DECODE

DESIGN LEARNING SITUATION:

INTEGRATION OF DIGITAL COMPETENCE

BEST PRACTICES

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1. Project Description

Learning objectives, in terms of demonstrable skills and knowledge that students have to acquire by the end of the third year of the secondary lower school, are prescribed by the National guidelines for the curriculum. According to them, students must understand fractions and must be able to use them for calculus and measurements. Generally, fractions and arithmetic with fractions, are proposed to students attending the second class. In this period, however, most pupils experience a particular moment of their physical and psychological growth, that can lead them to be distracted and to reject complex subjects. This is particularly true in cases in which students, that have not yet achieved the proper skills with calculus, are required to execute a considerable number of repetitive assignments.
In order to motivate students and to guide them towards the acquisition of the required competences, collaborative teaching methodologies can be used in combination with new technologies.
The core of the proposed learning unit is the development of a "game" by using the visual programming with Scratch 3.0 (coding) in order to provide students with an insight of what fractions are and to let them work in small groups. At the end of the project, "the game" will be published on the school website.
From a didactic point of view, coding is the perfect combination of doing and thinking, because it entails both logical and practical activities: starting from a design phase (individual or group-based) and a logic conception (definition of an algorithm), a code is written step by step and its functionality is tested by the students.
The enthusiasm with which generally the new generations work with computers and with Scratch will also allow students to overcome difficulties with fractions, to become passionate about the subject and overcome the reluctance towards it.

Working on the project, students will learn:
- the definition and significance of fractions and their calculation rules;

and also how to:
- create an algorithm;
- use visual programming with Scratch in order to implement an algorithm;
- check the correct functioning of the developed algorithm;
- carry on a logical-creative mental process that allows to break down a complex problem into simpler parts and solve problems of various kinds using specific tools (development of computational thinking and problem-solving);
- identify any errors and correct them;
- work in group,
- accept their role in a group and to know how to interact in order to find a common solution.

2. General Information

Title of the learning situation	*Learning Fractions by Scratch 3.0*	
Application context	Stage / educational level	*Lower Secondary school / 2nd year*
	Curricular areas involved	*Mathematics, Information Technology*
Description of the learning situation	Skills	- *Working with numbers for calculus and measurements* - *Programming digital environments* *- Using resources for planning and realizing simple digital products*
	Methodology	- *Traditional lesson* - *flipped classroom* - *brainstorming* - *learning by doing* - *peer tutoring* - *gamification*
	Activities	***Analysis:*** *Knowledge of fractions and their calculation rules (traditional lessons, flipped classroom)* ***Ideation****: choice of the type of product (brainstorming)* ***Planning and development:*** *definition of the Algorithm and production of the "game" with Scratch (learning by doing, peer tutoring)* ***Sharing and validation:*** *publication of the activity on the school web site and collection of feedback by form on-line*
	Learning resources	- *Video lessons prepared by teachers on fraction theory and algorithms* - *Paper notes for students who haven't digital devices at home to watch video lessons prepared by the teacher*
	Digital technology	*- hardware: computer science lab with internet connection, Lim,* *- software: Scratch 3.0 and web site*
	Monitoring and evaluation	- *Test on fractions knowledge (by on-line test prepared with Google-form)* - *Monitoring of the planned activities by means of a checklist* - *Evaluation of the effectiveness of the defined algorithm* - *Evaluation of the produced game* - *Evaluation of students' work by means of observation sheets*
	Teacher role	*Math teacher: project coordination, preparation of the video-lessons, tutor in brainstorming phases, supervisor in cooperative learning phases* *Technology teacher: help in ideation, planning, development and sharing phases*
	Working load	*Working hours in class: Math 11 hours and Technology 9 hours*
Learning outcomes	*Students working on this project:* *-Will understand fractions and their meaning, as well as operations with fractions;* *- Will learn to:* ✓ *produce an algorithm;* ✓ *Implement this algorithm by using Scratch visual programming;* ✓ *Verify its right functioning;* ✓ *perform a logical-creative process that can divide a complex problem into simpler parts and solve different problems by using specific instruments (computational thinking development and problem-solving);* ✓ *Identify mistakes and eventually correct them;* ✓ *Cooperate with classmates, know their own role and how to interact to find a common solution*	

3. Activities

Activity 1	*Learning operation with fractions*
Learning targets	*Knowledge of fundamental rules on operation with fractions*
Description	*Fractions will be introduced starting from simple and well-known concepts (natural numbers division). In particular division by two, three and four parts will be taught. Meanwhile the typical fractions symbols will be introduced.* *After operations with fractions (addition, subtraction, multiplication, division) will be thought.* *Students will be stimulated by simple questions with a solution that can be found without hard calculations. The very simple answer will allow students to learn, without any particular difficulty, the typical structures of operations with fractions.* *Then the concept of least common multiple LCM should be introduced to go on with very simple expressions with fractions. To keep a very deep attention it's important to combine the mathematical formulas with a graphic model.* *Students will be asked to solve some exercises to consolidate their competencies in calculation developed by using the flipped classroom methodology.* *At home students could watch some videos with a brief synthesis of concepts proposed in the classroom and with the calculation rules. In the same videos, some calculation exercises will be proposed and solved.* *In the classroom the teachers will support students that should report some difficulties and, on the other hand, will give more tricky and challenging exercises to the others.*
Working strategies	*Traditional types will be alternate with cooperative ones in which students will be organized into small groups (2-4 students).* *Flipped classroom methodology will be adopted to consolidate the knowledge (watching videos at home and revision in the class. The revision could be organized individually or with students subdivided into small groups defined on the basis of their level).*
Learning resources	*workbook, videos and teacher notes*
Digital devices	*Pc or tablet at home. Lim in the classroom* *Teacher Website with videos and notes.*
Learning environment	*Mixed: Classroom and teacher website*
Monitoring and evaluation	*Observation in class, exercises evaluation.* *Test on line with google apps (true/false, multiple choice)* *Oral test, discussion with mates, speeches, problem solving*
Learning outcomes	*solve simple problems by using operations with fractions*
Working load	*8 hours*

Activity 2	*Definition of requirements for the video game on fraction to be developed with Scratch.*
learning targets	*Creativity development, ability to share ideas with others*
Description	*The teacher will guide the students to identify the requirements for the game by means of a brainstorming session.* *The students will be asked to choose characters, backgrounds and level numbers. Then they will select the problems to be implemented in the game.* *The choice will be performed by using different colours note-sheets posted on one board.* *Working phases will be:* *a) Activities rules explanation;* *b) Choice of characters: the teacher will ask each student to write on a coloured sheet (i.e. yellow) the name of a "sprite" chosen among the ones of a proposed group. Each student will attach his own sheet on the board. The two sprites receiving more votes will be selected as game characters;* *c) Choice of backgrounds: the teacher will ask each student to write on a coloured sheet (i.e. green) the name of a backgrounds chosen among the ones of a proposed group. Each student will attach his own sheet on the board. The two backgrounds receiving more votes will be selected as game backgrounds;* *d) Choice the level numbers: the teacher will ask each student to write on a coloured sheet (i.e. blue) the number of levels selected inside a peculiar range i.e. five levels (from 5 to 10). Each student will attach his own sheet on the board. The number of levels receiving more votes will be selected;* *e) The teacher will subdivide the students into as many groups as defined at point d;* *f) Each group will write and solve a problem related to fraction calculations (each problem will be a level of the game).*
Working strategies	*Phases from a to d: brainstorming in which students can express their opinions.* *Phases from e to f: small groups work*
Learning resources	*posters, note-sheets, LIM*
Digital devices	*Lim*
Learning environment	*Classroom*
Monitoring and evaluation	*Observation in the classroom.* *Monitoring by checklists* *Evaluation of participation, commitment and cooperative working.*
Learning outcomes	*Learning to express and share ideas.* *Development of creativity* *Cooperative working.* *Booster the operation with fractions.*
Working load	*3 hours*

Activity 3	*Development of Scratch product*
Learning targets	*Knowledge of programming rules, from the algorithm to the final product*
Description	*The teacher will guide the students through the definition of simple algorithms commonly used in real life (brainstorming phase).* *In the I.T. laboratory the students will work on the website https://scratch.mit.edu/ to understand its basic rules. The students will insert the first "sprite", selected in the previous activity and will define the first basic movements.* *The students will be guided by the teacher in backgrounds definition and in the creation of spaces for possible levels chosen in the previous activity 2.* *Once become more confident with the software, the students will implement the problems selected during the previous activity.* *The teacher will carefully merge into just one game all the levels prepared by the students.*
Working strategies	*All the students will be involved during the software presentation, then the students will be subdivided into small groups as defined in activity 2*
Learning resources	*Videos and note-sheets by the teacher, tutorials from website https://scratch.mit.edu/*
Digital devices	*Lim.* *Teacher website with videos and digital notes.* *PC*
Learning environment	*mixed: pc and learning sharing site (teacher's website and scratch website)*
Monitoring and evaluation	*Observation in the classroom. Evaluation of the process* *Monitoring by checklists* *Test: creation of the project on the website https://scratch.mit.edu/* *Real life test: Evaluation of the acquired competencies*
Learning outcomes	*Development of creativity by software* *Learning to work in groups.*
Working load	*6 hours*

Activity 4	*Sharing and validation*
Learning targets	*publication of the final product on the school website and collection of feedback by using Google form online.*
Description	*The teacher will prepare a Google form and will share the link on the website of the school. Furthermore, the teacher will define some types of communication, with the help of the students, to share the work and to collect the feedback data (parents, friends, …)*
Working strategies	*Once published and shared the 'game', a feedback will be requested on the work. These feedback data will be analyzed later to choose any possible changes eventually needed.*
learning resources	*Tutorials from website https://scratch.mit.edu/ for possible changes*
Digital devices	*Lim* *IT laboratory*
Learning environment	*sharing platform (school website – scratch website)*
Monitoring and evaluation	*Observation in the classroom. Evaluation of the exercises* *Test: the program will be upgraded on the basis of negative feedback received*
Learning outcomes	*Analysis of the received feedback data*
Working load	*3 hours*