
FabLab@School: From Digital Literacy to Design Bildung

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Abstract

Digital fabrication is becoming commonplace in the educational systems. As has often been stated, it offers opportunities for enhancing digital literacy. In this paper we take the argument further - claiming the need for a *design bildung* perspective on digital fabrication. In doing so, we emphasize (1) the *designerly thinking* inherent in digital fabrication. Seeing it in (2) a *bildung* perspective puts emphasis on knowledge, skills and competences for all citizens of the near future. The implications of taking a design bildung perspective on digital fabrication are stated here as an increased focus on solving real-world problems, on technology as a material, on the ability and motivation to act designerly and on integrating the entire process of design (e.g. early ideation, co-design activities and prototyping) into the scope of digital fabrication in education.

Author Keywords

Design Bildung; Digital Fabrication; Digital Literacy; Design Competence; FabLab; FabLab@School;

Introduction

The term *digital fabrication* can be used with different meanings ranging from simple use of 3D-printers for producing a standard key-chain to innovations of digital artifacts solving societal challenges. Technologies include 3D-printers, CNC-routers, laser-cutters, a

variety of electronic toolkits and microprocessor-boards. Here, the global *fablab* movement and its maker-culture [1] are seen as embodiments of digital fabrication. The technologies and the maker-culture, enable consumers to tinker with products, to remix different technologies and above all to produce a wide range of objects to fit their needs and ideas. This democratization of production has the potential to disrupt our societies [2], [3], and therefore digital fabrication is (in itself) a relevant content in education.

A range of recent literature states the importance of learning with and about digital fabrication [4],[5]. To tech-savvy first-movers and fablab-enthusiasts, this may seem self-evident, and when the technology and its surrounding culture of making is touted as the new industrial revolution [2], it seems very credible. However, every time we plan to use the important and limited time of children and adolescents' school life, thorough deliberations are needed. Therefore we need to answer the questions of what to learn and how to learn it. Before we can answer these questions, we need to address the question of why children and adolescents should learn about and with digital fabrication at all.

The objective of digital fabrication

Blikstein [4] enthusiastically describes experiences with digital fabrication in education. He sees a potential for learning subject matter from different subjects (e.g. math, history, engineering) through the inherent interdisciplinary nature of work on personal projects. Blikstein argues that Digital Fabrication in education builds upon Papert's [6] visions of Children's programming and thus sees it as adding to the *technological literacy* of the pupils and students. This

resonates well with what is often termed digital literacy. Digital literacy has been an important research area for almost two decades, ranging from definitions focusing on information and computers [7], to more recently incorporating digital cultures [8] and entailing a range of digital literacies [9].

In Blikstein's work, when discussing digital and technological literacy, reference is made to concepts such as empowerment and a set of knowledge and skills for all citizens. In tune with this, Schelhowe [10] states that digital fabrication offers opportunities for *complex and sustained learning* and *bildung*. We build on this and go even further introducing *designerly thinking* [11] as part of this *bildung* perspective. By pointing to design as a crucial part of digital fabrication, we emphasize the process in which the digital artifacts are made. This process is not only about encouraging students to explore, tinker with and understand digital technology. More importantly, this process is about understanding the process of design which according to Schön [12] is a reflective conversation with the material. *Designerly* denotes the ability to work on *many alternative designs in parallel* in an *iterative way*, while going back and forth between the whole and the details of a future design [13]. Designerly thinking is a highly individual and social endeavour that challenges the student's ability to reflect, collaborate, ideate and introspect. Thereby a designerly perspective extends the objective of digital fabrication in education from digital literacy to design *bildung*. Design *bildung* entails the process in which students develop their design repertoire and ability and mindset to act designerly to manipulate and create new technological solutions to solve complex societal or personal problems. In the

following we will briefly introduce Bildung as an objective of digital fabrication.

A Bildung perspective

Bildung has been a central concept of educational thinking by a range of German philosophers (e.g. Humboldt, Kant and Hegel), and as defined by Wolfgang Klafki it concerns the formation of citizens in a given society [17]. The term as it is used here, takes the classical bildung as a starting point but since our societies are changing, what constitutes bildung must also change [14]. Treating digital design as part of *allgemeinbildung*, highlights the knowledge, skills and competences which are relevant to all adolescents. Thus bildung is used as a central tenet, which points out the direction of learning [15].

Taking a bildung-perspective means that learning should be directed toward goals of *emancipation, empowerment and citizenship* [16]. In a society disrupted by technological revolution, this presupposes digital literacies and design competence. If the citizens of tomorrow are to be more than consumers directed by Silicon Valley and national security agencies, they need to understand the technology surrounding them to a degree that allows a *technological imagination* [17]. They need to view and interact with the world in designerly ways - using the technologies to create preferred states [11] and transforming technologies to better fit a desired future. They need a Design Bildung.

Design bildung in digital fabrication

The need for design bildung in digital fabrication is not new. Blikstein [4] describes how digital fabrication can facilitate ideation and invention by accelerating design cycles and thereby offer experiences with collaborative

learning through several cycles of failure and redesign. This is a good example of digital fabrication as a conversation with the material [12] and therefore of something that should be a very central part of work with digital fabrication. What we suggest here is to extend the objective of digital fabrication beyond that of digital literacy to acknowledge the quality of designerly thinking: We need to expand our understanding of digital fabrication from a focus on the digital to design and from the concept of literacy to a more fundamental focus on bildung.

As stated, this paper concerns the development of a concept of design bildung, and in doing this of answering the why, how and what of education through digital fabrication. Doing this, we build on Bliksteins observations of design- and engineering processes in educational FabLabs, and we build on Schelhowes introduction of the term bildung to the field. In creating the concept of Design Bildung, we have set out to answer Schelhowe's call for a deeper understanding of how to best use digital fabrication to facilitate complex and sustainable learning [10] but also of answering the question of why this is relevant in the educational formation of future citizens.

The implications of taking a design bildung perspective on digital fabrication are many: We envision a focus on:

- Solving real-world problems and studying complex problem solving in digital fabrication
- Transforming our understanding of technology from a digital platform to a design material

- Integrating the entire design process from early ideation, paper prototyping and codesign to digital prototyping in digital fabrication curriculum

What is to be studied further, is how these implications of taking a design bildung perspective are implemented in educational settings with digital fabrication.

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