

DESIGN FUTURES: Combining Design Thinking and Maker Education in elementary education across Europe

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Abstract

Design Thinking (DT) and Maker Education (ME) are pedagogies that aim to equip students with the necessary skills to thrive in the non-linear and constantly evolving contexts of the 21st century. These constructivist learning approaches nurture 21st-century skills through creative, making processes and can be combined as they both involve ideating, creating, and reflecting on experience. By introducing them in early childhood education, students can develop their creative, collaborative, and making skills. However, there are still few implementations of DT and ME in formal, elementary education.

In this paper, we investigate 1) the challenges of implementing a formal DT and ME educational program, the *Design Futures* curriculum, for students aged 8 to 12 and 2) its impact on these students' collaborative and creative self-efficacy. We showcase the development of the program which is aimed to be able to be implemented in elementary education within different socio-cultural contexts. The design is guided by 1) the theory of constructive alignment which poses that effective constructivist teaching practices align their learning objectives with their learning activities and assessment procedures, 2) the curricular spiderweb which presents different aspects of education and their relations, and 3) the design thinking process. We present a lesson plan consisting of a sequence of nine lessons that bridges the gap between the educational context and the outside world by teaching students about a problem that society is currently facing. It takes the students through a process of 6 phases in which teams, through research, define a sub-problem that they try to solve by design. Moreover, the students learn about electronic circuits and use basic electronic components in the creation of a mock-up of their design. The teaching activities incorporate DT- and ME-related learning objectives, which get assessed through connected assessment activities that implement both teacher-led assessment and student self-assessment.

We report on preliminary results of a triangulated mixed-methods study in which the Design Futures curriculum gets tested in 20 schools distributed over 4 countries (Romania, Greece, Italy, the Netherlands). We combine data from pre-post test measures on the students' self-efficacy related to their creative and collaborative skills, user experience surveys from the students' and teachers' perspectives, and post-intervention interviews with students and teachers. Quantitative results are evaluated through analysis of variance and measures of central tendency. The interview transcripts are analyzed through inductive thematic analysis. Other materials, such as worksheets, are used to

complement the results. Outcomes of the different socio-cultural contexts are compared to find distinctive implementations, trends, difficulties, and reflections from the students' and teachers' perspectives.

We hope to contribute to the further reenvisioning of formal elementary education towards the inclusion of DT and ME activities by 1) showcasing the challenges and impact of implementing DT and ME in formal primary education, 2) uncover which elements of DT and ME are transferrable between socio-cultural contexts and which are specific to a socio-cultural context, and 3) making recommendations for future development of DT and ME material for early education.

Keywords: Design Thinking, Maker Education, Elementary education, Curriculum development, Design-based learning.