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The EDUMAT+ Project: Teaching with Infographics

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Abstract

The article is based on the EDUMAT+ project, funded by the European Commission under the Erasmus+ programme. The project is being implemented by a partnership from five countries: Italy, Bulgaria, Spain, Portugal, and Romania. Education experts have emphasized the importance of bridging the digital literacy gap between generations in recent years. Despite efforts made to invest in the development of human capital in schools, particularly among teaching staff, there is still a lack of effective use of technology as a teaching support tool. This hinders the development of digital literacy and the acquisition of fundamental and transversal skills in students. The article presents the main goals of the EDUMAT project, which aims to solve this problem by giving teachers the tools and guidance they need to include coding and STEAM subjects (science, technology, engineering, arts, and math) in elementary school lessons. The project seeks to leverage coding and STEAM as innovative tools to enhance humanities teaching and explore digital education pathways that focus on key topics from the 2030 agenda. The target groups involved in the project are primary school teachers, 8-9-year-old students, and experts in STEAM and coding. The article focuses on one of the project's key outputs, the Digital Infographic Teaching Mats, a collection of interactive educational resources designed for primary school classes, as well as on teachers' reactions. The project's creative resources focus on critical themes such as environmental sustainability, social inclusion, gender equality, health and wellbeing, biodiversity, climate change, and reducing waste. By engaging with these digital education activities, children are encouraged to think critically about social and environmental issues, develop a deeper understanding of the world around them, and acquire the skills and knowledge needed to take charge of their well-being and contribute to protecting the environment.

Keywords: *primary school teachers, students, STEAM, infographics*

1. European Context

In recent years, the concept of "digital capital" has gained prominence in schools. Jeong (2024) defines it based on three key components: the hardware and software infrastructure available in the school, the digital competence of the students, and the teachers' use of information and communication technology (ICT) in the classroom. The objective is to enhance teaching methods that leverage technology to facilitate student learning, promote social interaction with teachers, and foster student engagement. Although there has been progress in integrating digital literacy into educational curricula, these initiatives often lack sufficient support for teachers, making it challenging for them to effectively implement digital education while ensuring the psychological and emotional safety of their students [1].
The EDUMAT+ project aims to bridge this gap by leveraging coding and STEAM as innovative tools to enhance humanities teaching and explore digital education pathways that focus on key topics from the 2030 agenda [2].

2. The EDUMAT+ Project

The goal of the EDUMAT+ project is to help teachers use coding and STEAM to teach the humanities in primary school, to develop new ways of using coding and STEAM to support and implement humanities teaching, and to investigate how to use digital learning paths in primary schools to learn about certain topics from the 2030 agenda and the humanities. The target groups involved in the

project are primary school teachers, 8–9-year-old pupils, and experts and researchers in the field of STEAM and coding.
The project will produce the following deliverables: a collection of digital education infographic mats on the topics of environmental sustainability and social inclusion, intended for primary school classes; a training course for teachers on the use of STEAM and coding for teaching the humanities in primary school; a set of recommendations for the application of innovative teaching methodologies based on STEAM and coding for teaching the humanities.
The project is being implemented by a partnership made up of universities, schools, and organizations in the fields of education and IT from five countries: Italy, Bulgaria, Spain, Portugal, and Romania [2].

3. The Target Group's Profile

Children aged seven and eight display active learning profiles marked by short attention spans and an intense need for involvement. These young learners thrive in settings that provide varied and engaging activities associated with similar learning objectives to avoid boredom. Their inherent spontaneity and enthusiasm for exploration enable them to accept mistakes as integral to the learning process, rendering them less reticent and more inclined to get actively involved than their older counterparts. They engage in active listening and imitation, which are crucial for their learning through play, performance, and experiential exploration. Positive reinforcement is essential at this stage; children react favorably to praise and rewards, enhancing their motivation and fostering an atmosphere that promotes learning. Effective pedagogy for this kind of group necessitates delivering concise, straightforward elucidations regarding their environment, utilizing age-appropriate language and visual aids. Interactive classes that integrate games, storytelling, and collaborative group activities enhance the enjoyment of learning while fostering the internalization of healthy habits and the cultivation of social skills. Encouraging engagement and explaining complicated concepts while promoting experiential learning are essential instructional tactics for these young learners.

4. Methodological Framework

The project employs STEAM as a teaching methodology to enhance students' disciplinary and soft skills, as well as their visual language through infographic storytelling, rather than traditional narratives. This approach utilizes interactive mats to engage children and facilitate their understanding. By integrating science, technology, engineering, arts, and mathematics, STEAM emphasizes hands-on learning that develops both technical and interpersonal skills. The use of infographics on interactive mats allows children to interact with content in a dynamic and visually stimulating manner, which boosts their comprehension and participation.

4.1 STEAM

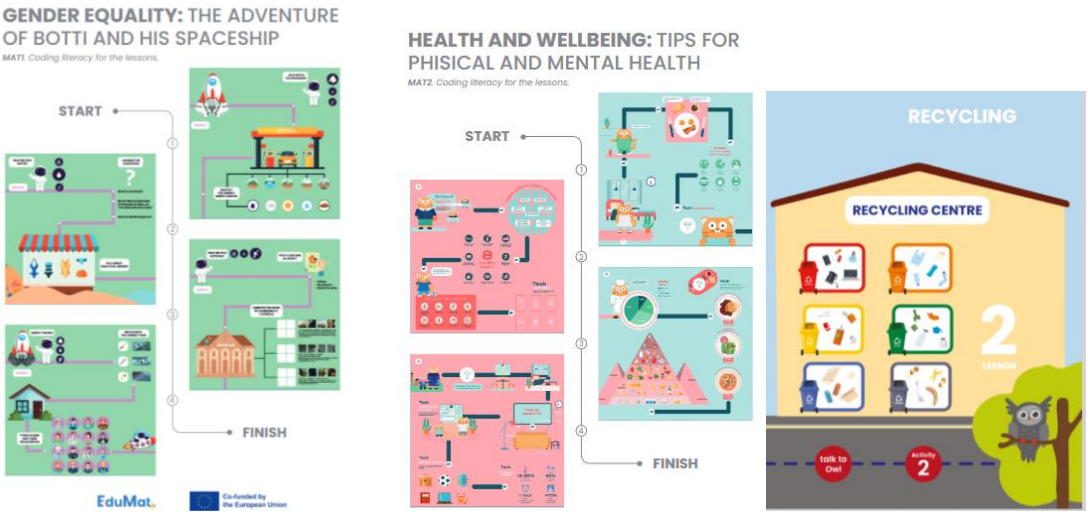
STEAM, which stands for Science, Technology, Engineering, Arts, and Mathematics, has become increasingly popular as a method to invigorate traditional teaching practices, promoting creative and experiential learning. The benefits of STEAM education include improved cognitive skills, as students conduct research and develop higher-order thinking; enhanced communication skills, as students learn to express their ideas clearly using various forms of communication; better social skills, as collaborative work fosters a democratic classroom environment, with teachers serving as guides; increased emotional motivation, as students become interested in a variety of subjects, boosting their overall engagement; greater technological proficiency, as students improve their digital skills, creativity, and critical thinking when evaluating information. While STEAM serves as a methodological framework rather than a primary learning objective, it supports broader educational goals, including those in the humanities [3].

4.2 Infographics

The project employs infographics, rather than traditional narratives, to tell stories through interactive mats, enhancing children's engagement and understanding. These interactive mats are dynamic educational tools that promote hands-on learning experiences for children, combining traditional teaching with technology. They encourage play-based learning by allowing children to explore concepts related to environmental sustainability, social inclusion, gender equality, health and well-being, biodiversity, climate change, and waste reduction through active participation. Additionally, the project incorporates coding methodologies, which stimulate computational thinking through computer programming [4,5,6].

An infographic is a visual representation of information or data that combines graphics, images, and text to communicate complex information clearly and concisely (Figure 1). Infographics serve as a visual thinking strategy, simplifying and organizing data to make it more digestible and engaging for the audience. There are a few key aspects of infographics as a visual thinking strategy. Infographics utilize visual elements—like icons, charts, graphs, and illustrations—to break down information into understandable segments, allowing viewers to grasp key points quickly. They organize content in a structured manner, often using layouts that guide the viewer through the information in a logical flow, making connections between concepts easy to understand. By incorporating visually appealing elements, infographics capture attention and increase interest in the topic, which aids retention and recall of the information presented. Infographics present quantitative data in a visual format (like pie charts or bar graphs), making it easier to identify patterns and correlations that may be less obvious in raw data formats. They can tell a story by illustrating a narrative or process through visuals, helping to contextualize the information for the viewer and provide a more meaningful understanding. Moreover, the use of colour, typography, and imagery in infographics can evoke emotional responses that further deepen engagement. By combining both aesthetic appeal and informative content, infographics not only convey complex ideas but also make the learning experience more enjoyable and memorable for the audience.

Fig. 1. Infographics



Infographics make complex data more accessible to a wider audience, including those who may find traditional text-heavy reports challenging to comprehend. Overall, infographics serve as an effective tool for visual thinking, enabling clearer communication, enhancing understanding, and fostering engagement with the information presented [4,5,6].

While infographics can be a powerful tool for visual thinking and communication, several biases may arise in their design and interpretation. Here are some potential biases about infographics as well as strategies for teachers to overcome them:

- Infographics may prioritize visual appeal over accuracy and clarity, leading to misleading or incomplete information.
- Infographics may selectively present information that confirms preconceived notions or ideas while ignoring contradictory evidence.
- Viewers may misinterpret the information presented due to a lack of understanding or design limitations.

When presented with infographics, the recipient tends to filter them through social and cognitive biases caused by their visual perception process, and data visualization is not error-free [4,5,6]. When someone decodes an infographic to communicate, they use patterns of interpretation that include grouping, organizing, and linking to make a value judgment based on what they see [4,5,6]. The recipient's level of attention during the artefact's consumption may have an impact on these patterns. This can lead to varied interpretations of the same data, depending on the individual's pre-existing beliefs and knowledge base. Consequently, data visualization must be designed with an awareness of these biases to enhance clarity and effectiveness in communication. Additionally, teachers should encourage children to reflect on their own biases and assumptions when interpreting infographics, fostering a more nuanced understanding of information. Incorporating multiple sources and formats can also ensure a well-rounded grasp of the topic.

To mitigate these biases, teachers can help pupils develop critical thinking skills by encouraging them to evaluate infographics critically, question assumptions, and consider alternative perspectives. As noted by Cortoni et al. (2023): “Critical thinking is essential for human development and the only defense against illusion, deception, superstition, and self-ignorance of ourselves and the world around us” [5, p.552].

4.3 Teaching Children Coding through the Educational Platform Scratch

Considering teachers' "growing realization that teaching coding to children will not only make it easier for them to understand how the information technology works but also give them a skill for life," we used the educational platform Scratch [6]. The educational platform *Scratch* was created by the Massachusetts Institute of Technology (MIT) to teach children the fundamentals of coding. It makes coding simple and fun, like building with virtual LEGO blocks. Coding is the process of decomposing difficult issues into smaller, more doable jobs. Instead of typing lines of code, Scratch employs vibrant, graphic pieces that children can drag and snap together to create interactive stories, games, or animations. *Scratch* enables children to bring their imaginative thoughts to life and unleash creativity by creating their own characters, backdrops, and interactive features. *Scratch* fosters creativity and encourages innovative thinking in children. Children can share their projects, receive criticism, and work together in the encouraging online environment that *Scratch p*rovides. *Scratch* helps children develop critical thinking, problem-solving skills, build confidence in coding, and enjoy a hands-on, creative learning experienceW, all while having a fantastic time [7].

4.4 The Interactive Mats

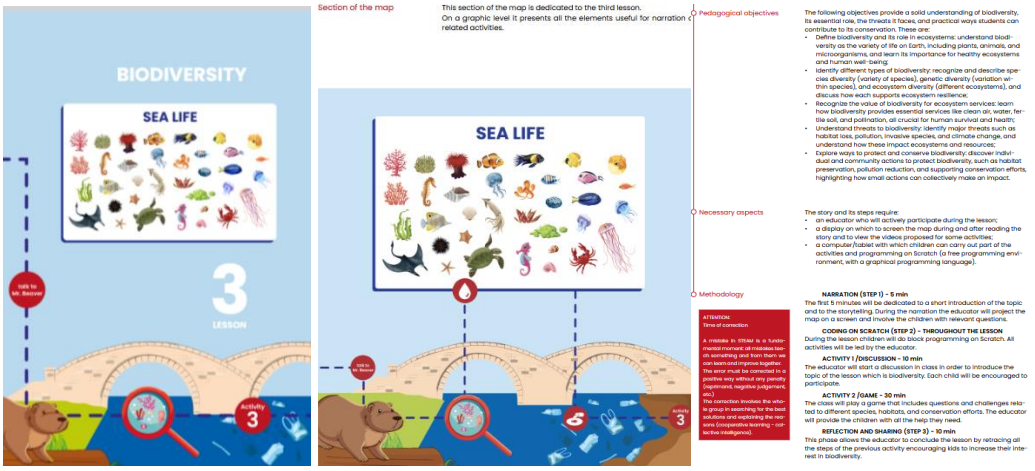
The EDUMAT+ project emphasizes our current reality, highlighting significant concerns that necessitate immediate action, while also guiding children on how to contribute effectively. For example, in module 6: "Life and Land," the children can learn about different environmental problems (Figure 2) that threaten the future of all living things and how these can be fixed. These problems include the buildup of trash in cities and the oceans, the worrying loss of biodiversity due to species extinction, and the widespread cutting down of trees that weaken the Earth's natural defenses [2].

Fig. 2. Different environmental problems

To facilitate children's understanding of these significant concepts, this project employs a fictitious narrative featuring Sunny, a robot from the remote planet Proxima. The environment on Proxima is deteriorating, similar to that on Earth. King Kurbi, the sovereign of the planet, is concerned about the devastation resulting from pollution, deforestation, and the extinction of wildlife. In a state of desperation, he resolves to send his son Sunny on a quest throughout the universe to seek solutions. Sunny's expedition leads him to Earth, where he encounters Rubi, a supportive and eco-aware child. They undertake an exhilarating quest to uncover three essential ideas that can rescue Proxima and also benefit Earth. At the conclusion of the narrative, Sunny returns to Proxima equipped with the information and remedies necessary to assist his planet. These fictional narratives will motivate pupils to implement environmental lessons in their life, thus enhancing the well-being of our world.

The teacher acts as a facilitator, introducing the subject of "Life and Land" to the children through an interactive and visual infographic mat. The session begins with the teacher aiming to spark interest and curiosity by posing open-ended questions, such as, "What is the significance of land for life?" and "What consequences may arise if we neglect the land?" Using the mat, the teacher encourages the children to explore various ecosystems, highlighting their richness and importance (Figure 3). By connecting the imagery on the mat to real-world situations, the teacher helps make abstract concepts more concrete and relevant to the students' lives.
A brief discussion follows, where the teacher explains key concepts such as biodiversity, ecosystems, and sustainability.

Fig. 3. Biodiversity



The teacher highlights different sections of the interactive mat, which include forests, oceans, and deserts, pointing out their unique characteristics and interconnectedness. The discussion emphasizes how various life forms, from microorganisms to large animals, depend on terrestrial environments for survival. The children then work in pairs to explore the mat further, using magnifying glasses or paper markers to engage with the material. The children begin by identifying specific animals, plants, or land features depicted on the carpet and classifying them. In the next stage, they become familiar with *Scratch*, a basic coding platform that allows them to create a digital representation of the ecosystem they observed on the mat. For example, they might program simple animations that show the growth of plants or the movement of animals within a forest. The final stage encourages children to relate their learning to their own lives and consider the significance of ecosystems for their daily experiences. They are assigned to investigate a local ecosystem, such as a nearby forest or park, and gather photographs or information about its biodiversity. In the subsequent lesson, they will present their findings, making a connection between classroom activities and their community.
This hands-on approach not only deepens their understanding of ecological principles but also fosters a sense of stewardship for the environment. By linking their classroom learning to real-world experiences, children are encouraged to appreciate the complexities of nature and reflect on their role in its preservation [7].

5. Teachers' Feedback

We presented the project to teachers and school principals in Iasi, Romania. We explained our goals, target audience, strategy, and expected results. We also discussed the platform used for the project and asked them to help us evaluate the interactive mats. After reviewing the guidelines and methods, participants used the interactive mats to find strategies for their situation and how to use them with their students. We informed them of the significance of their comments for enhancing the tools developed and provided them with the evaluation questionnaire to complete. The method was effective, resulting in a substantial number of respondents. Consequently, six primary schools participated, representing diverse backgrounds, including a private school and standard state schools with students at risk of academic disengagement.
This phase encompassed 20 educators from seven institutions in Iasi. The educators were solicited to articulate their perspectives on various areas of the guidelines (Figure 4), indicate which element they considered most beneficial, and highlight the most intriguing features and strengths of the project.

Fig. 4. Evaluation of the interactive mats and guidelines

Please tick one of the numbers below where 1 = Poor and 10 = Excellent

Relevance	□ □ □ □ □ □ □ □ □ □
Accessibility	□ □ □ □ □ □ □ □ □ □
Coherence	□ □ □ □ □ □ □ □ □ □
Clarity	□ □ □ □ □ □ □ □ □ □
Innovativeness	□ □ □ □ □ □ □ □ □ □
Consistency of the layout	□ □ □ □ □ □ □ □ □ □

The feedback (based on the criteria established in the application) gathered from these educators provided valuable insights into their experiences and expectations regarding the interactive mats and guidelines. Many emphasized the importance of tailored support for integrating IT into their teaching, having pupils as collaborators in the learning process, and fostering creativity through technology. Some teachers mentioned that the project could improve student interest and encourage a hands-on way of learning, allowing students to explore ideas actively. Others pointed out that it could also provide chances for students to work together, boosting engagement and making the classroom more inclusive.

The scores for the product range from 8.4 to 9.3, resulting in an overall average of 8.7. Participants praised the project for its relevance to real-world issues and its ability to address contemporary challenges. Innovativeness received the highest rating of 9.3, followed closely by transferability at 9.1 and usability at 9.0. Many teachers highlighted the importance of combining technology in education with inclusive practices, viewing it as a valuable tool feature:

“This project is particularly beneficial because it provides practical resources and reliable solutions for immediate use. I found the interactive mats especially valuable; they offer useful materials and methods for classroom implementation. These mats not only enhance pupil engagement but also cater to diverse learning styles, making lessons more accessible for all pupils. By incorporating innovative materials, educators can foster a more inclusive classroom environment that encourages collaboration and creativity.”

Although the project does not include a piloting stage, all teachers agreed that they would use all modules with their children. They expressed enthusiasm about integrating the new materials into their lesson plans and adapting their teaching strategies accordingly. This commitment reflects a strong belief in the potential benefits the project can bring to their students' learning experiences.

6. Future Developments of the Project

The online training course equips primary school teachers with the skills needed to integrate coding into their curriculum. It focuses on themes of environmental sustainability and social inclusion through an interdisciplinary approach. Utilizing the STEAM methodology, the course explores coding as a tool for enhancing learning experiences.

The course consists of an initial module comprising eight units that introduce the concepts of coding literacy using open-source software, specifically Scratch. The core modules provide a methodology for applying Scratch in the classroom and feature ten case studies that align with environmental and social themes from the UN 2030 Agenda. Each case study outlines learning objectives, educational pathways, and relevant school subjects. Each module includes storytelling sessions that connect the themes to coding activities using Scratch. The final module emphasizes the development of evaluation tools to assess student learning and the overall effectiveness of the course.

7. Conclusions

The analysis of teachers' feedback highlighted the project's impact on the target groups. The combination of storytelling and coding methodologies enhances the learning experience by integrating technical coding skills with narrative creativity, visual literacy, and experiential learning. This integrated approach not only fosters a deeper understanding of computational thinking but also instills essential skills that children will carry into their personal and professional futures.

Teachers can leverage these methodologies to create a more engaging, meaningful, and impactful learning environment. Storytelling captures children's interest by providing context and significance to coding tasks. By embedding coding within a narrative framework, students gain real-world context, helping them connect coding principles to their everyday applications. When children understand the purpose behind what they are coding, their motivation and commitment to learning increase.

By tackling story-based coding challenges, children enhance their logical reasoning, pattern recognition, and problem-solving abilities — all crucial components of computational thinking.

Incorporating coding into educational practices boosts children's problem-solving skills and creativity while preparing them for a technology-driven world.
By adopting diverse methodologies, teachers can create engaging and effective learning experiences tailored to children's needs and learning styles. The project promotes strategies that help schools develop children's critical thinking skills in a digital environment, better preparing them for life. Additionally, the project supports teachers in empowering children to thrive in a globalized, digitized, and rapidly changing society that generates vast amounts of information.

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