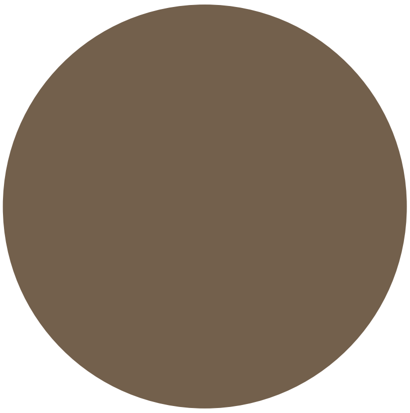


Learning through	minutes	%
Acquisition (Read, Watch, Listen)	0	0
Investigation	0	0
Discussion	0	0
Practice	15	38
Collaboration	10	25
Production	15	38

	minutes	%
Whole class	0	0
Group	0	0
Individual	0	0



	minutes	%
Face to face (not online)	40	100
Online	0	0



	minutes	%
Teacher present	40	100
Teacher not present	0	0

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