Chapter 16
The CCAP Project:
Using 3D Technologies to Support Teaching Scenarios of History

Panagiotis Angelopoulos
Ministry of Education, Greece

Efthalia Solomou
Ministry of Education, Greece

Alexandros Balatsoukas
https://orcid.org/0000-0002-5005-8871
University of Groningen, The Netherlands

ABSTRACT

The "CCAP" project is an effort to teach in an interdisciplinary way both the teaching subjects of History (the trip of Columbus to discover America) and Informatics (3D modelling and printing). Students of B grade from the Junior High School of Vrilissia (age 13), on a voluntarily basis, separated into groups of 4-6, have created in a 3D design environment instruments used by Columbus during its trip to America, astrolabes, compasses, caravels, etc., as were taught during the subject of History and according to the description of the instruments given by the school book and other resources. The instruments were eventually printed out using the 3D printer in the computer lab. Part of the program was supported through the school's curriculum hours, and part of the program had to be implemented out of school hours. After the completion of the project, students responded to a questionnaire prepared by the teachers in a Google form format. The most important results of this questionnaire are discussed in this work.

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INTRODUCTION

Mader & Dertien (2016), notice that Tinkering as a method in students' teaching and learning is characterized by a playful, experimental, iterative style of engagement, in which makers are continually reassessing their goals, exploring new paths, and imagining new possibilities. They also argue that not only engineering and design can profit from tinkering, but also science. In this Chapter we argue that Tinkering can also supports not only pure sciences but also social sciences, classical studies and the majority of cognitive objects taught in the classroom.

Artifacts serve as a way to interpret a story. People define themselves by their creations and actions and students can examine works to define a story, a period, an important event in history. Simultaneously, teachers use these experiences to get the students talking and thinking about the topic. Following Columbus and his trip to discover America, students can freely express themselves and produce their own creations and proceed to the construction of maritime objects used at that period, through the utilization of digital 3D technology.

Also, Papadakis & Kalogiannakis (2017) notice that "there are concerns among researchers and education professionals that students in our classrooms are bored, unmotivated and disengaged from school. One of the reasons is that old teaching methods are no longer beneficial to the students. On the other hand, game-based learning can improve learning motivation of students. Compared with traditional lectures, digital game-based approaches can indeed produce better learning effects, which underscore the need to develop appropriate instructional materials.

The terms Computational Thinking, educational artifact and making in learning was already known through the work of Seymour Papert (Papert, 1980) and his constructionism theory that supports that the experience and process of building something physical or digital provides the context for developing understanding and learning. According to Psycharis (2017) CT is the ability to: a) develop computational abstractions of real-world problems; and b) design, develop, refine and reason about computation artefacts. The Computational Thinking is now recognized as a concept that encompasses the pervasiveness of Computer Science constructs and problem-solving strategies such as abstraction at different hierarchical levels, algorithmic thinking, automation, decomposition, modeling, patterns, recursion, scale, and symbolic representations.

Recent works have provided frameworks and examples for incorporating computational thinking across different subject areas and others relate Computational Thinking to the larger context of learners informally engage in as makers and creators (Voogt et al.,2015). In this work, by using 3D technologies in formal and informal school activities, there is an effort to study how CT skills can be developed in students in disciplines other than programming and Computer Science and how Tinkering, making of Artifacts can contribute in teaching and learning. We have used an interdisciplinary approach and focus on the learning results and students' opinion about the followed teaching approach described below.

Although, there are some recent studies providing ideas for investigating the effectiveness of educational CAD tools and curricular scaffolds designed specifically for K-12 students for supporting integrated STEM learning anchored in the design process (Dasgupta, Magana, Vieira, 2019; Ng & Chan, 2019) the literature in connecting the use of 3D Technologies and development of Computational Thinking skills is poor at the moment. On the other hand, 3D technologies can be a supporting field concerning the development of STEM education and the deriving skills like problem solving, use of patterns, use of abstraction and algorithmic thinking. From this point of view, the wide use of 3D technologies in education can play an important role in supporting integrated STEM teaching and in developing the grow of acute demand for