Student Engagement in digital storytelling with Scratch in classroom settings

Katerina GLEZOU
A΄ Arsakeio General Senior High School, Psychiko, Athens, Greece
kglezou@di.uoa.gr

Summary

The digital storytelling process merges many of the 21st century learning skills that will be critical to success in the future: thinking creatively, communicating clearly, analyzing systematically, collaborating effectively, designing iteratively, and learning continuously. This study attempts to draw on the main parameters of designing, developing and implementing an effective constructionist approach aimed at engaging students in digital storytelling as a cross-thematic multimedia project. In this paper, the author presents some important lessons learnt through teaching courses and conducting workshops on the educational uses involving digital storytelling with the multimedia programming environment Scratch. Examples of activities are described; key aspects of implementation and evaluation are reported. Finally, conclusions and recommendations are given and special issues of interest and future research plans are discussed.

Keywords : Scratch, constructionism, programming, digital storytelling.

Introduction

Modern education should prepare students for their dynamic integration in the “Creative Society”. Mitchel Resnick concedes (Resnick, 2010): «[...] *success in the future will be based not on how much we know, but on our ability to think and act creatively*». Nowadays, digital storytelling has become increasingly popular and is recognised for use in education (Robin, 2008a, Robin et al., 2009). Recent research studies focus on the increasing use of digital storytelling both in teaching and learning. Teachers and students, from early childhood classrooms to graduate school, are using digital storytelling in many different content areas and across a wide range of thematic fields (Ohler, 2008; Robin, 2008a; Robin, 2008b). The digital storytelling process combines many of the 21st century learning skills that will be critical to success in the future: thinking creatively, communicating clearly, analyzing systematically, collaborating effectively, designing iteratively, and learning continuously. Digital storytelling can be considered as a gateway of empowering students to be self-directed learners, organizing information, conveying emotions, and building community.

This study attempts to contribute to the discussion on the main parameters of designing, developing and implementing an effective constructionist approach aimed at engaging students in digital storytelling as a cross-thematic multimedia project. In this paper, the author articulates some important lessons learnt through teaching courses and conducting workshops on the educational uses involving digital storytelling with the multimedia programming environment Scratch.

Scratch (www.scratch.mit.edu) is a modern graphical programming language, developed by the Massachusetts Institute of Technology (MIT) Media Lab's Lifelong Kindergarten Group. Scratch enables young people aged 8 and up to create their own interactive stories, games, art and simulations, and then share those creations in an online community with other programmers from around the world (Brennan & Resnick, 2012; Brennan et al., 2010; Resnick, 2010; Resnick et al., 2009; Maloney et al., 2010). Scratch was designed to prevent the common beginner pitfalls in traditional programming languages, like misspelling and errors in consistency (Koh, 2013; Kordaki, 2012; Brennan & Resnick, 2012; Resnick, 2010; Wong, 2010; Resnick et al., 2009; Maloney et al., 2008). Instead of typing commands, programming in Scratch is performed by simply dragging-dropping and joining colored programming blocks. This graphical interface allows users to easily control the way in which different types of commands react to each other.

The remainder of this article is organized as follows. In Section 2 the research framework is described. In Section 3 some key points of implementation and evaluation are reported. Finally, recommendations and conclusions are given in Section 4 of this article, in which special issues of interest and future research plans are also discussed.

Research Framework

The present study is part of a wider research, which aims to explore the potential of implementing cross-thematic educational scenarios that promote collaborative constructionist exploratory learning as a framework for activities and for a series of lessons. The aim of this research is to bring forward the basic parameters of an effective constructionist approach, on the level of designing, development and implementation. Scratch is considered an appropriate multimedia programming environment for the development of digital stories as projects, in the framework of implementing cross-thematic educational scenarios.

The basic research questions of this particular study are: a) how do the students collaborate and interact with the programming environment? and b) which are the special features of Scratch that contribute to or cause difficulty in the development of an effective constructionist learning environment? It is a case study that uses ethnographic and action research elements since the researcher was also the teacher of the class. Data were collected from the researcher's notes-diary after each didactic hour, the students' notes-drafts, the filled-in worksheets, the projects of the students, as well as from semi-structured interviews of students. Then, the data underwent a qualitative analysis, whose results led to the gradual ameliorative reshaping of lesson plans, worksheets and preconstructed projects.

Implementation - Evaluation

The suggested approach was implemented in the framework of i) "Project" and "Informatics" courses of the1st and 2nd grade, and "Multimedia-Networks" course of the 3rd grade in option classes of A΄ Arsakeio General Senior High

School and ii) training programs for in-service teachers of Informatics and Science teachers, in Athens, Greece, during the school years: a) 2011-2012, b) 2012-2013 and c) 2013-2014.

From the first lesson the students show special interest in their interaction with Scratch and remain really active during the lessons, especially in the phases where they have to create their own projects. As the students or/and trainees proceed to a sequence of activities, they are characterized by increased motives for learning; they repurpose code in a personal meaningful way by reusing pieces of code and creatively recombining them for new constructs; they get familiarized themselves with remarkable ease and comfort in the environment and quickly develop the required dexterities for the handling of tools, even those who are totally inexperienced in programming.

In Figure 1, indicative snapshots corresponding to different scenes of “WEB 2.0” project (in Greek, http://scratch.mit.edu/projects/10298290/) are presented as a project example. This project concerned an introduction to the WEB 2.0 tools, as denoted by the title. The project as well as the presentation -referred below in Figure 2- were created in the context of “Project” course of 2nd grade by a student, enthusiast fan of Scratch, in order to share his passion with and help his classmates to get familiarized with Scratch. In the phase of project construction two of his classmates proposed voluntarily to collaborate and recorded the written texts as a dialogue among the actors-sprites.

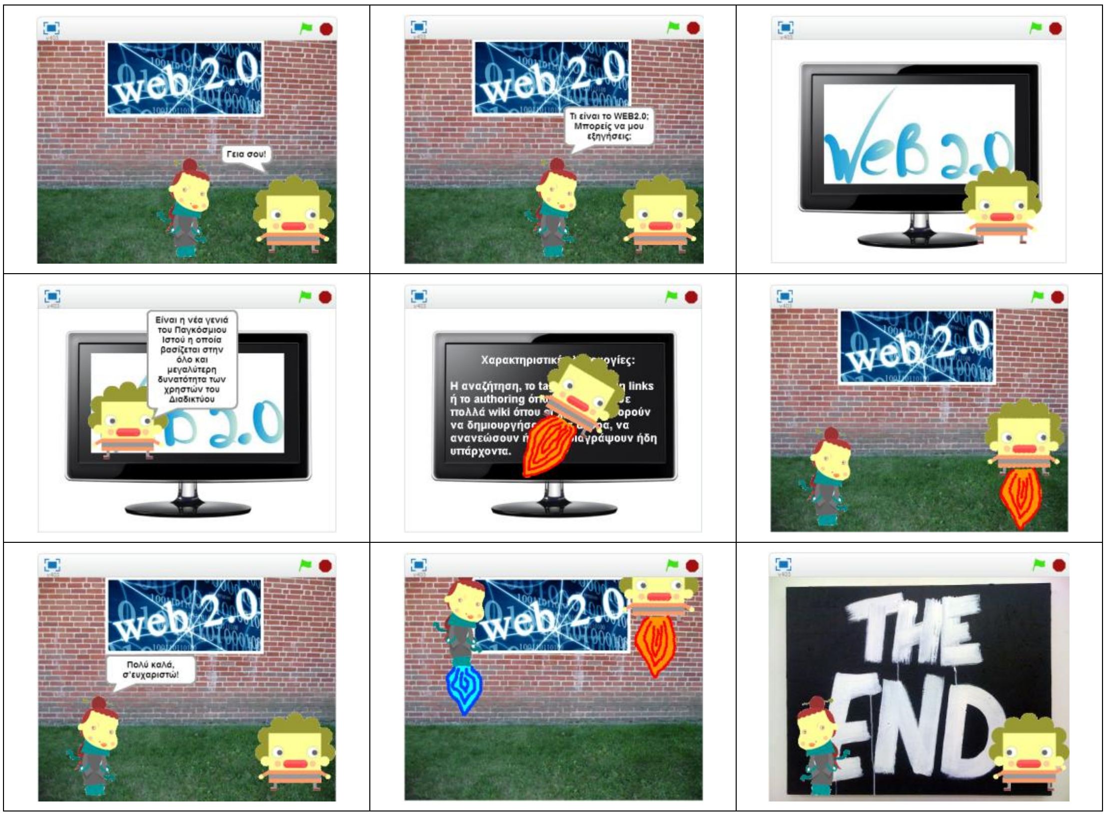

Figure 1. *Indicative snapshots of “WEB 2.0” project (in Greek, http://scratch.mit.edu/projects/10298290/)*

Figure 2. *Presentation slides of Guidelines developed by a student for students - Steps of "WEB 2.0" project construction: a) title slide, b) project page in community, c) backgrounds scripts, d) sprite1 scripts, e) sprite2 scripts, f) music/recordings(in Greek)*

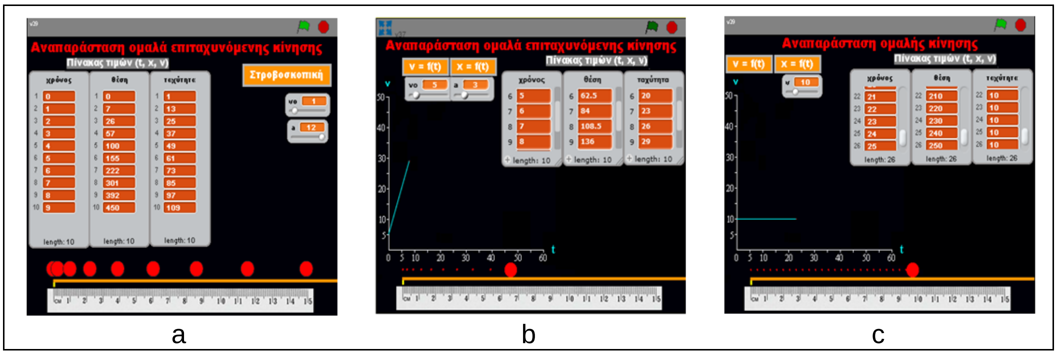

Figure 3. *Snapshots of Motion Simulation Projects (in Greek) a) http://scratch.mit.edu/projects/2131574, b) http://scratch.mit.edu/projects/2144134, c) http://scratch.mit.edu/projects/2144124*

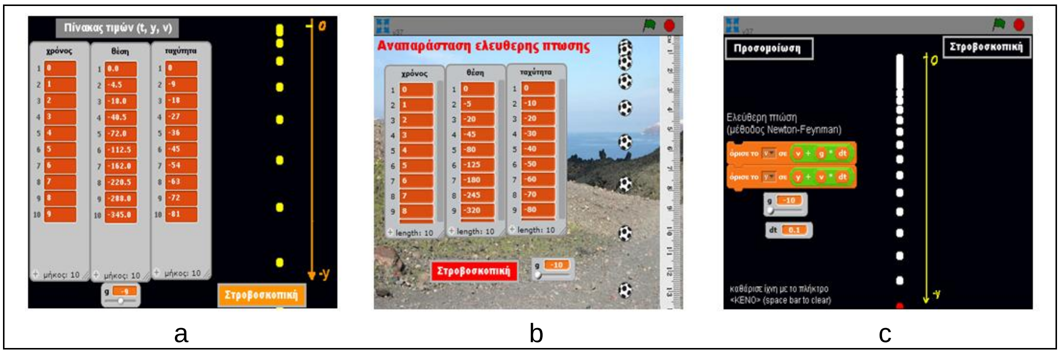

Figure 4. *Snapshots of Free Fall Simulation Projects - a) http://scratch.mit.edu/projects/2076443, b) http://scratch.mit.edu/projects/2181029, c) http://scratch.mit.edu/projects/2140003*

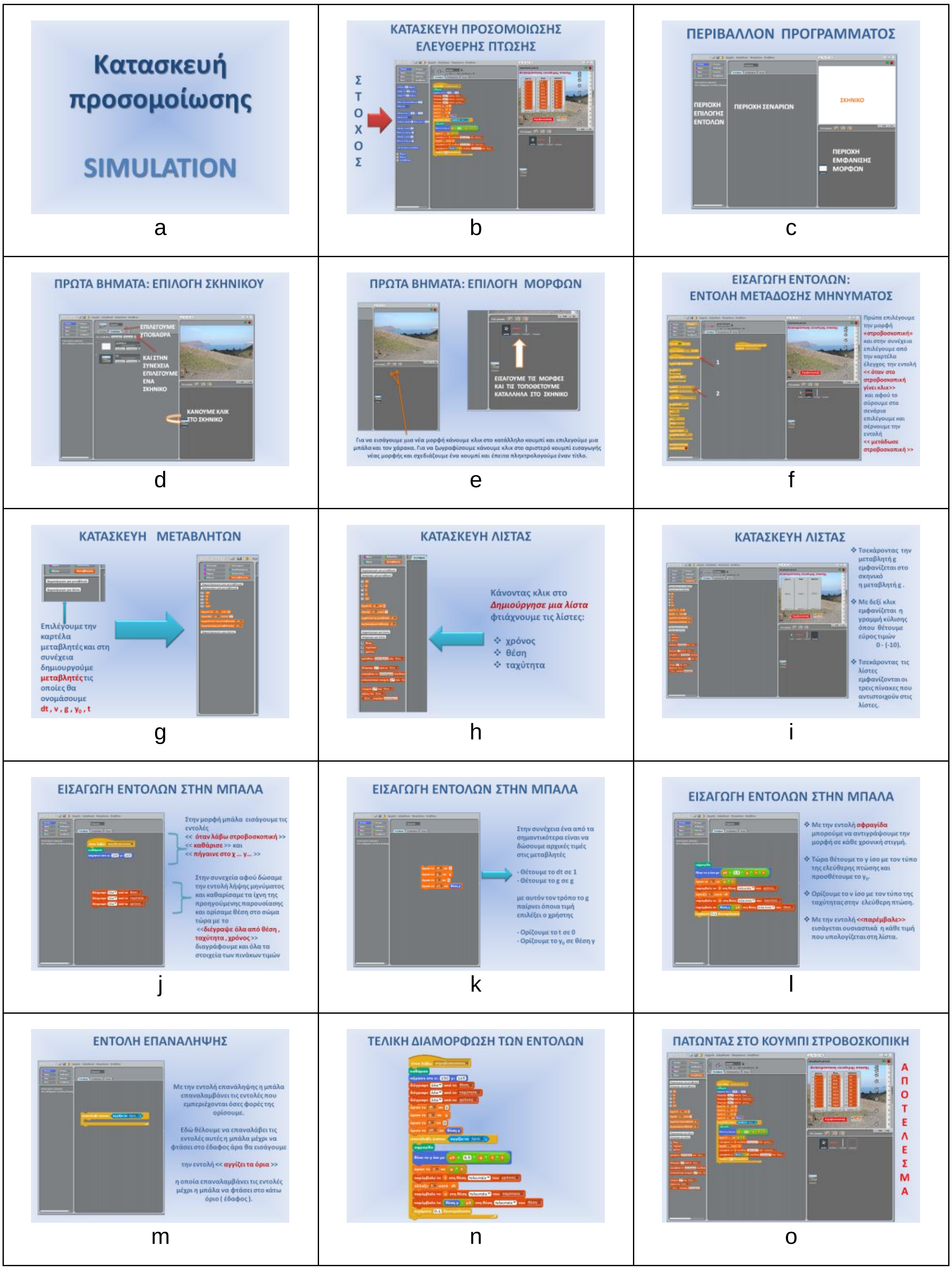

Figure 4. *Presentation slides of guidelines developed by a student for students - Steps of Free Fall Simulation project construction (in Greek, http://scratch.mit.edu/projects/2181029)*

In Figure 2, presentation slides of guidelines as steps for “WEB 2.0” project construction are shown.

In Figure 3, indicative snapshots of linear motion simulation projects are presented where one can notice sprites shaped as ball, ruler, buttons and texts in combination with lists as tables {to output the values of time (t), position (x) (: ordinate X) and velocity (v)}, sliders to input the value of variables, graphs and stroboscopic representation of motion in parallel. In Figure 4, examples of reusing & remixing free fall simulation projects are shown.

In Figure 5, presentation slides of guidelines as steps for "Free Fall simulation" project construction (http://scratch.mit.edu/projects/FanisK/2181029) are presented. This project and the presentation was developed in the context of Project course of 1st grade from a student, another enthusiastic fan of Scratch, in order to help his classmates to get accustomed to simulation construction with Scratch.

While investigating each project, students go repetitively through a cycle of imagining, prediction, coding, code-testing and consideration of the limitations of any current model's scope of application. In their experimentation process students receive direct feedback from the environment; they negotiate, cooperate, criticize one another, evaluate themselves, take turns in the first and second role, suggest ways of coping with new situations and try out new commands. The students demonstrate their inventiveness; they build alternative personal artifacts with different levels of detail and variations of methods. Their centre of interest is transferred easily, tracing new exploration paths.

The overall process has a positive effect on learners differing in extent and depth of comprehension. Students in all ability levels make gains in cultivating:

- Design Skills (imagining, creating, tinkering, evaluating, remixing)
- Social-Emotional Skills (collaborating, sharing, persevering, reflecting)
- Problem-Solving Skills (identifying, formulating, analyzing, decomposing & debugging problems)
- Computational Concepts (sequence, iteration, conditionals, variables, event handling, data structures, synchronization)

Some teachers-trainees often express their frustration and fear in front of open-ended activities accepting with relief the idea of 'digital immigrants' for themselves. As they gradually engage with constructionist activities that involve construction, exploration, investigation and self-discovery they increasingly display deep levels of understandings about their own learning experience and about their understandings of teaching - learning process. They realize that these skills could not be taught, but only cultivated through practice and think about their own thinking by connecting praxis to constructionist learning theory. Meanwhile, they report high levels of enthusiasm and self-satisfaction when they manage to create their own first project, share it in Scratch community, connect and collaborate with others.

Recommendations

A well structured series of sample projects and activities characterized by a gradual increase in complexity and difficulty function as scaffolding during the gradual familiarization both with digital storytelling and Scratch.

An appropriate environment for novice learners should be developed in gradual steps and according to their previously acquired experience.

Some students, especially the nonpersevering, might need additional attention or support. Students are more willing and often demand free experimentation than teachers who, in majority, need to move on step by step following analytical guidelines according to strictly structured worksheets.

The teacher-trainer needs to proceed in subtle handlings, in order to support learners in a tailored way and accommodate them with no more support than what they need.

Teachers need practical teacher training focused on learning process in order to engender constructionist teaching-learning in their classrooms.

Comments in code or/and in project notes prove very helpful for further understanding as well as documenting processes.

Scratch and ScratchEd online community of practice offers multiple opportunities to teachers and students on connecting, sharing, remixing projects, collaborating with each other.

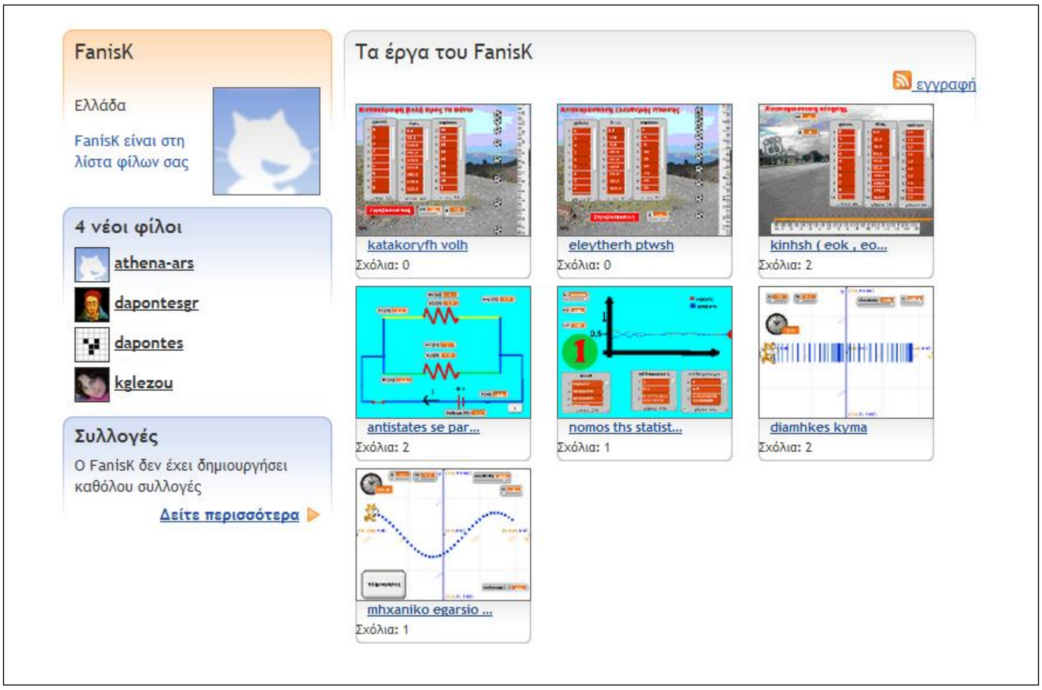

Figure 5: *Scratch community student profile page (in Greek, http://scratch.mit.edu/users/FanisK)*

Discussion

Creating projects in Scratch first of all helps students develop a deeper level of fluency with digital technology. Nowadays, to be fluent with digital technology, students must learn not only how to interact with the computer but also to create with it. Most students will not become professional programmers when they grow up, but learning to program offers benefits for everyone: it enables students to express themselves creatively, pushes them develop as logical thinkers, and helps them understand the new technologies that they encounter everywhere in their everyday lives.

As students create Scratch projects (like interactive stories, animations and games), they learn mathematical and computational ideas that are built into the Scratch experience. They learn core computational concepts such as iteration and conditionals. They also gain an understanding of important mathematical concepts such as coordinates, variables, and randomly generated numbers. Significantly, students learn these concepts in a personal meaningful and motivating context.

As students work on Scratch projects, they also learn about the process of design. Typically, a student will start with an idea, create a working prototype, experiment with it, and debug it when things go wrong, get feedback from others, then revise, redesign and remix it. It’s a continuous spiral: get an idea, create a project, which leads to new ideas, which lead to new projects, and on and on.

In traditional classes, when students learn about variables in mathematics, they usually feel little personal connection to the concept. Although, in the context of Scratch they want, and ask to learn about variables as they can use them in very personal meaningful ways in praxis: to control the speed of an animation, or to keep track of the score in a game they are creating.

Design-based activities, such as creating interactive stories and games, offer a particularly effective way for youth with diverse interests to become engaged in exploring computational ideas (Brennan & Resnick, 2012; Resnick, 2010; Resnick, 2009).

The Scratch online community provides a social context for Scratch users, allowing users to share their Scratch projects, receive feedback and encouragement from their peers, and learn from the projects of others (Koh, 2013; Kordaki, 2012; Brennan & Resnick, 2012; Resnick, 2010; Wong, 2010; Brennan et al., 2010; Maloney et al., 2010).

Conclusions

In this paper, the author presents some important lessons learnt through teaching courses and conducting workshops on the educational uses involving digital storytelling with the multimedia programming environment Scratch.

Scratch cultivates creativity, gives the teacher pedagogical freedom and supports the students’ active engagement and learning. Exploring and remixing sample projects and developing new ones promotes new perspectives and understanding of computational concepts and practices. The use and re-use of preconstructed projects for the creation of new digital stories with a gradually increasing degree of complexity encourages the systematization of knowledge and bridges the gap between the simple and the more complex, especially effective in scaffolding digital storytelling. Sample projects can inspire, operate as starting points to build on them, changing them or decomposing parts of them in order to construct a new artifact.

Scratch offers students a doorway to express and exploit their ideas, emotions, thoughts, and instincts and support the process of building knowledge by creating - imagining, programming and sharing - projects as learning environments rich in speculation and opportunities for experimentation, communication and collaboration.

Future work

Our future research plans focus on exploring the use of Scratch by implementing alternative teaching strategies in order to support student engagement in digital storytelling, computational thinking, knowledge and/through artifact construction and collaboration.

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