

Enabling 21st Century Skills for Textile Education by Integrating Design Thinking in Elementary Schools

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ABSTRACT

Creativity, problem-solving skills and the ability for collaborative work are considered key competences for facing the challenges of the 21st century. Children are born with an inherent creativity that decreases throughout their school careers. A research team of designers and educators investigates whether the implementation of Design Thinking (DT) in textile education in German elementary schools is a suitable method to preserve children's creativity. Initial surveys with teachers and pilot studies in elementary schools showed high motivation and open-mindedness towards DT in classroom. The challenge will be to develop suitable teaching modules for elementary schools of the federal state Baden-Württemberg.

Key Words: Design Thinking (DT), Creativity, Problem-solving Skills, Collaborative Work, Textile Education

1. INTRODUCTION

Children are curious by nature and often discover creative solutions in a playful way [1]. They also like to work with any kind of tactile materials, create new objects out of them and enjoy training their sensory perception by experimenting with materials [2]. In this way they gain their own experience and acquire new knowledge [3, 4]. Creativity, problem-solving competence and the ability to work collaboratively are defined in numerous international studies as well as by the OECD as crucial skills of the 21st century [5]. According to the Education Plan 21 in Switzerland, problem-solving skills are defined as overarching competences that can be explicitly promoted in the school subjects of Textile and Technical Design [6]. Despite these requirements it can be observed that the creativity of children decreases more and more over the course of their school career, therefore the preservation and promotion of curiosity and creativity in children throughout their school careers requires the early intervention of in-service teachers who possess the necessary interest, sensitivity, and observational skills [7]. However, even tutors of creative subjects describe having lost access to their inherent creativity [8]. The gradual disappearance of fostering creativity over the course of school time influences the cooperation of students at universities and has a negative effect on the cooperation of experts from different disciplines in later professional life. Educators at schools and universities should therefore offer learners a methodology that strengthens a balanced interdisciplinary and harmonized network [9]. The aforementioned considerations and the introduction of a new education plan in the German federal state of Baden-Württemberg (BW) in 2016 provided the ignition for the presented research project. It investigates whether Design Thinking (DT) could be a suitable method to foster children's creativity, their problem-solving skills and ability to work collaboratively. The project is funded by the State Ministry of Baden-Württemberg for Sciences, Research and Arts.

1.1 DT as structured and collaborative approach

DT offers the opportunity for interdisciplinary and collaborative work as its core elements are the iterative process, working in multidisciplinary teams, and flexible space. It is orientated towards the way designers work and think. Its phases are named as *Understand*, *Observe*, *Point of View*, *Ideate*, *Prototype*, and *Test* [10], as visualized in figure 1.

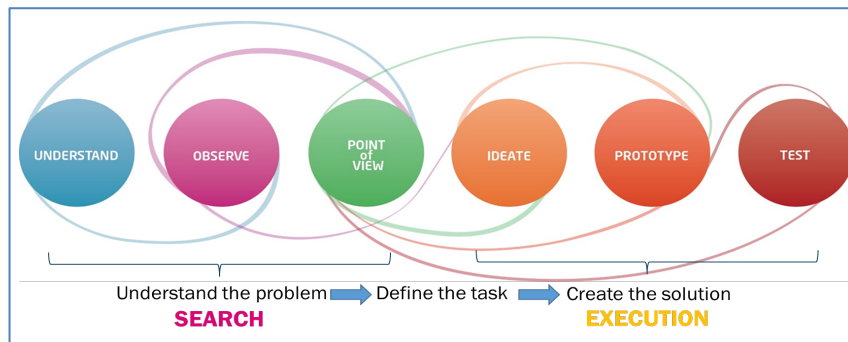


Figure 1. The DT process of the HPI school of Design Thinking in the context of teaching and learning [11]

The US design agency IDEO pushed for a transfer of DT into technology-related areas in order to create innovation over the last two decades [12, 13]. According to international surveys conducted in companies which have integrated DT in their corporate culture, 71% of respondents said that DT improved their way of collaboration, 69% felt that the innovation process was more efficient, and that customer needs were taken into account [14]. Companies with an entrepreneurial focus on DT determined that this method offers the opportunity to make technology more human and to develop products and services that better meet the requirements of their users [15]. Studies conducted in classes at secondary level in the US, Germany and Asia show that DT can lead to more sustainable learning success for children through the use of creative and collaborative elements as well as to a greater satisfaction for educators while teaching their subject matter [16, 17, 18].

1.2 Congruence between DT and textile education in Baden-Württemberg (BW)

According to the new education plan, competences to be acquired by children are divided in process- and content-related ones. As far as the elementary education level is concerned, the Education Plan 2016 features nine subjects including Art/Crafts (i.e. *Kunst/Werken*), which combines Visual Arts, Technical and Textile Education, and General Science and Social Studies (i.e. *Sachunterricht*), which includes topics of STEM Education. The educational value of the subject Art/Crafts is described as follows: “the subject Art/Crafts comprehensively promotes creative skills and aesthetic sensitivity. It enables children to gain knowledge about themselves and the world through perception and action to ultimately position and unfold themselves [...]. The children discover their potential in the design process” [19]. In the subject General Science and Social Studies the combination of natural and social disciplines results in complex tasks that are “better solved in multidisciplinary groups with different perspectives on one and the same problem” [19].

The aforementioned two subjects are of specific interest for this work and share the same process-related skills: *Experiencing and perceiving the world*, *Exploring and understanding the world*, *Communicating and making yourself understood*, *Acting in the world - shaping the world*, and *Reflecting and positioning yourself* [19]. The implementation of the DT process may help children to acquire the process-related competences. The iteration within the DT phases

enables a different kind of learning than the usual linear approach with a pre-defined final result. Its key principles such as understanding and penetrating the given tasks in the first phases, empathy for user behaviour, learning from mistakes, visualising ideas, and building prototypes to experience one's own ideas and those of others [12, 13], are regarded by the authors as having a potential positive impact on teaching.

1.3 Research questions and objective

The following research questions were defined: *To what extent can a methodical approach based on DT enable teachers to foster creativity and problem-solving competence of children, and to what extent does DT promote collaborative work in the subjects Art/Crafts and General Science and Social Studies?* These research questions lead to the objective: to fulfil the requirements of the process-related skills of the subjects Art/Crafts and General Science and Social Studies, which are both strongly related with textile education. The aim is to design appropriate teaching modules together with stakeholders of textile education like teachers, teacher trainers and students, to implement them in classroom settings, and to transfer them into the curricula of elementary schools after a positive evaluation. To ensure that curriculum requirements are implemented and that children's corresponding competences are promoted, teachers, trainers and students need to be involved, because they will be the ones in charge. "When teachers experience that they can noticeably change their teaching behaviour and that these changes also bring about perceptible changes in the learning processes of the children, they are more willing to deepen further training content and strive for a transfer into teaching practice" [20].

2. APPROACH

2.1 A questionnaire survey with in-service teachers

The first step in this project was to gain an overview of previous knowledge about Design and DT of elementary school teachers in BW, their attitudes towards the promotion of creativity, problem-solving skills and collaborative work among children, and openness to learn DT under the guidance of design experts. A questionnaire with quantitative and qualitative items was sent to 21 elementary schools in close geographical proximity to both universities. Their answers were used as prior information for the development of an in-service training in DT.

2.2 A Baden-Württemberg (BW) wide training unit in DT for teacher trainers

In November 2018 a full-day workshop was conducted at a teacher training seminar in the context of the annual conference of the study subject „Everyday Life Culture and Health". This subject provides an expertise in domestic and textile science. A total of 18 teacher trainers from all over BW took part. They were trained in the DT process and its principles and worked in four teams on the following task: "Create the perfect reading place for children". At the end of the training unit all teams had to present their prototypes in front of the entire group. They were subsequently asked to take part in a group discussion about chances and limitations of the implementation of DT in classroom settings and to answer a questionnaire with 10 items. The objective was to get valid answers about their assessment of chances and limitations of DT as a method in classroom settings of elementary schools.

2.3 A Swiss wide training unit in DT

A DT training unit was conducted at the conference “Creative Methods in Arts and Design” in February 2019 at the University of Education in Basel, Switzerland. The target group was teachers, teacher trainers, students, and scientific staff members at elementary and secondary levels of the creative subjects Visual Art, and Textile and Technical Design in the German speaking countries of Austria, Switzerland and Germany. A total of 46 participants were divided into two groups and were given the same task as at the German teacher training seminar. They were asked to take part in a group discussion and to answer the same questionnaire. The objective of this training unit was to evaluate the level of knowledge of those target groups in neighboring German-speaking countries as well as the dissemination and application of Design and DT in the classroom, and teachers’ attitudes towards fostering creativity.

2.4 Pilot teaching units

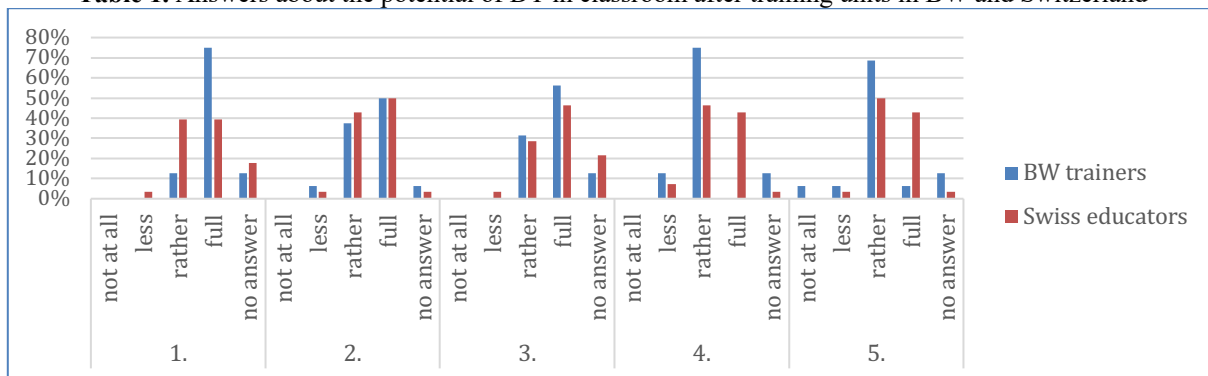
Teaching units were conducted in October 2018 and in February 2019 in two grade 3 classes in two elementary schools in BW. Both were conceived by a designer and a student teacher in accordance with the phases of DT and the principles of good teaching practise [21]. One was held by the student, the other one by the designer. In both cases the class teachers were involved in the planning process. The children also had to present their prototypes in this study. Participatory observation, subsequent interviews with the class teachers and group interviews with the children were applied as research methods.

3. EXPERIMENTAL RESULTS AND DISCUSSION

The explorative survey received sixteen teacher responses from eight schools. It can be stated that the teachers’ interest in promoting creativity and problem-solving skills was very high. Almost all agreed that these skills should be fostered in elementary school children. The majority stated interest in applying respective teaching-learning methods. The demands on the framework conditions were related to additional time and more suitable premises.

More than two-thirds of the participants of the BW workshop confirm the high potential of DT as a new method in elementary schools. More than 50% are of the opinion that DT in classroom is a suitable method to foster creativity, problem-solving skills and collaborative work in elementary school children. In the final group discussion there were some concerns regarding an adequate transfer to elementary education and the need for more concrete guidelines. Especially the trainers expressed reluctance to engage in teaching scenarios in which they neither define the outcome in advance nor plan the process that meets their expectations. As the conference “Creative Methods in Arts and Design” in Switzerland was addressed to participants from all German-speaking countries, only Swiss participants took part. This offered the advantage of the homogeneity of a group: Swiss participants seem to be more familiar with the design process due to their curriculum. Members of the University of Education in Basel use a specific model of the design process which was elaborated especially to initiate a problem-solving process. Although the teacher trainers in BW had no previous knowledge of Design and DT in comparison with the Swiss participants, it can be stated that the answers of both groups are similar in regards to the potential of DT in the classroom. BW teacher trainers have a higher tendency to fully agree to the potential of DT promoting creativity. But when it comes to applying DT or passing it on to students, they tend to be more hesitant, answering “rather”, while 50% of the Swiss participants fully agree in this point. Table 1 compares the answers of the main five questions out of ten by BW and Swiss participants.

Table 1. Answers about the potential of DT in classroom after training units in BW and Switzerland



1. DT in classroom promotes children's creativity.
2. DT in classroom promotes children's ability to recognize problems and develop solutions.
3. DT in classroom promotes children's ability to collaborate.
4. I can imagine using the phases of DT in my teaching.
5. I believe that teachers in education should learn about DT as a teaching method.

Participatory observations during pilot teaching units in grade 3 classes and interviews with class teachers showed that the methodical approach along the phases of the DT process helps children to solve teaching questions in a process-oriented and structured way. In group interviews, they stated that they could organize themselves well in teams without the help of the teacher, tackle tasks together and that it was easy for them to build on the ideas of their team members. They also appreciated having been allowed to choose the materials freely when building the prototypes without receiving any instructions from the teacher. All stated that they were satisfied with the result and proud to have managed it by themselves.

4. CONCLUSION

Initial results show that both the process and the principles of DT enable children to achieve a goal-oriented form of independent learning. Surveys and discussions show that teachers and teacher trainers see a high potential of DT for the promotion of creativity, problem-solving competence, and the ability to work collaboratively. Figure 2 shows that the prototypes designed by teacher trainers, teachers, students and children are similar in some ways.



Figure 2. Prototypes of “The perfect reading place” designed by German teacher trainers (left), Swiss teachers, teacher trainers, and students (middle); third graders (right) ©Högsdal

The main challenge will be to provide teachers and teacher trainers with a solid understanding of the DT process and its principles in order to apply it in a self-sufficient way and to have confidence in an open process. Based on these findings, the next step will be to develop teaching scenarios together with student teachers that will be tested and evaluated in class. The industry should be interested in preparing for the challenges of the 21st century by promoting the creativity of children, their employees of tomorrow.

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