TEACHING KIDS THE BASIS OF CODING. MAKE IT FUN!

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Abstract

The following article presents the need for the integration of coding in classrooms to develop 21st-century skills such as critical thinking, problem-solving, and creativity. In a computer-driven world, younger generations increasingly demand to learn the foundations of coding, such as computational language. There is an observed lack of training in the field of programming, both among students and, more concerning, among teachers. The need for tools that address how to integrate programming in the classroom is imminent.

The Erasmus+ Coding4Kids project provides the opportunity for primary and secondary education students to learn the foundations of coding and offers tools for primary and secondary education teachers to integrate it into their subjects.

Keywords: coding, project, coding in education, STEAM methodology, primary education, secondary education, teacher training, creativity, critical thinking, problem-solving,

Coding as Digital Competence in Education

Digital skills are assuming a growing significance within contemporary society. As asserted by UNESCO, these proficiencies facilitate the creation and dissemination of digital content, foster effective communication and collaboration, and offer problem-solving capabilities (Cuesta, 2022).

Concurrently, within the realm of professional environments, the demand for digital skills by enterprises and employers is progressively escalating. Such skills empower organizations to enhance their competitiveness and adapt to modern practices, thereby contributing to heightened productivity (Cuesta, 2022).

Programming and coding languages are integral components of the aforementioned digital skills. To adequately equip young individuals for their forthcoming endeavors, it is imperative that educational institutions incorporate the teaching of such languages into their curriculum. Particular emphasis should be placed on

cultivating the aptitude to write in programming languages, enabling students to create websites and programs.

The prevalent challenge lies in the inherent difficulty that adults often encounter when attempting to grasp this novel language. In contrast, digital natives perceive programming as a familiar dialect, effortlessly harnessing it to stimulate their imagination and acquire knowledge through interactive engagement (Fundación Telefónica, 2020).

In an era dominated by computer-centric societies, it is imperative for students to acquire proficiency in computer programming languages. In the future, the ability to program may prove to be as essential as possessing proficiency in spoken English. While subjects such as mathematics, geography, chemistry, physics, and biology have long held significance in the realm of scientific education, computer science, despite its distinct domain, has yet to establish its rightful place within the school curriculum.

The question arises: should programming and coding be compulsory subjects? Addressing this query necessitates an examination of the future demand for skills within the professional sphere that these young individuals will encounter. Research conducted by Carl Benedikt Frey and Michael A. Osborne indicates that as many as 54% of jobs in Europe could be automated within the next decade (Benedikt & Osborne, 2013).

In the digital realm, it is imperative for young individuals to comprehend the internal workings of computers and software. Emphasizing computational thinking is of utmost importance, as this language underpins and propels numerous technologies that pervade contemporary society (Yadav, 2014). This surpasses the confines of current computer science education, which primarily revolves around the acquisition of computer operation and utilization skills. The underlying perspective asserts that acquiring proficiency in present-day computer programs may yield limited utility, as they swiftly become outdated. Instead, it is crucial to develop proficiency in navigating various forms of digital media. While technology undergoes rapid transformations, the fundamental principles of programming have endured unchanged throughout this period.

Is it necessary for all children to be trained as programmers? No, but it is essential and realistic to provide all children with a foundation in programming basics. This would enhance their understanding and comprehension of how technology functions. Is such an endeavor feasible? In terms of teaching materials, there is an abundance of resources available for imparting programming skills to children and young individuals.

However, the challenge lies in integrating programming education into the curriculum and adequately preparing teachers to deliver this instruction. A study conducted by the Organisation for Economic Co-operation and Development [OECD] in 2018 revealed that less than 40% of European educators felt adequately equipped to utilize digital technologies in their teaching practices (OECD, 2019a). Furthermore, a study conducted by the International Association for the Evaluation of Educational Achievement [IEA] in 2018 indicated that no more than one-third of students aged 13-14 possessed even the most rudimentary level of digital skills (IEA, 2018).

As per data provided by the European Commission [EC] (EC, 2019), a substantial proportion of students in both lower-secondary and upper-secondary education levels, specifically 79% and 76% respectively, have rarely or never participated in coding or programming activities within their educational institutions. This survey encompassed 31 countries and involved interviews with school management, teachers, students, and families.

In response to these findings, the European Union has implemented initiatives aimed at digitalizing education. Examples of such endeavors include the Digital Education Action Plan 2021-2027 (EC, 2020) and the EU Code Week, which commenced in 2020 (EC, 2023).

The Skills that are Fostered through the Learning of Coding

The knowledge required for coding skills will help understand the "background" of the devices we use on a daily basis. Programming teaches children to create rather than consume. Through programming, they acquire skills such as creative and logical thinking, spatial awareness, problem-solving abilities, structuring things/situations, collaboration, and more (Bers, González-González & Armas-Torres, 2019).

The purpose of learning programming is not necessarily to train children to become computer programmers, but rather to impart them with skills that will be highly valuable for any future educational or professional pursuits. Creative and critical thinking are among the essential skills for students. These skills can be enhanced through programming by utilizing playful, gamified, dynamic tools that foster creativity, critical thinking, and logical reasoning.

Creativity is a vital skill that empowers individuals to think innovatively, generate fresh ideas, and approach problems from new perspectives. These skills are included in the well-known 21st-century skills (OECD, 2019b). Integrating coding education, as an innovative pedagogical approach in the field of education

(Sánchez-López, Pérez-Rodríguez, & Fandos-Igado, 2019), in schools can provide students with a unique platform to nurture their creativity.

The integration of coding with other disciplines offers a seamless blend that enables students to explore the synergies between computer science and various domains. By incorporating coding into subjects like art, music, literature, science, or social sciences, students are empowered to unleash their creativity through interdisciplinary projects. For example, they can create interactive visualizations to represent scientific data, compose digital music using coding principles, design digital storytelling experiences, or develop virtual reality applications that simulate historical events. The amalgamation of coding with other disciplines fosters a comprehensive comprehension of how computational thinking can amplify creativity and innovation in diverse fields (Williams, 2021).

According to Yadav and Cooper (2017), fostering creativity through coding education provides schools with an opportunity to cultivate essential skills for the digital era. This approach not only prepares students for future careers in technology but also equips them with transferable skills applicable in diverse domains. The cultivation of creative problem-solving, innovative thinking, and interdisciplinary exploration through coding empowers students to become lifelong learners and active contributors in a constantly evolving society.

Moreover, coding as a creative outlet enhances student engagement and motivation, enabling them to develop a profound passion for exploring and creating with technology. They transition from being mere consumers of content to becoming creators or, at the very least, gain the motivation to create.

Erasmus+ Project Coding4Kids

The Erasmus+ Coding4Kids project [2022-1-ES01-KA220-SCH-000086530] stems from the European need to incorporate coding into primary and secondary education. It embarked on its journey on December 1, 2022, and will continue to develop its outcomes until December 31, 2024. Over the course of two years, the project consortium, comprising Spain, Greece, Cyprus, the Netherlands, and Ireland, will collaborate to create educational resources for students and teachers pertaining to the fundamentals of coding.

All the partners forming the consortium have prior experience in implementing Erasmus+ projects, as well as projects related to new technologies, STEAM methodology, and coding. The coordinating organization of the project is the Autonomous University of Madrid, which has extensive previous experience in coordinating Erasmus+ projects and specializes in bachelor's and master's degrees in teacher training.

This 24-month project consists of four work packages: the first one dedicated to project management; a second work package focuses on creating learning modules for primary and secondary students; the third work package involves teacher training materials; and the final work package is responsible for promotion, dissemination, and activities to engage stakeholders.

In essence, the project will develop resources for the two main target groups: primary and secondary education students, as well as teachers.

Development of Learning Modules

The learning modules are developed within the second work package of the project, targeting primary and secondary education students. Among its objectives, we can highlight the creation of a set of learning modules on programming, the development of activities to promote the learning of programming fundamentals, the acquisition of new digital tools and methodologies, and the exchange of knowledge, contexts, and ideas among partners.

All modules will be accessible in all the languages of the partners to ensure the accessibility of content for all individuals participating in the pilot phases and the future autonomy of the project.

Twelve learning modules are being developed, divided into three phases: computational language; introduction of new concepts such as variables, methods, and procedures; and learning to automate.

The structure of the modules consists of a brief introduction, description of the objectives, a concise theoretical content related to the module's topic, and three lesson plans for each module. The lesson plans are documents designed for teachers to use directly in the classroom with their target audience, the students. For example, an example of a lesson plan for Module 1 of the first phase is "What is computational language? Definition and introduction”.

To develop these modules in a digital format, a training session was scheduled for the consortium in Cyprus, where the Cypriot partner provided training to the other partners on the development of SCORM packages and adapting the modules to an e-Learning platform.

To ensure the quality of the outcomes, once all the lesson plans are created and the modules are finalized, a pilot phase will be conducted. Each partner country will test the learning modules with four primary and/or secondary school teachers and 100 students. This will involve a total of 24 teachers and 600 students who will

provide feedback and suggestions to ensure the final result meets the necessary quality standards.

Train the Trainer Package

The third work package of the project focuses on the development of an e-learning platform where teachers will have access to all the resources developed in the project, including the lesson plans, theoretical content, and other tools to incorporate programming into their teaching practice.

This platform will be user-friendly and developed in Moodle, hosting various content for teachers. First, the theoretical content will be generated based on the creation of the lesson plans in the previous work package. Furthermore, all the content created in the project outcomes will be adapted to the Moodle format, providing a more visual, engaging, dynamic, gamified, and playful learning experience. Moodle offers different tools that will facilitate the adaptation of such content.

Jaitek Tecnología y Formación (Jaitek) is the partner responsible for the development of the platform. They are one of the Spanish partners in the project, with over 20 years of experience in developing LMS platforms, e-learning solutions, training in new technologies, and teacher training.

Conclusions

As we have seen, the inclusion of programming in classrooms promotes the acquisition of multiple 21st-century skills, such as critical thinking, problem-solving, and, above all, creativity.

So why don't we include this discipline in all classrooms? The main problem lies in the lack of teacher training in the field of programming. This does not necessarily mean that all teachers need to be programmers, but rather that they should acquire basic programming concepts and, most importantly, tools, resources, and materials to integrate it directly into their teaching practice, regardless of the subject.

Thanks to initiatives like the Erasmus+ *Coding4Kids* project, the integration of programming in classrooms is increasingly in demand and sought after. With this project, we not only obtain a package of resources for the classroom, but also theoretical content specifically aimed at teachers, enabling them to acquire the basic yet necessary knowledge about programming and how to integrate it into their subjects.

The project is still in the development process, but it is expected that the pilot phase will yield results that help demonstrate the need for the topic and the desired quality of the resources.

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