Maker-Education: Interdisciplinary Computer Science Activities

Bernadette Spieler[1,*,†], Tobias M. Schifferle[1,*,†]

[1]Zurich University of Teacher Education, Lagerstrasse 2, 8090 Zurich, Switzerland

Abstract

Typical characteristics of Making are creative and novel solutions and open, problem-based learning environments. Thereby, Making facilitates interdisciplinary connections and cross-cutting competences, for example, technical understanding, creativity, craft skills, or concepts of sustainability and entrepreneurship. Traditional crafts can be combined with modern technologies such as programmable embroidery machines, 3D printers, laser cutters, or microcomputers. In this way, Making can be an inspiration to further develop a mutual understanding of teaching in tandem with the promotion of creative project activities, simultaneously combining analog and digital tools across disciplines. However, Making is still in its early stages in schools and education. Therefore, much is still undefined and open.

Keywords

Maker-Education, Making, Open Learning Spaces, Interdisciplinary, Teacher Training, STEAM

1. Making, Makerspaces & Maker-Education

In recent years, the Maker movement has surged in popularity and has become attractive for didactic research [1]. With the introduction of the Swiss Curriculum 21 (https://lehrplan.ch/) in German-speaking Switzerland in 2014, a strong focus on general competencies and future skills such as creativity can be observed in schools. In connection with Making, familiar characteristics from the constructionism theory, such as "learning-by-doing", "objects-to-think-with" or principles such as student-centered, project-oriented, individualised, and self-organised learning are emphasised. Making has many dimensions, and especially in informatics, it can cover topics such as programming, robotics, virtual reality, or data literacy (e.g., building measuring instruments). It also allows for interdisciplinary projects, e.g., explaining biological phenomena or creating musical instruments.

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*Corresponding author.

†These authors contributed equally.

bernadette.spieler@phzh.ch (B. Spieler); tobias.schifferle@phzh.ch (T. M. Schifferle)

https://phzh.ch (B. Spieler); https://phzh.ch (T. M. Schifferle)

0000-0002-0877-7063 (B. Spieler); 0000-0003-1018-7158 (T. M. Schifferle)

2. Making & Informatics

In informatics, students should develop critical thinking and problem-solving skills, especially in the context of Computational Thinking (CT) [2]. CT is generally understood as processes that strengthen logical, algorithmic and abstract thinking. Thus, Making can be an anchor to creatively introduce students to informatics principles, e.g., in programming or design projects [3]. However, the purpose of Making is not just to reproduce projects, but to encourage active participation, knowledge sharing and collaboration through open exploration and creative use of technology. Making can thus be seen not only as an opportunity to experiment with new forms of teaching informatics, but also as a driving force for a new learning culture that opens up broader perspectives for school development.

3. The Making at School project

Makerspaces can be publicly accessible creative spaces at fixed locations, temporary "popup" makerspaces [4], or mobile versions such as experimental kits ("Workshop in a Box") or integrated into classrooms as Maker-Education [5]. To permanently establish Making and the corresponding "Maker Mindset" in schools, exchange and further teacher training formats are needed in addition to the supply of infrastructure and high-quality interdisciplinary teaching materials. During the project "Making at School" as part of the digitisation initiative of the Zurich Universities of Applied Sciences (DIZH), modules for Making are collaboratively designed by the Zurich University of Teacher Education (PHZH), together with the University of Zurich, as well as in cooperation with the School Authority of the City of Zurich [6].

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