Make2Learn: Fostering Engagement and Creativity in Learning through Making

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I hear and I forget. I see and I remember. I do and I understand.
– Confucius

Abstract. The International Workshop of Making as a Pathway to Foster Joyful Engagement and Creativity in Learning (Make2Learn) aims to discuss the introduction of creative and joyful production of artifacts "maker movement" in the learning processes. A variety of environments have been developed by researchers to introduce making principles to young students. Making principles enable them foster co-creativity and joy in learning processes and construct knowledge. By involving students in the design decisions they begin to develop technological fluency and the needed competences, in a joyful way. Make2Learn aims to bring together international researchers, educators, designers, and makers for the exploration of making principles towards the acquisition of 21st Century learning competences, by employing the state art aspects of entertainment technologies, new media, gaming, robotics, toys and applications. The main objective is to build a research community around this topical area. In particular, Make2Learn aims to develop a critical discussion about the well-established practices and entertainment technologies of the maker movement, and expected outcomes of putting them into practice under different spaces such as Hackerspaces, Makerspaces, TechShops, FabLabs etc. This will allow us to better understand and improve the value of Maker philosophy and the role of entertainment technologies to support teaching and learning.

Keywords: Maker movement, entertainment technologies, creativity, knowledge construction, technological fluency, constructionist

1 BACKGROUND

Digital artifacts that enable people to exchange, create, and distribute information have, in the past couple of decades, profoundly reshaped the way we work and live [7]. The

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creative production of digital artifacts and use of entertainment technologies in learning activities has been linked to teaching new computer and design literacy skills [1]. Common inspiration is the work of Papert [6] that stresses the importance of creating a 'felicitous' environment to facilitate learning. The idea here is that the students benefit from being happy and in a carefree and creative environment. In accordance with Papert, Csikszentmihalyi's [3] research has exhibited that students' motivation is highly predictive of achievement; however, educational systems neglect creative and joyful aspects on learning activities. Educational programmes focus on recall and reproduction abilities instead of emphasizing the development of problem solving, creative thinking and decision-making abilities.

Digital artifacts have the potential to make the symbolic and abstract manipulations involved in creative procedures more concrete and manageable for young students [2]. For example, artifacts allow students to learn by iteratively testing, rebuilding their designs and working collaboratively. The interactions between the young students and the artifacts in creative and joyful activities are vital [4]. During the past decade, we have seen an increased appearance of environments and community spaces offering diverse opportunities for young students to facilitate learning through construction. Environments like Scratch, Alice and Storytelling Alice and spaces like Hackerspaces, Makerspaces, TechShops, and FabLabs have allowed researchers to empirically investigate the potential benefits of the maker movement towards the acquisition of 21st Century learning competences. Collecting and discussing around those advances will allow us to formulate better understanding of several technical and practical aspects that could be valuable in designing effective making activities to foster joyful engagement and creativity in learning.

2 OBJECTIVES

The advances of digital environments, entertainment technologies, manufacturing equipment and community spaces offer diverse opportunities for making practices to facilitate learning, especially when supported by engaging and joyful entertainment technologies and designed in an appropriate pedagogical manner. From current research, it is difficult to tell what aspects of environments, engaging-entertainment technologies, applications, equipment and practices can have a positive impact.

The current drive in many countries to teach design and technology competences to all has potential to empower and support making as a creative, joyful and problem-solving tasks. However, there are a number of challenges in ensuring that procedures, tools and environments, embody appropriate progression and engender motivation and joyful. This workshop will attempt to address these key research challenges.

One of our main objectives is to bring together researchers, educators, designers who are interested for the exploration of making principles and supportive entertainment technologies towards the acquisition of 21st Century learning competences. Make2Learn aims to provide an environment where participants will get opportunities to: develop their research skills; increase their knowledge base; collaborate with others in their own and complementary research areas; and discuss their own work.

3 CONCLUSIONS

The contributions of Make2Learn covered several topics, such as tangible technologies, computer science and programming education, empirical examinations, augmented reality applications in schools and best practices to foster creativity in learning. The workshop proceedings are freely accessible from CEUR-WS series (http://ceur-ws.org/Vol-1450/).

In particular, Alsos [10] presents a programming course, where students of interaction design used Arduino to build interactive everyday things. Interaction Designers need to know and understand the virtual material they work with – in other words they need to know basic programming in order to make their products highly interactive. As illustrative examples, Alsos presents the six interactive innovative products made by the students. Videos of all the products are available on http://bit.ly/1K4YPYB

Svanæs [11] describes experiences from an introductory course for first-year computer science students. During the course Arduino, robot programming and app development with Processing was used to foster engagement and creativity. The main learning objective for the students was to learn basic hardware and software skills, while at the same time motivating for further computer science courses. The major challenges were related to creating exercises, educational material and a physical work environment for the students that allowed for creativity in the spirit of the maker culture. Crucial factors were found the development of a high number of well-documented small and complete examples as well as the adequate experience and training of teaching assistants.

Koulouris [12] presents the EC C2Learn project, C2Learn aims to foster co-creativity in learning through digital gaming activities whose design and development is grounded on rigid theoretical foundations. The project is shaped as a progression from theoretical foundations to design, development, pilot implementation and evaluation in real life educational settings. Careful pedagogical and game designs have defined the elements of learners' gameful digital experiences and produced the specifications for the development of the corresponding technologies and activities. Throughout the project, school communities have been engaged in iterative dialogic cycles leading to design decisions, their implementation and evaluation in real-life educational settings. Koulouris describes that, despite the fact that C2Learn is originating in a different context, there is a direct contribution to the 'maker movement'.

More et al., [13] discuss the making of interactive board games as a learning activity. They present AnyBoard platform which is currently under development, and demonstrate how AnyBoard supports the design and implementation of board games. The innovation of their approach stems from the fact that they do not use a game board virtualised on an interactive surface, but rather achieve interactivity through technology-augmented game pieces. Hence, they offer a broad design space and low costs of the final product.

Papavlasopoulou et al., [14] present the design and implementation of a computer science education, with the goal to encourage students to acquire programming skills and become creators and not only mere consumers. This paper presents an initial ex-

ploratory evaluation of the workshop program and the development of a set of guidelines for improving students' experience. The results aim to inform designers and researchers about the impact of a) gamefulness, b) guidance, c) programming experience, d) pro-grammable hardware platforms and e) technical problems in the design and implementation of creative programing experiences.

Karamanoli and Tsinakos [15] present a literature review focused on Augmented Reality (AR) and its current and future incorporation in modern education via various context aware technologies (e.g. tablets, smartphones). AR can provide opportunities for more interactive and joyful educational experiences, especially when combined with Open Course Project situations, such as the one which is available at the Eastern Macedonia and Thrace Institute of Technology in Greece. With the main purpose to inform "creators" and stimulate "users" to engage with this promising technology throughout the educational process.

4 CONCLUSIONS AND THE WAY AHEAD

The advances of digital environments, technologies, manufacturing equipment and community spaces offer diverse opportunities for making practices to facilitate learning, especially when supported by engaging and joyful entertainment technologies and designed in an appropriate pedagogical manner. From current research, it is difficult to tell what aspects of environments, technologies, applications, equipment and practices can have a positive impact.

The current drive in many countries to teach 21st century skills to all has potential to empower and support making as a creative, joyful, problem-solving and critical thinking tasks. However, there are a number of challenges in ensuring that procedures, tools and environments, embody appropriate progression and engender motivation and joyful.

To explore the future of technologies, tools, and various spaces to foster engagement and creativity in learning, we seek to promote interest in well-established tools and practices of the maker movement, and expected outcomes of putting them into practice under different spaces such as Hackerspaces, Makerspaces, TechShops, FabLabs etc. This will allow us to better understand and improve the value of Maker philosophy as well as to accelerate the process of disciplinary convergence. We aspire to bridge computer science, design, HCI and related disciplines to encourage ambitious research projects that could yield potent tools for many students to use. This workshop is implemented with an aim to collect high quality studies around this topical area, to envision what the next generation of technologies, environments, spaces and practices might look like. In particular, future work need to:

1. Accelerate research on Maker Movement by proposing ways to create greater interest and synergies among researchers, educators, students, policymakers, and industrial developers,

2. Promote rigorous multidimensional and multidisciplinary methods and implement rigorous experimentation strategies and metrics for in-depth longitudinal case studies,

3. Design tools, kits and spaces for individuals to promote "low floor" (easy to get started) and a "high ceiling" (opportunities to create increasingly complex projects over time) opportunities for young students.

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