RESEARCH ARTICLE

Visual programming for the greation of digital shadow play performance using mobile devices in times of Covid-19

Alexandros Georgios Kapaniaris[1*]   **Georgios Zampetoglou**[2]

[1] School of Classics and Humanities, Department of History and Ethnology, Democritus University of Thrace, Komotini 69132, Greece
[2] School of Nea Ionia, Ministry of Education & Religions, Volos 38333, Greece

[*] **Correspondence to:** Alexandros Georgios Kapaniaris, School of Classics and Humanities, Department of History and Ethnology, Democritus University of Thrace, Komotini 69132, Greece;
Email: akapania@he.duth.gr

Abstract: The design of a guided research project using an educational scenario based on a visual programming environment using smart mobile devices (smartphone, tablet) aimed at creating a digital shadow play performance. It was implemented in a classroom environment as part of the festive activities of the 4th Primary School of Nea Ionia Volos "Panagiotis Katsirelos" to celebrate the 200 years since the Greek Revolution. Moreover, the digital work that emerged was presented at the 10th Digital Creation Festival (Volos, Magnesia junction). The guided research project was approached interdisciplinary with the collaboration of teachers of Informatics, Theatrical Education, and general education teachers. The educational scenario was addressed to the 6th-grade primary school students. The students were already familiar with internet applications, ICT tools, and Scratch, a visual programming environment. The students used three smart mobile devices to create the final digital artifact with Scratch's visual programming environment due to special learning conditions caused by the Covid-19 pandemic.

Keywords: guided research project, mobile learning, shadow play, folk culture, visual programming

1   Introduction

In this extraordinary crisis environment caused by COVID-19, almost all sovereign national governments took strict measures to prevent the virus's rapid spread and reduce the number of casualties in terms of infections and loss of life. Following the COVID-19 outbreak, the traditional classroom approach where face-to-face learning occurs was rapidly replaced by virtual classrooms. In this new classroom setting, teachers were urgently asked to adapt to online methods of teaching. During this period, both students and teachers experienced significant levels of uncertainty about how and what to teach (Karakose et al., 2021a). The changes in teaching methods and the lack of established guidelines for these new teaching practices have further increased this uncertainty. Educators had to adapt to online teaching methods at all schooling levels and transform teaching materials for the new online space to ensure students could continue learning during the pandemic. In addition, both teachers and students had to learn how to use the various forms of online software used in distance education (Karakose et al., 2021b).

The primary purpose of this educational scenario was to implement a digital shadow play performance following a guided research project. For this reason, the participant searched for information on the internet, viewed relevant videos, and used software to create the text and graphics of the gameplay. The guided research project was implemented using the visual programming software Scratch and smart mobile devices. Scratch, unlike general-purpose programming languages, offers a student-friendly programming environment without code writing being required. Thus, the "drag and drop" method provides a limited set of instructions in the form of blocks so that students can experiment, program, and eventually create their projects. The students sought information about a hero of the 1821 revolution and a hero of shadow play following the educational scenario activities. After assembling the required information, they created equivalent dialogues for these heroes. They then searched the internet again for details on shadow play figures related to their chosen heroes. This was necessary to introduce these heroes as costumes in Scratch's visual programming environment and accordingly program each figure to move and speak following each student group scenario.

2   Learning programming through mobile devices

Consequently, using programming to teach Computational Thinking (CT) and coding skills is common in postgraduate and continuing education (Minchillo et al., 2018). New curricula around the globe point to the need to improve digital literacy, CT, and programming (or coding), to support a generation of children who will build the future of civilized countries (Falkner, 2015). This shift has prompted an uptake in pedagogies and frameworks in the education systems worldwide (Papadakis & Kalogiannakis, 2019; Papadakis & Kalogiannakis, 2020). Coding and CT can often meet difficulties to fit into a formal early childhood program. At the same time, some educators are discouraged from teaching young learners how to code for various reasons, such as the lack of prior training or studies and/or extensive experience with coding (Herdzina, 2018). For that reason, learning initiatives to foster computational literacy are now actively being developed, such as the 'hour of code' in the United States and the 'code week' in the European Union (Strawhacker et al., 2018).

Furthermore, several computational tools and kits are available to help younger children with different coding backgrounds or expertise. These tools grasp essential coding elements through interactive games and activities (Dorouka et al., 2021; Kyriakides et al., 2016). Digital applications or apps for smart mobile devices that teach young children coding skills and CT concepts with game-like activities have recently gained significant interest (Sheehan et al., 2019). Research has shown that developmentally appropriate tools offer interactions and collaborative learning (Vaiopoulou et al., 2021; McLennan, 2017). At the same time, through playful ways, encourage children to explore coding (Tzagkaraki et al., 2021). Many children use smart screen devices and apps at increasing rates, while many apps are already advertised as 'educationally valuable' (Schroeder & Kirkorian, 2016). Thus, it is critical to identify and evaluate whether and how these apps are designed to maximize educational benefits.

It is well established that young children spend a substantial amount of time with touchscreens devices. They can handle these devices as young as 18 months old, often before reading. Touchscreen technology has reduced the children's need to perform tasks with a computer, which was challenging for young children with limited fine motor skills. Furthermore, object-oriented, "drag and drop" apps have removed much of the code development complexity inherent in traditional text programming languages. As a result, they engage teachers and students in purposeful activities and conversations and help students better understand CT concepts. Findings prove that coding apps may be an ideal tool to introduce young children to coding activities even before entering formal schooling (Sheehan et al., 2019; Sullivan et al., 2017). It is essential to mention that physical coding toys/approaches are more engaging for young children and have huge educational potentials (Hamilton et al., 2020).

Although there are many programming tools in apps (Ehsan et al., 2017), most are not designed for young students. It is not enough to copy models of computer science education developed for middle or high school students, which are not developmentally appropriate for young children (Bers, 2020). Some coding apps rely heavily on words, while others mask programming actions, thus obscuring critical aspects of creating coding (Kazakoff, 2014). Text-based programming languages are not considered developmentally appropriate for children aged 5–7. This is an age group that includes pre-readers (0–5) and emergent readers (6–7) (Sullivan & Umashi Bers, 2019; Pelánek & Effenberger, 2020). On the contrary, evidence suggests that young children can learn coding at a young age when given developmentally appropriate tools. These tools must support open-ended play and reduce cognitive effort in a fun and enjoyable way (Murcia et al., 2020). A developmentally appropriate educational approach must be consistent with the children's needs and embrace their maturational stages by combining play, discovery, socialization, and creativity (Bers, 2019). Since 2009 Resnick and his colleagues proposed that programming environments must be characterized by "low floors, high ceilings, and wide walls" (Resnick et al., 2009).

3   Guided research projects in the Primary school

The integration of the research assignments is directly related to the philosophy of the current Information Technology (IT) curriculum (2021-22) and the new IT curriculum that will be implemented in the years 2021-22 and 2022-23. Following the IT curriculum, students are treated as minor "intellectuals", "scientists", and "researchers" (Ministry of Education, Lifelong Learning and Religious Affairs, 2010: 10-11). The deliverables of the research work include the research report, the artifact, which can be in the form of crafts, artistic composition, or any other analog or digital format. Finally, the actions include visits, excursions, and events in collaboration with the wider local community (Matsagouras, 2011).

The role of the internet in the implementation of research projects is complementary, providing students with ideas and information to formulate the topic to be explored and their initial research questions. Therefore, the teacher should create and/or enhance this inquiry process. In this way, students will be helped to achieve their goal, i.e., the formation of the aim and central questions of the research work. However, for the teacher to fulfill his/her role in implementing the research work (project), he/she should know and suggest to the students developmentally appropriate online tools. Students must have access to these tools from a computer lab environment. In the present study, the online tools that contributed to the collection of information by the students were search engines (Greek and/or foreign languages), meta-search engines, and thematic catalogs. Additionally, websites that collect educational material were used for multiple representations of information (texts, photos, video, audio) (Kapaniaris & Papadimitriou, 2012).

Furthermore, the basic features of project planning were based on: a) Diversity: enriching many different types of programs (internet search, enriched digital books, collaborative environments for managing and sharing digital material, visual programming, etc.), b) Personalization: facilitating students to personalize their digital crafts based on their creativity, c) Possibility of revealing & exploratory learning, d) Enhancing students' interest in laboratory hands-on activities and development of additional skills (e.g., exploring the additional possibilities of software) (Kapaniaris & Papadimitriou, 2012).

In the scope of Primary School's Information and Communication Technology (ICT) discipline, the research projects (short-term) with guidance require shorter procedures while evaluating and utilizing various sources. These sources include using the internet in the context of appropriate activities related to Information and Communication Technologies (ICT) or even other school curriculum subjects. The topics of the project were part of a meaningful framework of school and social life activities. Consequently, it was proposed to implement intersectional assignments to connect various curriculum subjects (language, history, physical sciences, environment, mathematics, social sciences, etc.) (Kapaniaris, 2019).

The actualization of a work plan during ICT in Primary school presupposes both "interdisciplinarity" and "intersectionality." The term "interdisciplinarity" is associated with the analysis of a topic in the context of research work based on the cognitive objects of the classroom curriculum. In contrast, "intersectionality" is associated with analyzing a topic where questions are asked by themselves (Aslanidis, 2011).

4   Curriculum implementation

4.1   Curriculum for the scientific field: Arts - Culture

According to the current curriculum for the scientific field: Arts - Culture, Educational Learning Object: Art Education, for grades first to sixth in primary education, students are expected: a) to become acquainted with multimedia and ICT applications through games, b) to explore and use the internet for research and publication of their works and/or actions, c) to become acquainted with the publication of their ideas through their works of art and/or digital crafts, either the exhibiting their works in the community or on the internet.

Regarding the more specific teaching objectives for the 5th and 6th grade in the course of Art Education, the students are sought: a) to comprehend that culture and art are an essential way of expression and can convey messages on crucial issues such as peace, humanity, rescue from the energy crisis that threatens the planet, recycling, fraternity, b) to evaluate new information and transform it to enrich their works, c) to exploit their previous knowledge on culture and visual arts in other subjects, and vice versa, d) to develop initiatives and disseminate their ideas by collaborating and respecting the ideas of others, e) to use problem solving strategies applied in the field of culture and visual arts in other cognitive areas, f) to enrich their ideas and work with digital technology, g) to apply digital methods and techniques, such as short shots with a digital camera and / or video which are then processed with simple programs offered on school computers to create video art, h) to participate in individual and / or group work through which they take initiatives to search for information (internet, school library, publications), their processing and utilization, up to the exhibition of their works in the school unit or the their publication on the internet.

4.2   Curriculum for the scientific field

According to the existing teaching instructions for Information and Communication Technologies (ICT) for the school year 2021-22 concerning all grades of Primary school, follow

a relevant suggestion of the Institute of Educational Policy of the Ministry of Education & Religions in Greece. The indicative distribution of teaching subjects section includes, among others, for the 5th and 6th grade the following relevant axes: a) "I communicate and collaborate with ICT" in the thematic fields "I learn the Internet" and "I communicate and collaborate," b) I investigate, discover and solve problems using ICT in the thematic fields "I program on the computer" and "I implement work/research plans," c) ICT as a social phenomenon in the thematic field "I acquire digital education and literacy."

Especially in the thematic axis "I investigate, discover and solve problems using ICT" in the thematic field "Implement work/research plans (project)," the primary goal of the section is research projects (of short duration). These projects require procedures that evaluate and utilize information from various resources on the internet and the World Wide Web in the context of appropriate activities related to ICT and the other curriculum subjects. The topics of the work plans are part of a meaningful framework of school and social life activities. Therefore, it is proposed to implement intersectional assignments that connect various curriculum subjects (language, history, physical sciences, environment, mathematics, social sciences, etc.)

The present educational scenario, on which the guided research project was based, was compatible with the Intersectional Unified Curriculum Framework of the Primary School. It was also consistent with the 6th grade Language course Curriculum for producing written speech, the respective History Curriculum, and the Theatrical Education course Curriculum. Furthermore, it was related to the existing curriculum for the teaching of informatics in Primary schools (Unified Reformed Curriculum) and the Intersectional Unified Curriculum Framework, with the thematic unit for the 6th grade of elementary school "I program and control."

The scenario was compatible with the new detailed pilot program. In particular, in the sub-section "I program the computer" of the section "Exploring, discovering and solving problems using ICT," the expected learning outcomes are identified with the objectives of the scenario. They also follow the suggestion of the Institute of Educational Policy to manage the material for the subject "Information and Communication Technologies (ICT)" at Primary School. Also, the educational scenario on which the guided research project was based is compatible with the new under-development IT curriculum for the primary school, which will be piloted in 2021-22 and 2022-23. In addition, it can have a similar application in other grades of the Primary School after proper modifications.

Following the above instructions concerning the distribution of the teaching subjects per axis and the expected learning outcomes, we conclude that the specific educational scenario based on the guided research project meets these specifications concerning how the students worked. Moreover, the same topic concerning shadow play and programming through creative activities using ICT requires research projects (short duration). It also needs the utilization of research material that must be carried out to develop small tasks (multimedia applications).

4.3   Visual programming environment scratch

Coding is part of logical thinking and is one of the basic skills known as '21st-century skills' (Chatzopoulos et al., 2021). Coding acquisition is necessary as it is used in a wide range of occupations. However, computer programming is challenging to learn, and programming courses often have high drop-out rates. Novice programmers suffer from a wide range of difficulties and deficits. Research in teaching and learning programming across different countries and educational contexts reveals that novice programmers face the same challenges in their efficiency of writing, debugging, and running programs. These difficulties have led those involved in programming to consider further the most effective ways to facilitate novice programmers in learning the basic programming concepts. Visual programming environments that support program construction through a drag-and-drop interface are among the most popular coding tools for teaching novice programmers.

Scratch is an educational visual programming environment created by the MIT Lifelong Kindergarten group. Since its first official release in 2003, educators of all levels worldwide have been using it successfully to teach introductory programming lessons. Scratch has become the most popular programming environment for beginners aimed at Primary and Secondary students. Similar to international trends, in Greece, most conference reports are related to successful examples of Scratch use at all levels of education. According to recent data from the Scratch website, approximately 73 million registered users in June 2021 shared 80 million projects and posted 487 million user comments.

Scratch as a programming environment allows the creation of programs by connecting different pieces just like a puzzle, providing additional graphical and multimedia management capabilities. It supports novice users to create animated stories, multimedia presentations, games, simulations, and other interactive programs in a fun way by enabling them to share their

creations online through a highly dynamic online community (Poultsakis et al., 2021; Vidakis et al., 2019). Scratch users learn to program, develop computational thinking, think creatively and collaborate - skills necessary for the 21st century (Maloney et al., 2010; Brennan & Resnick, 2013).

4.4   Shadow play in education

Shadow play creates an interactive relationship with the students. Especially in education, it functions as a spectacle - entertainment and as a learning tool. Shadow Play, through performances with Karagiozis as the main hero, positively activates the children, enhancing their creativity and imagination. According to Wikipedia, Karagiozis or Karaghiozis (see Figure 1) is a Greek folklore's shadow puppet and fictional character. He is an offspring of the Turkish shadow play Karagöz and Hacivat and the tales narrated in the Turkish and Greek shadow-puppet theatre (Wikipedia, 2021). Thus, children improvised, imitated, painted, directed, created their own stories and original dialogues. Additionally, students within the group actively participate in the group creation of an original script, work collectively, learn to respect, and are given the opportunity for collaborative and experiential learning and strengthening relationships between children (Kiourtsakis, 1996).

Figure 1   Karagiozis shadow puppet (Source: Saltmarsh - Own work, CC BY-SA 2.0.)

4.5   Design of a guided research project

The students' cognitive objects and skills through the educational scenario on which the guided research project was based were the production of written speech, the folk tradition and the shadow theater, the heroes and the fighters of 1821. Beyond the autonomous cognitive object (visual programming), computer science is defined as an interdisciplinary tool for approaching knowledge, utilizing ICT applications to diffuse knowledge in all learning objects. More specifically, shadow play brings the students in contact with a particular form of folk tradition, familiarizing them with the peculiarities of shadow play through the approach of the written text intended for a digital interactive performance of our well-known Karagiozis (a central figure in Greek shadow play).

5   Teaching process: Assessment of students

The first teaching hour (psychological and cognitive preparation) of this educational scenario began with the presentation of a short video (https://www.youtube.com/watch?v=DI5_mh5_krM) on the history of shadow play. A discussion in class followed to motivate students and help

them realize the importance of shadow play as part of our folk tradition. Then, the students navigate on the website of the Spatharis Museum (http://www.karagiozismuseum.gr) and study the main characters of shadow play. After this, they watch a short play by Karagiozis to get to know the unique characteristics of each hero (dialect, movement, etc.) and observe how the heroes interact through the script of the script play (see Figure 2)

Figure 2   Shadow play performance on YouTube play

At the end of the 1st teaching hour, a corresponding worksheet was completed, including psychological and cognitive preparation activities. The aim was to form an appropriate emotional climate, evaluate students' existing knowledge, and detect any cognitive difficulties. The teacher monitored the process throughout all the activities. In case of a problem observed, the teacher helped and encouraged the students. At the end of the teaching hour, there was a short plenary discussion to resolve questions and cognitive difficulties that may have arisen during teaching. During this teaching hour, the Theatrical Education teacher's contribution was deemed necessary. After video screening and through a plenary class discussion, the students realized the peculiarities of the theatrical text.

At the beginning of the 2nd teaching hour, there was a short plenary discussion in the class. Then the students navigated to the digital resource of the photodentro (http://photodentro.edu.gr/v /item/ds/8521/10881). The National Accumulator of Educational Content "PHOTODENTRO" collects descriptions (metadata) of digital educational material. This activity aimed to match the heroes of shadow play with their names and connect them with the previous lesson creating an aesthetic experience. After screening the multimedia material, the children searched the internet for heroes of 1821 and filled in the corresponding activity sheet with information regarding their actions and contribution to the fight.

As part of the group activities, the children had to choose one shadow play hero. Students searched and downloaded in the group e-portfolio folder relevant shadow play images/figures related to these heroes. The images/figures were digitally processed by the members of each group using image editing software. The images were adjusted according to the specifications given by the teacher, concerned with their size, resolution, and background. The teacher supervised, organized, and provided technical and cognitive support throughout the teaching intervention where needed.

The 3rd teaching hour begins with a small plenary discussion, taking into account the shadow play's heroes and the play's general theme. The Theatrical Education teacher's contribution is essential for guiding the conversation. Also, he explains how students will develop the theatrical discourse and the general script structure while providing ongoing cognitive support. Collaboratively, students should create dialogues for the two heroes they have chosen in the previous lesson. Using a worksheet and word processing software, they record for each hero the lines, the possible duration in seconds, the possible movement of the figure, and save it in the e-portfolio of their team.

In the 4th teaching hour, the material recorded in the respective activity sheet was transferred to the Scratch visual programming environment to program the final deliverable (https://scratch.m it.edu/projects/525008969) (see Figure 3).

Children used the corresponding activity sheet (stored in their e-portfolio), where they had recorded the dialogues and other relevant information about their heroes. Next, they started the Scratch visual programming software (either online or the desktop version). Each group
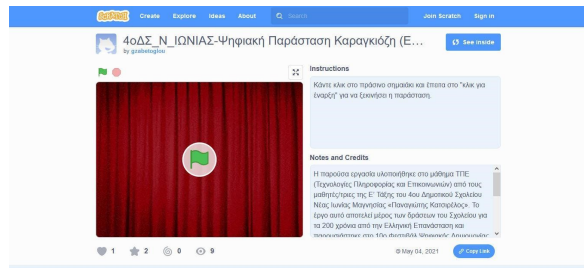
Figure 3   The home page of the online Scratch version

inserted the images of the heroes they had selected. Then they created the necessary dialogs, always consulting the corresponding worksheet. Finally, they programmed each figure/object to move, reproduce sound effects, and adjust the transition timing between dialogs.

For the final form of the digital play, each group's digital work was merged into the final Scratch file, which was the final deliverable of the teaching scenario (see Figure 4). Throughout the lesson, the teacher had a supportive role, enhanced the students' self-motivation, and provided cognitive and technical support where necessary.

Figure 4   Snapshot of the digital play

The teacher conducted the final student's assessment. At the end of each teaching hour, it took place considering students' outcomes, i.e., the digital artifact (see Figure 5).
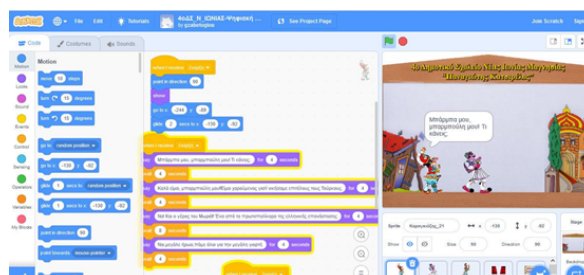

Figure 5   Tile programming in Scratch software

6   Suggestions - Extensions

An extension of this educational scenario would be creating a more specialized digital shadow play performance, utilizing the e-shadow software (http://eshadow.gr). The eShadow is a modernized version of the traditional Shadow Play. It is a tool of creative expression and a modern way of dramatized digital storytelling. It is enjoyable and attractive for both students

and teachers. It was developed by the Laboratory of Distributed Information Systems and Multimedia Applications of the Electrical & Computer Engineering department of the Technical University of Crete. With the eShadow software, the educational community can create digital performances, record, share, and watch them. It also provides the possibility of synchronous communication and collaboration via the internet. This software allows students to draw/insert graphics and figures while playing the show, even using motion detection control.

References

Karakose T., Yirci R., & Papadakis S. (2021a). Exploring the Interrelationship between COVID-19 Phobia, Work-Family Conflict, Family-Work Conflict, and Life Satisfaction among School Administrators for Advancing Sustainable Management. Sustainability, 13(15), 8654.
https://doi.org/10.3390/su13158654

Karakose, T., Yirci, R., Papadakis, S., Ozdemir, T. Y., Demirkol, M., & Polat, H. (2021b). Science Mapping of the Global Knowledge Base on Management, Leadership, and Administration Related to COVID-19 for Promoting the Sustainability of Scientific Research. Sustainability, 13, 9631.
https://doi.org/10.3390/su13179631

Minchillo, L. V., Vellozo, A., Borin, E., & Borin, J., F. (2018). Towards better tools and methodologies to teach computational thinking to children. In $26/circ$ Workshop sobre Educação em Computação, 26, 1.
https://doi.org/10.5753/wei.2018.3515

Falkner, K. (2015). Computational thinking as the 'new literacy': professional development opportunities.
https://www.scisdata.com/connections/issue-95/computational-thinking-as-the-newliteracy-professional-development-opportunities

Papadakis, S., & Kalogiannakis, M. (2019). Evaluating the effectiveness of a game-based learning approach in modifying students' behavioural outcomes and competence, in an introductory programming course. A case study in Greece. International Journal of Teaching and Case Studies, 10(3), 235-250.
https://doi.org/10.1504/IJTCS.2019.102760

Papadakis, S., & Kalogiannakis, M. (2020). Learning computational thinking development in young children with Bee-Bot educational robotics. In Handbook of research on tools for teaching computational thinking in P-12 education, 289-309.
https://doi.org/10.4018/978-1-7998-4576-8.ch011

Herdzina, J. (2018). TEC play and lesson plans: T+M In STEM: Coding and computational thinking.
http://teccenter.erikson.edu/early_childhood_educators/tecmentors_coding

Strawhacker, A., Lee, M., & Bers, M. U. (2018). Teaching tools, teachers' rules: Exploring the impact of teaching styles on young children's programming knowledge in ScratchJr. International Journal of Technology and Design Education, 28(2), 347-376.
https://doi.org/10.1007/s10798-017-9400-9

Dorouka, P., Papadakis, S., & Kalogiannakis, M. (2021). Nanotechnology and mobile learning: perspectives and opportunities in young children's education. International Journal of Technology Enhanced Learning, 13(3), 237-252.
https://doi.org/10.1504/IJTEL.2021.115975

Kyriakides, A. O., Meletiou-Mavrotheris, M., & Prodromou, T. (2016). Mobile technologies in the service of students' learning of mathematics: The example of game application ALEX in the context of a primary school in Cyprus. Mathematics Education Research Journal, 28(1), 53-78.
https://doi.org/10.1007/s13394-015-0163-x

Sheehan, K. J., Pila, S., Lauricella, A. R., & Wartella, E. A. (2019). Parent-child Interaction and Children's Learning from a Coding Application. Computers and Education, 140, 103601.
https://doi.org/10.1016/j.compedu.2019.103601

Vaiopoulou, J., Papadakis, S., Sifaki, E., Stamovlasis, D., & Kalogiannakis, M. (2021). Parents' Perceptions of Educational Apps Use for Kindergarten Children: Development and Validation of a New Instrument (PEAU-p) and Exploration of Parents' Profiles. Behavioral Sciences, 11(6), 82.
https://doi.org/10.3390/bs11060082

McLennan, D. M. P. (2017). Creating coding stories and games. Teaching Young Children, 10, 3.
https://www.naeyc.org/resources/pubs/tyc/feb2017/creating-coding-stories-and-games

Tzagkaraki, E., Papadakis, S., & Kalogiannakis, M. (2021). Exploring the Use of Educational Robotics in primary school and its possible place in the curricula. In Educational Robotics International Conference, 216-229.
https://doi.org/10.1007/978-3-030-77022-8_19

Schroeder, E. L., & Kirkorian, H. L. (2016). When seeing is better than doing: Preschoolers' transfer of STEM skills using touchscreen games. Frontiers in Psychology, 7, 1377.
https://doi.org/10.3389/fpsyg.2016.01377

Sullivan, A., Bers, M., & Pugnali, A. (2017). The Impact of User Interface on Young Children's Computational Thinking. Journal of Information Technology Education: Innovations in Practice, 16(1), 171-193.
https://doi.org/10.28945/3768

Hamilton, M., Clarke-Midura, J., Shumway, J. F., & Lee, V. R. (2020). An Emerging Technology Report on Computational Toys in Early Childhood. Technology, Knowledge and Learning, 25(1), 213-224. https://doi.org/10.1007/s10758-019-09423-8

Ehsan, H., Beebe, C., & Cardella, M. (2017). Promoting Computational Thinking in Children Using Apps. Proceedings of ASEE Annual Conference and Exposition (Columbus, Ohio). https://doi.org/10.18260/1-2-28772

Bers, M. U. (2020). Coding as a Playground: Programming and Computational Thinking in the Early Childhood Classroom. New York, United States: Routledge. https://doi.org/10.4324/9781003022602

Kazakoff, E. R. (2014). Cats in Space, Pigs that Race: Does Self-Regulation Play a Role when Kindergartners Learn to Code? The USA: Doctoral dissertation, Tufts University.

Sullivan, A., & Umashi Bers, M. (2019). Computer Science Education in Early Childhood: the Case of ScratchJr. Journal of Information Technology Education: Innovations in Practice, 18(1), 113-138. https://doi.org/10.28945/4437

Pelánek, R., & Effenberger, T. (2020). Design and Analysis of Microworlds and Puzzles for Block-Based Programming. Computer Science Education, 1-39. https://doi.org/10.1080/08993408.2020.1832813

Murcia, K., Pepper, C., Joubert, M., Cross, E., & Wilson, S. (2020). A Framework for Identifying and Developing Children's Creative Thinking while Coding with Digital Technologies. Issues In Educational Research, 30(4), 1395-1417.

Bers, M. U. (2019). Coding as Another Language: a Pedagogical Approach for Teaching Computer Science in Early Childhood.Journal of Computers in Education, 6(4), 499-528. https://doi.org/10.1007/s40692-019-00147-3

Resnick, M., Maloney, J., Monroy-Hernández, A., Rusk, N., Eastmond, E., Brennan, K., et al. (2009). Scratch: programming for all. Communications of the ACM, 52(11), 60-67. https://doi.org/10.1145/1592761.1592779

Kapaniaris, A., & Papadimitriou, E. (2012). Computer Literacy in the New Digital School. Thessaloniki: Ziti.

Kapaniaris, A. (2019). Development of content-training material for new branches of teachers and internal evaluation of the Act Pedagogical utilization of ICT in interdisciplinary-collaborative teaching - Three (3) Sample educational scenarios (Primary Education - Primary School). Athens: Institute of Educational Policy.

Aslanidis, A. (2011). Research Papers. Athens: Patakis.

Chatzopoulos, A., Kalogiannakis, M., Papadakis, S., Papoutsidakis, M., Elza, D., & Psycharis, S. (2021). DuBot: An Open-Source, Low-Cost Robot for STEM and Educational Robotics. In Handbook of Research on Using Educational Robotics to Facilitate Student Learning, 441-465. https://doi.org/10.4018/978-1-7998-6717-3.ch018

Poultsakis, S., Papadakis, S., Kalogiannakis, M., & Psycharis, S. (2021). The management of Digital Learning Objects of Natural Sciences and Digital Experiment Simulation Tools by teachers. Advances in Mobile Learning Educational Research, 1(2), 58-71. https://doi.org/10.25082/AMLER.2021.02.002

Vidakis, N., Barianos, A. K., Trampas, A. M., Papadakis, S., Kalogiannakis, M., & Vassilakis, K. (2019). in-Game Raw Data Collection and Visualization in the Context of the "ThimelEdu" Educational Game. In the International Conference on Computer Supported Education, 629-646. https://doi.org/10.1007/978-3-030-58459-7_30

Maloney, J., Resnick, M., Rusk, N., Silverman, B., & Eastmond, E. (2010). The Scratch programming language and environment. ACM Transactions on Computing Education (TOCE), 10(4), 1-15. https://doi.org/10.1145/1868358.1868363

Brennan, K., & Resnick, M. (2013). Stories from the scratch community: connecting with ideas, interests, and people. In Proceedings of the 44th ACM technical symposium on Computer science education, 463-464. https://doi.org/10.1145/2445196.2445336

Wikipedia. (2021). Karagiozis. Retrieved on 09 September 2021. https://en.wikipedia.org/wiki/Karagiozis