

# HOW CAN CREATIVE SELF-EFFICACY BE FOSTERED IN DESIGN EDUCATION?

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## ABSTRACT

Creative self-efficacy plays an important role in the context of innovation: Without this belief in our creative abilities we cannot act when facing challenging situations, for instance wicked problems. [1]. Due to a lack of the trust in one's own capacity to perform creatively, the best idea will not be realized nor implemented to become an innovation. This belief influences success expectations and motivation to reach a challenging goal. Creative self-efficacy is an education objective of d.schools [2][3]. Against the background of creative self-efficacy as a crucial quality for innovators, we will look at design thinking education at d.schools. Based on observations we describe how d.schools likely mediate creative self-efficacy in their education.

*Keywords: Self-efficacy, design thinking, design education*

## 1 INTRODUCTION

An important aim of design education in general, and Design Thinking education in particular, is to generate innovation. Faced with wicked problems and an increasingly challenging society, there is a need for 'critical innovations' and a need for responsible innovators. Therefore a high performance concerning innovations is crucial. Self-efficacy is a construct that was defined by Bandura. The idea behind it is that people with a higher self-efficacy perform better than those with a lower one. How can we manage to maximize the competencies and skills of future innovators so that they innovate more? Scientific research [4] has shown that it is possible to mediate self-efficacy and to understand the possible influences on it. However, research has yet to be done how self-efficacy in design education can be mediated and how it can be strengthened. We believe it to be an important theme for educators at design schools and in practical application, as well as an important consideration for design practitioners. When fostering creative self-efficacy the promising effects and impacts on design education (as well on professionals) concerning innovation are obvious. By transferring Bandura's construct of self-efficacy to design thinking education, we will try to show evidence that there is a mediation of creative self-efficacy and at the same time these examples can work as practical examples of how creative self-efficacy could be integrated into an design educational model.

## 2 DEFINITIONS

### 2.1 Critical Innovation

In the early twentieth century, the definition of innovation was mainly focused on technical progress. [5] Nowadays, however, this definition would not be sufficient considering the increasing social and sustainable aspects that make a holistic and human-centred approach necessary. Thus, we see innovation as a construct that builds on scientific knowledge and serves as the basis for the innovation of new processes, products and services and is thus necessary to acquire an advantage in today's competitive market". [6]

### 2.2 Design education

Design Education supplies a theoretical and practical base for future designers in different design disciplines (e.g. universal design, sustainable design, information design and interaction design). During this mostly academic education, which lasts approximately three to four years, the design student will prepare for life as a professional designer. Design education shares one important goal

with the design thinking education: Both education concepts aim, among other aims, to train future innovators.

### 2.3 Design Thinking Education at d.schools

The dominant role of expert knowledge as a resource for professional problem solving has been more and more under pressure since the rise of the information age. The increasing complexity and wickedness of problems we are faced with in our professional lives call for creative and empathic problem solving skills. These not only apply a 'scientific' knowledge base, but also a generally widespread understanding of various knowledge domains beyond one's own profession. For instance, project-based and multidisciplinary team work as a popular aim in the corporate world calls for a greater ability and awareness of sharing and learning knowledge from other professions as well as from various stakeholder domains. Skills that help to learn and to transform unfamiliar kinds of knowledge become likewise important for problem solving as skills to apply already internalized knowledge. Design thinking methodology as taught in d.school education aims at fostering such abilities of meta-professional learning and creativity. 'Design Thinkers' are trained (e.g. in D-school Potsdam between six to twelve months) in understanding and creatively transforming cross-domain knowledge as well as integrating different expert domains in creative problem solving processes. Internalized problem solving strategies and skills are a crucial step on the way to innovate. [6]

### 2.4 Self-efficacy

In this paper, we work with Albert Bandura's concept of self-efficacy. Bandura defines self-efficacy as follows:

"Perceived self-efficacy refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments." [4] p. 3

Self-efficacy therefore supplies the necessary conditions for taking action under risk. If we do not expect success, we will not act or take risks. The same is basically true for creative self-confidence: If we approach a creative problem without substantial optimism, it is unlikely that our project will end up being successful. Successful problem solving therefore is not only a result of the amount of knowledge a person has already internalized, but, as Bandura puts it, of *belief*:

"Beliefs of personal efficacy constitute the key factor of human agency. If people believe they have no power to produce results, they will not attempt to make things happen." [4] p.3

This statement has fundamental implications, meaning that even if we are able to implement a required action we already know about, we will perhaps not do it because we believe that we lack the necessary capacity to succeed. Bandura puts it as follows:

„People's beliefs in their efficacy have diverse effects. Such beliefs influence the course of action people choose to pursue, how much effort they put forth in given endeavours, how long they will persevere in the face of obstacles and failures, their resilience to adversity, whether their thought patterns are self-hindering or self-aiding, how much stress and depression they experience in coping with taxing environmental demands, and the level of accomplishments they realize.“ [4] p. 3

Self-efficacy therefore can be seen as a crucial precondition for coping successfully with complex challenges in the most diverse fields, regardless of the real individual level of skills. However, Bandura defines self-efficacy as a general and non-area-specific concept and thus as applicable to diverse situations. He therefore indicates that self-efficacy beliefs might vary regarding specific areas. In the area of creativity and self-efficacy research has already been done within an organizational context by, among others, Tierney and Farmer. [5]

### 2.5 Creative self-efficacy

In this work, we build on the concept of *creative self-efficacy* as formulated by Tierney and Farmer:

"Working from Bandura's general definition of self-efficacy as targeted perceived capacity, we defined creative self-efficacy as the belief one has in the ability to produce creative outcomes." [5]

## 3 SOURCES OF SELF-EFFICACY

Bandura performed research on how self-efficacy originates and which factors have an impact on self-efficacy. He identifies and describes four sources of self-efficacy. In the following, we will illustrate these sources and then we will transfer the sources into the d.school context by interpreting our explorative observations. Our aim is to check if there are situations and conditions in the d.school education, which show that the mediation and enhancement of self-efficacy at d.schools is plausible and how creative self-efficacy is likely mediated. [3] According to Bandura, the self-efficacy of a person originates from four sources of information: (1) enactive mastery experience, (2) vicarious

experience, (3) verbal persuasion and (4) psychological and affective states. In the following, we will compare these four sources with explorative observations at d.schools. Our comparison will view each of the four sources juxtaposed with d.school situations in order to find out more about potential parallels and how creative self-efficacy can be mediated.

### **3.1 Enactive mastery experience**

Following Bandura, acting to master a difficult task is the first way that leads to self-efficacy. Situations that offer direct experiences are therefore a good way to achieve a stronger belief in one's own capabilities. Bandura calls such experiences "mastery experiences" and claims that:

"Successes build a robust belief on one's personal efficacy. Failures undermine it, especially if failures occur before a sense of efficacy is firmly established. (...) After people become convinced that they have what it takes to succeed, they persevere in the face of adversity and quickly rebound from setbacks. By sticking it out through tough times, they emerge from adversity stronger and more able." [4] p. 80

Also, Bandura points out that even small successes can help people to believe in their own capability to master future tasks or new activities in settings that are uncommon for them [8]. We therefore asked ourselves: What kinds of difficult situations are proposed to students at d.schools to be successfully mastered? Which methods are mediated and will empower students to deal successfully with difficult and challenging tasks in the future? In d.school education, students get to know the methodological design thinking process by repeating the methods during several so called "design challenges". These design challenges are real projects, which are handed in by project partners. In all cases they hand in a project that has to deal with complex or wicked problems. Dealing with ambiguity and wickedness of problems is therefore a main skill that has to be trained during the course of a design thinking education. Finding solutions for wicked problems, however, does not seem to be a promising way for "small" successes that can be easily achieved, as claimed by Bandura. What tools are being delivered by the design thinking education in order to establish creative self-efficacy in students? We could observe some crucial aspects of methods that may help students to feel more creative and confident. For example, they learn to apply research methods such as interviewing and observation to better know the user and his needs: They learn how to ask and how to observe the user in order to gain empathic knowledge about the user that he himself does not know or cannot verbalize. Students then develop a working hypotheses regarding the user's needs, building on the findings and insights of their research. In this phase they develop drawing skills and brainstorming techniques. These ideas from the brainstorming phase are being refined as solution proposals and are made tangible as prototypes. In this way, developing prototyping skills also goes along with a design thinking education. Of course the students learn as well to apply testing methods to gain user feedback on their prototypes and to iterate on their prototypes. Throughout the project, students are enabled by several mediating techniques and the knowledge of how to apply these techniques. If we compare our observations with Bandura's concept, we can assume that these techniques help the students to enlarge their problem perspective and to deal confidently with ambiguities within the design challenge. The design thinking methods are tools that are easily achieved and lead to moments of success within the team - the success in problem solving within projects may therefore enable the enhancement of creative self-efficacy. Bandura also stresses that mastery experience attributes need to be ascribed to one's own capabilities or one's own learning engagement if self-efficacy shall be established. The next question therefore is: What mirrors for the students that the accomplished action was successfully done? We found that each process step or mode needs to be shown in a small presentation that is open for feedback from the other teams. We could see that the students learn via their presentations and via the given feedback that they are able to solve tasks in a desirable way for the project partner. Consequently, they are more self-confident when it comes to the final presentation in front of the project partners. We could see that the students feel appreciated by these external partners. This is an important form of success that comes with a design challenge. It may even happen that project partners offer concrete jobs to students at the end of a project or that a company financially supports an alumni team in continuing their work on the idea in order to introduce it to the market. Another form of direct success can occur in the form of patents and awards. In summary we can assume that the d.school education mediates the design thinking process, skills and competencies as, for instance, problem solving competence for wicked problems. Furthermore, in comparison with conventional scientific university learning situations, it is more likely that the students at the d.schools achieve more positive mastery experiences based on project practice in a team and with the support of the teacher. According to Bandura, these positive mastery experiences lead to heightened self-efficacy.

### 3.2 Vicarious experience

Drawing conclusions about one's own competencies is possible when the individual watches other people, for instance models during their acting. The so called "vicarious experience" or "social learning" means that knowledge and cognitive and social skills can be acquired on one hand by solving problems in teams. On the other hand, this can be done by watching successful behavioural models, which based on different characteristics (insistent effort, effective assignment of learning strategies) can deal with difficult problems and demands. As Bandura describes it:

"The greater the assumed similarity, the more persuasive are the models' successes and failures. If people see the models as very different from themselves, their beliefs of personal efficacy are not much influenced by the models' behaviour and the results it produces. Self-modelling, in which people observe their own successful attainments achieved under specially arranged conditions that bring out their best, is directly diagnostic of what they are capable of doing."

Bandura [4] p. 87

We assume that students at the d.school have rather similar interests (e.g. an interest in design-oriented approaches). Similar interests also increase identification within teams and therefore enhance social learning as described by Bandura. Apart from having similar interests, the students come from different backgrounds. Due to different study fields the students expand or obtain different skills, special knowledge, various working methods and other perspectives on things. A core part of d.school education is to learn to treat these various knowledge and ability domains in a complementary way and to foster an open exchange among them. Because of this, there is very little individual competition in d.schools. The attitude of helping each other within and between teams predominates. *Teams do not focus on competing with each other but on solving complex challenges and delivering satisfying results.* According to our observations, the diverse teams develop a feeling for the different backgrounds and skills during a project quite well. A psychologist in a multidisciplinary team might bring in his skills to depict mental models and the needs of users comprehensively while a product designer might be the only one able to create concept sketches in a fast and extensive way. The more they identify themselves with their team members, the better they can begin to complement one another intuitively. A member of a d.school team therefore constantly has experiences that he never would have had alone. These are experiences of communication, visualization, structuring contents, organisation, risk taking, manifold learning etc. The student learns how to observe others – his team members, users, stakeholders – and likewise know what it is like to be observed himself. Due to the distribution of competences, expertises, skills and ideas about the students, every single one of them moves in a steady flow of vicarious experiences. Thus teachers are not only instructors of the method but are models to the students, as well. They are often involved in design thinking projects and present their results to the students. In comparison to other forms of teaching, the d.schools are characterized by an open atmosphere also concerning the relationships between teachers and students. Since teachers are not judging or evaluating the students, they can act as advisors, models, or sometimes just co-creators offering useful hints. According to Amabile [9], the creativity is enhanced additionally if one works together with a "coactor" that reflects the team's or individuals creative outcomes. Teachers as "coactors" therefore serve as a source for vicarious experiences as well. Also the use of open spaces and flexible working and communication surroundings, such as mobile furniture and an open kitchen support this process of constantly observing others as models in action in order to reflect one's own actions. In summary, vicarious experiences are made in d.school education in various ways. The students learn complementary skills, working methods and behaviours by watching their fellow students and teachers. The d.schools offer well-functioning and flexible premises, which provide free space to bring forward cooperative communication and therefore support social learning. A particular culture is promoted based on small teams with teachers monitoring and supporting the students throughout the entire processes and providing feedback, without judging them too early. This particular atmosphere can be regarded as a class climate that encourages learning, and we are convinced that it will affect self-efficacy expectations in a positive way.

### 3.3 Verbal persuasions

A further important source for the development of self-efficacy expectations (autosuggestion: "You can make it!") refers to verbal feedback or verbal persuasion. Verbal persuasion means that one persuades someone of being capable of doing something in a successful manner. Verbal feedback provided by another party is especially helpful and effective if it occurs task-related and promptly and if it shows realistic consideration of the actual level of skills, abilities and the performed learning progress of the team members. (see Kutner [10]). Not only the verbal persuasion from by other

persons is effective, but also that from one's own inner voice. This so-called "self-instruction" also belongs to this category of self-efficacy. As Meichenbaum [11] describes it, self-instruction is and self-verbalization are two of the prominent methods in psychology and specifically in behavioural therapy. They have proven to be valid concepts for handling stressful or frightening situations. The emphasis in self-instruction is placed on the measure of conviction regarding one's own capacity for acting ("I can do it!", "I have the right to do so!"). It is therefore related to the encouragement of self-efficacy. As Bandura puts it:

"People who are persuaded verbally that they possess the capabilities to master given tasks are likely to mobilize greater effort and sustain it than if they harbour self-doubts and dwell on personal deficiencies when difficulties arise." [4] p. 101

There is a high degree of mutual support and motivation in school teams. Through the use of motivation techniques, an atmosphere of constructive feedback and an attitude towards failure as a means for learning is created. There is generally a low level of fear and a high level of optimism involved. For instance, "fail early and fail often" is one of the key paradigms in design thinking and as a chance for further learning requested and welcomed. Within the process and the course of the project there exists informal and encouraging feedback at all times. Speaking from experience, a strong belief in the capabilities of a d.school team generally goes along with an attitude of "Yes, we can do it!"

Also, the d.school environment offers strong social support, in particular through the teachers. Every d.school team is assigned to one teacher who mentors and accompanies the students throughout the whole process and during the entire period of the project. If required, the teacher guides the team through certain project phases and intervenes if the process stagnates or if methods are applied incorrectly or in an unhelpful way. If a team does not get along well within the process and makes no progress or is not capable of changing this status, the teacher joins in and supports the team in completing the actual process phase by asking the right questions, reflecting on the situation and giving the team further methods to continue with. Moreover, some teachers actively participate in presentations (e.g. they take over a role within the role play). Other teachers also take part in activities outside the regular d.school lessons. In this way, the teachers act as guides providing the team with a feeling of backup throughout the process.

### **3.4 Physiological and affective states**

Physiological and affective states as well as physical arousal are expressions of the perceived belief in one's own self-efficacy and influence one's expectance of self-efficacy. Self-efficacy is also influenced by one's own emotional states while a person is thinking about a certain task or trying to solve a problem.

"People often read their physiological activation in stressful or taxing situations as signs of vulnerability to dysfunction. Because high arousal can debilitate performance, people are more inclined to expect success when they are not beset by aversive arousal than if they are tense and viscerally agitated. Stress reactions to inefficacious control generate further stress through anticipatory self-arousal. By conjuring up aversive thoughts about their ineptitude and stress reactions, people can rouse themselves to elevated levels of distress that produce the very dysfunctional they fear." [4] p. 5

In the d.school, every day starts with so-called "warm-ups" to relax the team members. We know that activity in the central nervous system influences the muscular tension and vice versa. [12] That means, a psychological strain accompanies increased physical states of tension but counteractive warm-ups lead to the relaxation of the musculature and contribute to a mental stress relaxation. [13] Even through the warm-ups in the d.schools do not seem to focus specifically on relaxation training and mental relaxation, one can assume that these practices contribute to a decrease in nervousness and that stress and negative or disruptive thoughts and feelings take a back seat. The tasks and challenges to follow may be accomplished more easily with this state of mind. Not only are relaxation and reduction of pressure important consequences of physical exercise - at the same time, the common performance within the group seems to heighten a certain "we-feeling" and team spirit. In addition, warm-ups are created in a way that small tasks have to be performed. Because of the low complexity factor of these tasks (e.g. "create a new greeting procedure and greet your neighbour with it") the participants gain a feeling of success right from the beginning. This provides relaxation but is also a convenient contrast towards the many small failures the teams will have to face in their projects. We can summarize that the fourth source of self-efficacy can only be moderated indirectly by the d-school education. Nevertheless, the d.school has found it beneficial to use warm-ups that can lead to a decrease of stress reactions. With a comfortable atmosphere created by moments of success and social support from the other group members negative affective states will occur more infrequently. We therefore assume that

this fourth source of self-efficacy is in fact addressed by the d.school and that it has a positive influence on the self-efficacy of the students. [3]

#### 4 OUTLOOK

A high creative self-efficacy could be considered crucial for generating innovative ideas and innovation. Creative self-efficacy is an objective of d.school education [2]. Design thinking education intends to mediate this capability in addition to other crucial skills such as wicked problem solving and empathic learning abilities. The observations at the d.schools support our assumption that a d.school education mediates self-efficacy in a creative context. We purpose that the effects and factors of self-efficacy are the same as for creative self-efficacy. [3] In the framework of a larger research project, we will evaluate empirically whether d.schools mediate creative self-efficacy and, if so, what influential factors can be observed. To be able to support a claim, empirical data must be collected. It seems to be promising to develop a measurement for creative self-efficacy in this specific context. Additionally, we are planning experimental settings to better understand the concrete mediation of creative self-efficacy in design (thinking) education and to verify whether tools, methods or settings can be identified that particularly foster creative self-efficacy. With these gained insights our aim is to contribute to the question of how future innovators can be trained in expanding the realm of creative self-efficacy.

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