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STEAME ACADEMY
TEACHING FACILITATION LEARNING & CREATIVITY PLAN (L&C PLAN) - LEVEL 2 SERVICE TEACHERS
TITLE: Programming through gamification (virtual classroom)

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1. Overview

Title Driving Question or Topic	Programming through gamification (virtual classroom) *Do you think we will only study in online classes in the future?* *How do you imagine your virtual classroom would be?*		
Ages, Grades, …	*15-18 years*	*1st-3rd grade of high school*	
Duration, Timeline, Activities	*18 hours*	*18X45 minutes*	*4 activities*
Curriculum Alignment Contributors, Partners	Informatics, Maths, Physics, Engineering 1st-2nd class of high school (sections 3-5), *Expert gamification and expert in virtual environment.*		
Abstract - Synopsis	*This project involves the design of a virtual reality application (Spatial) and the creation of basic interactions through programming.* *First students will learn the basics of the use of the platform, and then experts will present the basics of virtual environment design, implementation, as well as gamification strategies.* *Teachers of the school will present some content about programming and involved technologies.* *Students will work on the design specifications that will be required with the informatics teacher with the help of the virtual environment expert.* *Finally, students will work in teams with the help of informatics, maths and physics teachers to create a virtual classroom and define the scale of the online design.* *They will develop the online programming environment in Spatial with different phases. Each phase will involve gamification strategies. Virtual teams will be registered in an online platform and gain points for completing each phase. The team that completes with the best performance gets more points. After the final evaluation, teams will be able to enter a room where a virtual teacher will explain the solution to the teams.* *Concerning the project, the result of their work is peer-reviewed by other students and has to be graded as satisfying to get points. During this process, teams will*		

	be evaluated by experts and teachers. The team with the most points will have the driving role during the presentation of the project.
References, Acknowledgements	Some references: Spatial - The Metaverse for Creators, Artists, Exhibitions, and More How To Make A Gallery in Virtual Reality (for both NFT and non-NFT Artists) Spatial.io Overview / Tutorial of sorts https://teaching.ellenmueller.com/3d-design/resources/elements-principles-of-design/ https://xperiencify.com/gamification-tools/

2. STEAME ACADEMY Framework*

Teachers' Cooperation	**Teacher math:** • researches adequate content to be used in students' exercises **Teacher physics:** • researches adequate content to be used in students' exercises **Teacher computer science:** • investigate the appropriate programming language to use in the proposed problem **Teacher (Technology/Engineering):** • researches the adequate technological infrastructures of the virtual and gamification environments **Teacher 1 (Mathematics)** **Teacher 2 (Physics)** **Teacher 3 (Computer Science)** **Teacher 4 (Technology/Engineering)** T1 cooperates with T2 to propose exercises T2 cooperates with T3 to propose exercises T3 cooperates with T4 to define the contents and evaluation criteria involved in the design of the virtual environment (phases, numbers of rooms) and gamification strategies employed.
STEAME in Life (SiL) Organization	*Meeting with experts in virtual and gamification environments* -Meeting with experts from software organizations. The main goal is to see real virtual projects and get information about the proposed problem.

Action Plan Formulation	**Teacher in service work plan before project** Step 1: Theoretical background knowledge ● Understand the basic principles of virtual environments. ● Understand the basic principles of gamification environments. Step 2: Formulation and definition of the project ● Formulate a clear objective for the project: to create a virtual environment or modify an existing virtual environment to support the programming classes. ● Define specific gamification strategies as part of the teaching methodology to be used in the virtual classroom Step 3: Application of knowledge ● Implement the theoretical knowledge and strategies into a practical plan for the proposed problem. Step 4: Evaluation ● Assess the usability of the classroom design, the effectiveness of the gamification strategies implemented, programming skills and the quality of the selected technological setup. **This is directly related to "Teacher's cooperation" field and reflects the details in clear, descriptive manner of the activities in an action plan.** **Preparation (by teachers)** 1. Relation to Real Physics and/or Math Problems – Reflection 2. Incentive – Motivation 3. Formulation of a problem (possibly in stages or phases) resulting from the above **Development (by students) – Guidance & Evaluation (in 6-8, by teachers)** 1. Background Creation - Search/Gather Information 2. Simplify the issue - Configure the problem with a limited number of requirements 3. Case Making - Designing - identifying materials for building/development /creation 4. Construction - Workflow - Implementation of projects 5. Observation-Experimentation - Initial Conclusions 6. Documentation - Searching Thematic Areas (AI fields) related to the subject under study – Explanation based on Existing Theories and / or Empirical Results 7. Gathering of results /information based on points 4, 5 and 6 8. First group presentation by students **Configuration & Results (by students) – Guidance & Evaluation (by teachers)** 1. Configure the STEAME model to describe/represent/illustrate the results 2. Studying the results in 6 (previous phase) and drawing conclusions, using step 1 (corrent phase) 3. Applications in Everyday Life - Suggestions for Developing 6 (previous phase) **Review (by teachers)** 1. Review the problem and review it under more demanding conditions **Project Completion (by students) – Guidance & Evaluation (by teachers)**

1. Repeat steps 2 through 8 (phase development) with additional or new requirements as formulated in the previous phase
2. Investigation - Case Studies - Expansion - New Theories - Testing New
3. Conclusions
4. Presentation of Conclusions - Communication Tactics

* *under development the final elements of the framework*

3. Objectives and Methodologies

Learning Goals and Objectives	**Learning goals:** **LG#1:** The project will introduce the students to the principles of programming. gamification and virtual environments. **LG#2:** Present methodologies and frameworks to develop the project **LG#3**: Familiarize students with emerging technologies to use in math and/or physics problems **LG#4:** Introduce students to the formulation and testing of hypotheses about physics and/or match problems **Learning objectives:** **LO#1**: Students will understand the concept of virtual environment **LO#2:** Students will understand the concepts of gamification **LO#3:** Students will know the principles of creating virtual and gamification environments concerning real-world problems
Learning Outcomes and expected Results	**Learning outcomes** <u>Knowledge (Cognitive domain: recall, understand, apply, analyze, evaluate, create)</u> ● Know the basic principles of programming ● Know how to develop a software project ● Know the principles of a virtual environment ● Know the principles of a gamification environment <u>Skills (Psychomotor domain: Perception, set, guided response, mechanism, complex overt response, adaptation, origination)</u> ● Apply a programming language ● Use virtual environments ● Use gamification tool ● Better use of presentation software ● Better communication and presentation skills <u>Attitudes (affective domain: receiving, responding, valuing, organization, characterization)</u> ● develop an interest in programming ● develop interest in virtual environments ● develop an interest in gamification environments ● develop interest in STEAME **Expected results:** A short list or description of the “products”, the results that students are expected to produce e.g a final report with the results of analyses, a presentation, a prototype of a virtual environment that includes programming and gamification, etc.
Prior Knowledge and Prerequisites	**Prior knowledge - skills:** ● Mathematics or/and Physics background ● Basic knowledge of programming ● Basic use of office applications suite (Microsoft Office, Libre office or ● equivalent) ● Teamwork

	● Communication and cooperation skills **Prerequisites:** ● Laboratory with access to the web ● Office suite (presentations, spreadsheets) ● Virtual environment platform ● Gamification tools ● Teleconference platform ● Presentation equipment (projector/presentation screen)
Motivation, Methodology, Strategies, Scaffolds	**Motivation** ● Programming in a virtual gamification environment ● Project results that can be applied in a local context **Methodology** Project-based approach that presupposes the collaboration between teachers of maths, physics, computer science and IT, and students teamwork in a local project. **Strategies** ● Project-based learning ● Work in small teams ● Guided discovery ● Autonomous work **Scaffolds** ● Guidance and consultancy ● Additional information sources ● Computer laboratory access and support ● Collaborative development of products and evaluation methods

4. Preparation and Means

Preparation, Space Setting, *Troubleshooting Tips*	The teacher mainly in charge of the project is the Computer Science Teacher The Computer Science teacher discusses with the other teachers the goals and the concept of the project and the implementation steps. He/she accesses initially the sources of information and together with the other teachers sets the timeframe of their intervention. He/she prepares a project presentation sheet containing also the information from the other teachers. They all have preliminary access to the information sources. All the teachers together decide on the timeframe of implementation of the project. This project involves all computer science teachers + math teachers + physics teachers + engineering teachers. Depending on how much time is available and how many subjects will be involved the timeframe will be shorter or longer. For the realization of the project, students work in their classroom and in a computer laboratory. The description is quite clear and it could be further structured as follow: Space setting: Short description of needed spaces for the intervention (In classroom, in computer lab, online and combination of spaces etc) Preparation: Short description of any possible special preparations need to be taken into account (e.g., special permits, contacts with other actors, special arrangements – for meetings etc.) Troubleshooting/ Tips: If there are any specific/ special problems that need to be solved before the start of the project and how to handle them.

Resources, Tools, Material, Attachments, Equipment	**Classroom** A computer with access to the internet, office applications and teleconferencing applications is needed and presentation equipment for the presentation of new concepts, the presentation of the student's works and the communication with the external actors. **Computer laboratory** In the laboratory students will work in teams for access to online resources to implement the virtual environment. Therefore computers with access to the internet, virtual reality tools and office applications installed are needed. Instructions on the template: Instructional sources and digital material with the related references needed for the implementation of the learning plan. **Materials and Equipment** ● Educational resources and materials ● Description of resources, links, shared folder with materials ● Tools and equipment: ○ Laboratory with access to the web ○ virtual reality environment ○ gamification tool ○ Office suite (presentations, spreadsheets) ○ Teleconference platform ○ Presentation equipment (projector/presentation screen)
Health and Safety	No field work outside of school.

5. Implementation

Instructional Activities, Procedures, Reflections	This plan is developed under the assumption that it extents to 10 study hours based on each time 2 lesson blocks (so 90-100 minute lessons). Classes are held once a week in the context of additional activities in secondary education. The leading teacher (computer science teacher -T3) is involved in all lessons, the teachers of maths (T1), teachers of physics (T2) and technology/engineering (T4) are involved in specific project stage and during implementation following the organization and scheduling of the project. **Lesson block 1** T3 25 minutes presentation of the project to the students - raising motivation - project definition - presentation of collaborations T1, T2, T3, T4 Learning stations on ● gamification ● virtual environments ● programming **Lesson block 2** T1, T2, T3 Using gamification in programming exercises applied to math and/or physics exercises

	Lesson block 3 T1, T2, T3, T4 Implementing the programming exercises in virtual environments **Lesson block 4** Presentation of the results of the different groups to the teachers Peer evaluation General evaluation & feedback
Assessment - Evaluation	**Mixed evaluation (combine Assessment I and Assessment II)** **Assessment I** Evaluation is based on the final product of the students and is carried out by the teachers and the students of the other team It is clear and well-understood how the evaluation will take place. However, the criteria are not mentioned. **Assessment II** Project-based learning (PBL) thrives on a strong foundation of assessment and formative evaluation. An approach/system to effectively measure student abilities in PBL are provided further below. PBL goes beyond rote memorization. We assess a combination of skills and knowledge acquisition: • Content Knowledge: Ensure students grasp the core concepts explored in the project. • 21st Century Skills: Assess critical thinking, problem-solving, collaboration, communication, and creativity throughout the project. • Project Management Skills: Evaluate how students plan, organize, manage time, and adapt during the project. • Learning Process: Reflect on how students approach challenges, learn from mistakes, and demonstrate self-directed learning. • Formative Evaluation Strategies for PBL: Checklists & Progress Reports: Provide ongoing feedback with checklists outlining key milestones and rubrics for specific tasks. Students complete progress reports reflecting on their contributions and challenges. • Peer Reviews & Group Discussions: Facilitate peer reviews where students analyze each other's work based on rubrics. Organize group discussions to share ideas, troubleshoot, and refine approaches. • Exit Tickets & Minute Papers: Use short exit tickets or minute papers at the end of each session to gather student understanding of concepts covered and identified areas needing clarification.
Presentation - Reporting - Sharing	The final result of the project is presented to the teachers and the students of the other team. Other participants, like students from another class can also be present. It is only a plan and the deliverables do not exist yet, but will be developed by the students and therefore it is impossible to know in advance the the types: examples include: Documents, outputs, artifacts, products produced by the students with references, web links etc., for sharing to the media.
Extensions - Other Information	

STEAME ACADEMY Prototype/Guide for Learning & Creativity Approach
Action Plan Formulation

Major steps in the STEAME learning approach:

STAGE I: Preparation by one or more teachers

1. Formulating initial thoughts on the thematic sectors/areas to be covered
2. Engaging the world of the wider environment / work / business / parents / society / environment/ ethics
3. Target Age Group of Students - Associating with the Official Curriculum - Setting Goals and Objectives
4. Organization of the tasks of the parties involved - Designation of Coordinator - Workplaces etc.

STAGE II: Action Plan Formulation (Steps 1-18)

Preparation (by teachers)

1. Relation to the Real World – Reflection
2. Incentive – Motivation
3. Formulation of a problem (possibly in stages or phases) resulting from the above

Development (by students) – Guidance & Evaluation (in 9-11, by teachers)

4. Background Creation - Search / Gather Information
5. Simplify the issue - Configure the problem with a limited number of requirements
6. Case Making - Designing - identifying materials for building / development / creation
7. Construction - Workflow - Implementation of projects
8. Observation-Experimentation - Initial Conclusions
9. Documentation - Searching Thematic Areas (AI fields) related to the subject under study – Explanation based on Existing Theories and / or Empirical Results
10. Gathering of results / information based on points 7, 8, 9
11. First group presentation by students

Configuration & Results (by students) – Guidance & Evaluation (by teachers)

12. Configure STEAME models to describe / represent / illustrate the results
13. Studying the results in 9 and drawing conclusions, using 12
14. Applications in Everyday Life - Suggestions for Developing 9 (Entrepreneurship - SIL Days)

Review (by teachers)

15. Review the problem and review it under more demanding conditions

Project Completion (by students) – Guidance & Evaluation (by teachers)

16. Repeat steps 5 through 11 with additional or new requirements as formulated in 15
17. Investigation - Case Studies - Expansion - New Theories - Testing New Conclusions

18. Presentation of Conclusions - Communication Tactics.

STAGE III: STEAME ACADEMY Actions and Cooperation in Creative Projects for school students

Title of Project: _____
Brief Description/Outline of Organizational Arrangements / Responsibilities for Action

STAGE	**Activities/Steps** Teacher 1(T1) Cooperation with T2 and student guidance	**Activities /Steps** **By Students** Age Group: ____	**Activities /Steps** Teacher 2 (T2) Cooperation with T1 and student guidance
A	Preparation of steps 1,2,3		Cooperation in step 3
B	Guidance in step 9	4,5,6,7,8,9,10	Support guidance in step 9
C	Creative Evaluation	11	Creative Evaluation
D	Guidance	12	Guidance
E	Guidance	13 (9+12)	Guidance
F	Organization (SIL) STEAME in Life	14 Meeting with Business representatives	Organization (SIL) STEAME in Life
G	Preparation of step 15		Cooperation in step 15
H	Guidance	16 (repetition 5-11)	Support Guidance
I	Guidance	17	Support Guidance
K	Creative Evaluation	18	Creative Evaluation