STEAM
On the road to Knowledge
- integrated optional curricula –

Level: 7th grade
Topics: Mathematics and Sciences
Man and Society
Arts
Duration: 1 year
Number of classes per week:1 h/week

PRESENTATION NOTE

Integrated teaching represents a challenge for any teaching staff, because it is very dynamic, it requires continuous adaptation and updating of both the teaching staff and the student. It is a strategy that requires radical reconsideration not only in terms of content organization, but also in the "ambiance" of teaching and learning.

The four pillars of integrated learning are: learning to know, learning to do, learning to work together with others, learning to be. Such knowledge of the world brings with it a deep understanding of the surrounding reality, scientific benchmarks and adaptability to social conditions.

In order to meet the continuous need for knowledge of our students, to keep up with European trends in terms of education and, above all, the effective teaching of mathematics and sciences, we thought of this joint integrated optional curricula in order to capitalize on the offer of knowledge of three of the curricular areas included in the education framework plans: Mathematics and Sciences, Arts, and Man and Society. These three curricular areas ensure openings to other skills (such as those of communication and artistic expression). Integrated teaching is a solution for a better correlation of science with society, culture, technology, such as coding and robotics.

This integrated optional subject includes a training time budget of 34 hours per year (one hour per week), and the structure allows flexible organization of learning time. It presupposes the creation of meaningful connections between topics or skills that are, as a rule, formed disparately within different disciplines. The curriculum is built from the perspective of ensuring the unity of knowledge, considering knowledge as an end in itself. The proposed activities develop learning and self-assessment skills. Content elements are attractive, on topics of interest to students. The competencies proposed by the program of this integrated optional curricula have in mind the training profile of the primary school graduate and are correlated with the goals of education proposed in various national and European documents, being a tangible intellectual result

of the strategic partnership only between schools, the KA229 ”Taking a Learning Journey on the STEAM Train”, implemented in our partnership schools from UK, Bulgaria, Croatia, Italy, Romania and Turkiye by the help of the European Erasmus+ program.

The contents are selected according to the proposed themes, respecting the age characteristics of the students, the specifics of the class (level of performance, learning styles, types of intelligence), the local specifics, the resources of the school unit and the expectations of the students. The flexible approach to the contents helps the motivation for learning. The formative function of the evaluation will be carried out systematically through the active participation of students in projects, learning through play, coding, experiments, portfolio creations and by familiarizing students with the structure and requirements of these methods and specific evaluation tools.

This integrated optional curricula will create added value by directly contributing to the development of the existing curricular framework, by supporting the integrated approach, by promoting key skills and, above all, by addressing two current topics that will have a great impact in the future: coding and robotics.

I. GENERAL COMPETENCIES

1. The identification of phenomena, processes and the processing of quantitative data from the fields of mathematics, technologies, arts and sciences, their correlation and valorization in different contexts;

2. Solving problems and problem situations by using inductive and deductive reasoning, concepts and methods specific to different fields of knowledge;

3. Investigating the connections between mathematics and various scientific, social, arts and technologies fields;

4. Oral and written communication using the specific scientific language in formulating explanations, conducting integrated investigations and reporting results;

5. The use of information and communication technology in the collection of data, in their processing, systematization and communication;

6. Personal development through the formation of integrated thinking and the management of one's own learning.

VALUES AND ATTITUDES

• Development of interest in scientific documentation

• Developing curiosity about mathematics, technologies, robotics, sciences, coding, arts

• Development of independence in thinking and action

• Confidence in scientific truths and critical appreciation of their limits.

II. SPECIFIC COMPETENCES AND EXAMPLES OF LEARNING ACTIVITIES

1. ***The identification of some phenomena, processes and the processing of quantitative data from the fields of mathematics, technologies, arts and sciences, their correlation and valorization in different contexts***

Specific skills **At the end of the course the student will be able:**	**Examples of learning activities**
1.1. to identify in everyday language notions specific to the domains addressed	Creation of a vocabulary with specific scientific notions Exercises to identify the notions encountered in the optional in everyday language

1.2. to highlight characteristics of some phenomena and processes in nature based on the measurements made	Knowledge and understanding of nature: the human ability to discriminate between living things (plants, animals) as well as sensitivity to other features of the natural world, especially the environment
1.3. to use tools and standard measurement units for length, capacity, mass, area, time in various situations	Distance determination exercises Exercises to determine the geographical coordinates of some localities Exercises for drawing maps to scale Exercises for calculating the length of a tourist route using the map Exercises that make an analogy between geometric figures and architecture
1.4. to collect data, organize it in tables, sort and classify it based on given criteria and provide elementary interpretations of it	Data collection exercises Measurement exercises. Interpretation of local and county geographic data

2. ***Solving problems and problem situations by using inductive and deductive reasoning, concepts and methods specific to different fields of knowledge***

Specific skills	**Examples of learning activities**
2.1. Identifying problems and problem situations in the surrounding world	Activities to identify problem situations Holding round tables, debates on topics from the areas addressed
2.2. The use of mathematical models to solve some problems and problem situations in the surrounding world	Investigative activities, organization of information Creation of geographical maps Designing a brochure with tips to protect the Earth

	Activities for making geometric mandalas
2.3. Justification of explanations and solutions to problems and problem situations	Mathematical reasoning of some meteorological phenomena Argument through examples of finding the Fibonacci sequence in nature, arts, architecture, etc

3. Investigating the connections between mathematics and various scientific, social, arts and technological fields

Specific skills	**Examples of learning activities**
3.1. Investigating the importance of mathematics in the study of astronomy, geography, biology	Research-documentation activities in the field of robotics * drawings of robots in the future * making models from recyclable materials * How we imagine robots in the future * Programming Ozobot: "Escape the Labyrinth" * programming mBot or other robots (LEGO Mindstorms) Thematic debates with supporting arguments Making reports or thematic essays The Legend of the Minotaur/Labyrinth Study visit to the Technical Museum in Bucharest Students will learn about science and technology from qualified STEAM staff. By participating in these activities / documentary visits, they will discover the magic of science and technology. The museum develops activities with students based on the concept of learning-by-doing.

	Interactive experiments are placed in specific rooms, covering all STEAM disciplines - science, technology, engineering, arts and mathematics
3.2. Identifying and capitalizing on the integrated link between mathematics, sciences, technologies and arts	Documentation activities and making essays about geometry Investigating some documents, books, websites to determine the mathematical elements in Romanian folk art Scratch Coding: Students will learn the basics of Scratch, tolerance games, math games, etc. Watching thematic documentaries
3.3. Knowing the data from the history of the fields addressed related to mathematics and the contribution of great mathematicians in other scientific fields/arts/technologies	Documentation activities from the history of music, Romanian folk art and Romanian literature related to mathematics Researching the activity of some mathematicians: Leonardo da Vinci, Leonardo Fibonacci, Solomon Marcus

4. ***Oral and written communication using the specific scientific language in formulating explanations, in conducting interdisciplinary investigations and in reporting the results***

Specific skills	**Examples of learning activities**
4.1. Selecting information and distinguishing between relevant/irrelevant and subjective/objective information	Exercises for selecting relevant information Exercises to compare selected information from several sources to establish their subjectivity/objectivity

4.2. Decryption and interpretation of scientific texts and translation into common language	Activities of reading some scientific articles on mathematics, ecology, biology, architecture, geography and debating them for the understanding of the students Exercises of transposing the elements of sacred geometry, symbols from popular art into everyday life
4.3. The use of specific language in the oral and written communication of various observations on some systems or phenomena	Oral presentation activities of some topics to acquire the appropriate language for the respective field Exercises on the use of specific language in writing reports, thematic essays

5. ***The use of information and communication technology in the collection of data, in their processing, systematization and communication***

Specific skills	**Examples of learning activities**
5.1. The correct use of information and communication technology in accessing and collecting mathematical information and data from various fields	Documentation-research activities on the Internet Creation of documentation sheets, using Google, Yahoo, Ask, Internet Explorer, Opera search engines
5.2. The use of information and communication technology in the processing and presentation of mathematical information and data from various fields	Creating PowerPoint presentations Systematization of data and creation of diagrams in Microsoft Office Excel The use of Microsoft Office and other programs in the creation and presentation of thematic materials Using web tools 2.0: padlet, kahoot,

	Cromebook, Kizoa, Powtoon, Photopeach, Emaze, Quiz makers, QR Code Generator

6. Personal development through the formation of integrated thinking and the management of one's own learning

Specific skills	**Examples of learning activities**
6.1. The formulation of personal, critical and pertinent opinions, using appropriate language, regarding a problem or a concept	Oral presentation of some logical reasoning used in solving practical problems Making and presenting reports or thematic essays
6.2. Efficient management of own learning and study time	Realization of individual and group projects Systematization of notions and materials created in individual portfolios
6.3. Making various connections between acquired knowledge and their application in personal development	Completion of essays, projects that reflect the level of deepening and integration into the general culture of the knowledge accumulated by the students in the optional course
6.4. Cooperation with others in solving group or individual tasks/problems	Teamwork activities to achieve complex tasks by distributing tasks Brainstorming activities in order to find the optimal solution to accomplish the tasks/problems Intercollegiate evaluation and self-evaluation activities

III. CONTENT

1. Mathematics and technology in human history – 6 hours
2. Web tools 2.0 – 8 hours
3. Mathematics in coding and robotics – 3 hours
4. Mathematical milestones in geography – 6 hours
5. Mathematical foray into the arts – 6 hours
6. The applicability of the Fibonacci series – 4 hours

IV. METHODOLOGICAL SUGGESTIONS

In relation to the program's competencies, the learning and assessment activities are based on inquiry-based learning, project-based learning, discovery and experiential learning.

IV.1 Suggestions on the design of teaching-learning activities

The didactic approaches, both on the teaching-learning sequence and on the assessment, are appropriate to the specifics of the group of students and in accordance with the didactic and human resources available to the school.

Will be tracked:

• integration of previous learning experiences in new scientific contexts or new approaches to scientific contexts already studied;

• streamlining learning activities involves the use of media and computer resources in order to identify information, as well as its processing;

• partnership of education, the teacher assuming the roles of observer, mediator and regulator of the learning and knowledge process, the student being the generator of learning contents and responsible for the development of learning activities;

• independent research and group research, in which students are responsible for identifying and classifying information associated with the topics, integrating, ranking, using information in the context of interdisciplinarity and obtaining conclusions on the influence and educational gain. In this sense, project-based learning and evaluation will value documentation and investigation skills, communication, assuming tasks within the team, facilitating the development of correct attitudes and principles in collaboration and competition.

IV.2. Suggestions on evaluation activities

Related to the evaluation sequence of didactic approaches, both the evaluation of the process and that of the final results (group projects, individual portfolios, layouts, boards, PPT presentations, reports, essays), behavioral changes and the development of self-evaluation capacities and , implicitly, of the competence to learn to learn. Evaluation will accompany the training process at every moment or stage. The evaluation of the students will be carried out by referring to the specific competences of the topics and will involve complementary methods, which aim to integrate the essential in practical contexts, the acquisitions of the students proving their usefulness in relation to their responsibility for the quality of their own lives and the surrounding environment.

Assessment will focus on the specific strategies that students use in solving problems. The evaluation process will combine traditional forms with complementary ones (project, portfolio, self-evaluation, evaluation in pairs, systematic observation of the student's activity and behavior) and will focus on:

• the direct correlation of the evaluated results with the specific competencies targeted by the school curriculum;

• valorization of learning results by reporting on the school progress of each student;

• the use of various methods of communicating school results;

• recognition, at the evaluation level, of learning experiences and skills acquired in non-formal or informal contexts.

V.3. The use of information and communication technology in teaching

The efficiency of didactic approaches can be ensured by the use of interactive, attractive didactic means and materials, which presuppose the use of virtual libraries as a source of information, the modeling of some phenomena and the presentation of some devices, the realization of some virtual experiments, the processing of the obtained data, the creation of reports, the media presentation of information and reports.

V. BIBLIOGRAPHICAL SUGGESTIONS

Big Bang - http://science.nasa.gov/astrophysics/focus-areas/what-powered-the-big-bang/

Big Bang- http://www.youtube.com/watch?v=B1AXbpYndGc&feature=fvw

http://ziarullumina.ro/sfatul-psihologului/geometria-naturii

https://limbaromana.org/

http://www.cimec.ro

http://www.wikipedia.ro

http:// www.scritub.com

http://www.anulmatematicii.ro

http://www.romlit.ro

http://www.matematicasiteologie.ro

http://www.matematicaiubirii.ro

http://www.ziarullumina.ro

http://www.rovart.com/news_view.php?akcia=view&id=228

http://goldennumber.net/body.htm

http://powerretouche.com/Divine_proportion_tutorial.htm

http://www.fabiovisentin.com/blog/45.ashx

http://www.colorpilot.com/comp_rules.html

Introduce online platforms - kahoot, plickers, mentimeter.

https://kahoot.it/

https://plickers.com/

https://www.mentimeter.com/

http://goqr.me/ https://www.unitag.io/qrcode

https://qrinfopoint.com/

https://www.wmtday.org/

https://www.youtube.com/watch?v=GF6nCmcQ5es

https://www.wikihow.com/Multiply-With-Your-Hands