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TEACHING CREATIVITY BY CHANGE OF MIND-SET: FROM GOAL-ORIENTED TO OPEN AND CURIOUS

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ABSTRACT
Creativity is a wildly debated topic among scholars and practitioners, but one that lacks consensus. Many have tried to define, describe and explain creativity, its purpose, effect and use. Is creativity a personality trait you are born with, or can you learn to become creative? As a design teacher with a teaching practice focused on the skills of creativity, this is a relevant question, because if creativity cannot be learned, then it cannot be taught. The results of observations during a design methodology course for undergraduate design engineering students suggest that there are important common conditions in a learning situation that aims to enhance creativity through practice. In this case, it aims to implement a design thinking mind-set in a product development process. From a teacher perspective, this paper discusses the need to break students' goal-oriented mind-set, learned from the first day of primary school, to enable them to adopt a creative mind-set. In this context, students with a goal-oriented mind-set will immediately start working on finalising the first idea/solution that comes to mind without considering alternatives. Breaking this mind-set can be done by letting the students' practical experiences intertwine with self-reflection under teacher guidance. The focus is to identify each students' motivation to change mind-set by teaching the underlying reasons why creating ideas is hard work, not something that happens by chance. Hence, the teacher's focus is on generating student awareness those mind-set rules over method so they can embrace a different/new road to finding design solutions.

Keywords: Creativity, problem solving strategies, design pedagogy, change of mind-set/attitude, brainstorming, Synectics

1 INTRODUCTION

Being placed in a creative process can be an emotionally painful experience for some design engineering students. Their main struggle seems to be overcoming their fear of doing something wrong. One reason for this struggle is that the education these students have undertaken so far in their lives is mostly built on a strong foundation of fundamental knowledge [1]. This type of education is very different from the creative process that is expected to take place when using design thinking, which in contrast emphasises divergent thinking, experience mapping, explorative investigation, and challenging certainty, instead of a mathematically dominated curriculum [1]. Hence, when teaching engineering students design thinking and other design methods, one of the hardest tasks a design teacher has is to get students to explore beyond the first idea that comes to mind for a design solution. This can be compared with Ochsendorf's [2] argument that the emphasis of today's engineering education is only on finding the optimised solution. This can lead to reluctance to explore more freely, and has resulted in narrowed down abilities compared to the holistic view that existed in the last two centuries when engineers were also great inventors, such as Gustave Eiffel and others [1].

Design fixation refers to a blind and counterproductive adherence to a limited set of ideas in the design process [3]. This can be explained as mental blocks or obstacles (often self-imposed by the designer) that contribute to the feeling of being stuck in the design process that design students (and professional designers) experience when they are unable to get pass their initial ideas. This fixation is often narrowed down to one solution or approach to the design problem to be solved [3]. Hence, the students struggle with the lack of flexibility in their process [4]. One reason, according to Purcell and Gero [4], is the absence of domain specific knowledge (specific to the design problem). Instead, the designer

engineer relies on everyday knowledge and familiar examples that become an obstacle to coming up with innovative solutions.
Creativity is a behaviour that can be taught [5] and as such, it is often presented as a set of different methods to be followed. The methods consist of steps that steer the user towards divergent thinking and convergent thinking in relation to the specific method's different phases. However, teaching creativity does not only involve teaching them methods. The student's thinking style [6], personality and behaviour are equally relevant for a creative process to take place. Hence, giving students the opportunity to practice their ability to embrace openness and risk taking [7] becomes as important as giving them a set-up of methods.
In conclusion, design engineering students have little prior experience from their educational background of making decisions based on openness and risk taking. Many of them will thus experience design fixation when they are faced with a creative process such as a design project driven by design thinking. Giving them tools such as methods for creative problem solving and idea generation can work for some students. However, most of them also need guidance to change their thinking style and to understand how their own behaviours will hinder them from being creative. These behaviours include working on only one solution, or only looking at the problem from the perspective of one target group, or relying on what they already knew. For designer practitioners and design students alike, reflecting on their own design process is the main tool to further develop their professional skills. Moreover, people with a high level of creativity often are able to reflect on their own creative processes in an objective way [8]. Consequently, self-reflection is used as a teaching tool that enables students to gain awareness of how they themselves can influence their own flow [9] when creating ideas in the creativity workshop presented in this paper.

2 A CREATIVE WORKSHOP TO A BREAK MIND-SET

For over ten years I have carried out a creative workshop as a tool for teaching undergraduate design engineering students how their mind-set and attitude affect their process of generating ideas. The workshop is part of a design methodology course (five week university course), where other tools and methods for driving an industrial design process forward are also presented. However, the creative workshop is a learning activity based more on self-reflection and acting on one's own insights rather than on tools or methods, such as mood boards, persona, function analysis or 3-D doodling with fast paper models used in the rest of the course.
The reason why I chose to teach creativity by highlighting mind-set and attitude instead of presenting different methods and techniques (and there are hundreds of them) can be questioned. However, based on my teaching practice, I would argue that just learning a few steps in a method and then following them as a recipe does not work for these students. Learning a method is not enough for them when it comes to practicing creativity, which in this case involves creating new solutions/ideas to a given design problem. Almost all the students stick to their first idea. They start to dig into details and want to refine the idea immediately, striving to make it as complete as possible. It very seldom happens that the initial idea is the year's hit among innovations (but you never know!). To create innovative ideas is hard work, something most of the students do not recognise before taking my course, and especially not before taking part in the creative workshop. The goal of the workshop is to break their existing mind-set of being effective goal-oriented problem solvers, and enabling them to rebuild a new mind-set focused on openness, curiosity and looking for opportunities in a work process.

2.1 A workshop practicing an open mind-set

The workshop session lasts about three hours with two breaks. The students work on a design project in pairs in the course, so for practical reasons, both students take part in the same session. Based on my observations, the best situation for learning occurs when 6-8 students take part in one workshop session. Four students are too few, there is a risk that the flow of ideas will be low and that the process of generating ideas will stall because of the lack of input to energise the discussion. Ten students are too many. They cannot work as one group when generating ideas because there is not enough space for all to speak their mind (i.e., not physical space but dialogue space in terms of being noticed by others or contributing to the discussion). A group of ten will always divide on its own into two or more smaller groups, or one or more of the students will become invisible in the bigger group because they do not take part in the discussions at all.

As the teacher, I sit in a corner of the classroom, silently observing what they do and say as they sit around a table at the other end of the room. I track how they act in the process of generating ideas, but also how they treat each other, both orally and through body language. The reason why I act (teach) in this passive manner is because I want to highlight for them how their attitudes and behaviours in the group negatively or positively influence the group's ability to produce ideas.

Each workshop session follows a pre-set schedule. The session starts with me sitting quietly in the corner waiting for the students to arrive. The classroom has been arranged so that all the students can sit around one big table next to a white board. On the table, there are some products that represent the products to be designed in their first assignment. The first design problem is presented in writing on a piece of paper, face down at the centre of the table next to the products. On the back of the paper, a written instruction tells the students to turn the paper over at 9:15 a.m. Additional instructions are written on the white board: "You have eight minutes to jointly solve the design problem on the table. The eight minutes start at 9:15 a.m. sharp."

I do not answer any questions. I just point at the white board. The students sit down around the table, turn over the paper, and start discussing their task and the design problem as such. After eight minutes I come to the table and ask them to put their discussions on hold. I then ask them to reflect on what they did well during the eight minutes. They usually give me answers such as: "We listened to each other." "We all had the opportunity to come up with ideas." "We produced many ideas." Then I ask them what they would like to change if they were given the chance to repeat the eight minutes. Here they usually say: "Arrive on time" (few students are there on time, and so they have to restart the process, explaining the design problem a number of times). They also would like to analyse the problem with more structure and have time to think alone and to later share their ideas with the group. Many of them seem to be uncomfortable expressing unfinished ideas. I note down their suggestions for improvement and post them on the white board for all to see. Then I present Osborn's four rules for brainstorming [10] as input to improve the process. Next, they are asked to repeat the process in order to refine it by adding their suggested improvements. The whole group works on another design problem this time, one that the paired students brought with them and that is connected to what they are doing in the course; in other words, a project that they own. The time is extended to 10 minutes for the repetition in order to come up with as many solutions as possible.

Osborn's four rules as explained for the students:

No evaluation of solutions during ideation

Every idea is needed (welcome on the table), absurd as well as unpractical ones

Quantity gives quality; hence, as many ideas as possible are needed to find the best one

No one owns the ideas; everyone can play with them, change, improve or combine them

This process is repeated five times in the three hour workshop. It involves coming up with new design problem solutions in 10 minutes, self-reflection, and suggestions for improvements to reach the goal of producing as many ideas as possible. After each phase of self-reflection, I add their suggestions to the white board and give my own input based on my observations of what they do and say during the 10 minutes. In the self-reflecting phase, I also emphasise the ways in which mind-set, attitudes and behaviours lead to more flow and what hinders flow. I have a pre-established set of comments, based on my earlier experience, which is shared with the group to increase the flow of ideas and to describe the group dynamics.

The seventh and last problem solving round takes place after the second break. I change the setting to break the routine and to expose them to insecurity and a change of rules. I remove the table and place the chairs in a half circle in front of the white board. When the students return, I act as the process moderator, steering their process to generate ideas; hence, I have also changed my own behaviour from passive to active teaching. To steer the process, I use a modified version of Prince's [11] and Gordon's [12] synectics method, see Figure 1. Synectics was chosen because the process naturally includes many of the aspects I focus on when giving feedback throughout the workshop.

Figure 1. Illustration of the modified version of synectics that is used in the last round of problem solving in the creative workshop

2.2 Lessons learned from observations

There are something's that always happen. I often have one group that never gets into a flow, where the ideas have quite a low level of creativity. They come up with ideas that are very close to existing products and very realistic and easy to realise without any revolutionary changes. Hence, the ideas lack an innovative approach, newness and uniqueness. With these groups I need to increase guidance and give more explicit instructions to achieve a desired change or improvement. Sometimes, as a last resource, I interrupt their 10 minutes session to illustrate hands on how to apply the improvements we talked about just before they restarted their process. I have learned from my observations that students in these groups do not feel secure with each other for different reasons. They are afraid of making mistakes in front of the group or of making a fool of themselves. The level of trust is low and consequently, so is the level of risk taking. My priority then is to give feedback on creating a secure dialogue space for the group to work in. If they do not feel secure, they cannot allow themselves to let me guide them in the process of creativity, to open up their minds and open themselves up for exploring opportunities. Consequently, they become stuck in their previous life experiences.

I noted quite often in my observations that just one person's behaviour can affect the entire group's ability to act creatively. To resolve this, I actively address the consequences of a specific behaviour by asking open questions to the insecure group and by giving them space to twist and turn feelings and opinions related to the behaviour without pointing out anyone in particular. In a group with members who feel secure, I can use specific examples by asking personal questions like: "Sarah, I noted that David voiced that he didn't like your idea. How did that comment affect your next idea?" Or: "Henry, I noted that when you all talked about apples, you withdrew from the group for a while. What happened there? What did you feel?" However, in a group with very insecure members, I use micro-lectures or my own experiences of similar group work to exemplify indirectly how a negative judgement will stop the flow. In a gentle way, this illustrates what I observed in their work but without stepping on anyone's toes. I cross my fingers and hope that what I say will initiate silent associations and reactions in their minds. This builds on their shared understanding of how their own behaviours and attitudes affect their ability to create ideas. This results in a more open-mindedness in both the secure and insecure groups, which better enhances creativity.

Sometimes I have groups where my instructions are almost unnecessary; where the group already has an active process driving itself in the direction I want it to go. My work with these groups is to confirm and reinforce the existing process and to speed up the flow. I observe from the start that the members in these groups have a more open attitude to the workshop itself but also to each other. They dare to play around with their thoughts. They use humour to get each other to laugh and they sometime tease each other without upsetting anyone. They also give each other feedback that is more positive and in a natural way, take responsible to grow the ideas of others.

3 DISCUSSION

Can we learn to be creative? Or is creativity a skill so connected to our personality that not every student can learn it? Evidently, it is easier for some people to act creatively than others. Why that is the case cannot be entirely explained here; however, I would like to present some reflections from my teaching experience. When the students begin their first round of finding solutions in the creative workshop, most connect their process to brainstorming. Brainstorming has almost become a synonym for creating ideas: “Let’s go and brainstorm!” However, very few of the students are actually familiar with and knowledgeable about how to use the method and what it is based on. When I give them Osborn’s four rules or talk about Osborn as the father of brainstorming, it is all new to them. Thus, their (spontaneous) way of brainstorming is just a matter of throwing out ideas and not really thinking divergently in the way Osborn describes it. The process is not steered by anything, such as divergent questions to help open-up the problem to be solved. It consists mainly of the first solutions that come to mind. If there is more time, they will also sum up their ideas and quite soon start to evaluate them, and thus start using their critical thinking skills and convergent thinking. Depending on personal factors such as the group members’ personality and trust within the group, ideas on a high creative level can certainly spring up [13], but most of the ideas are quite close to reality (as exemplified in Figure 2). To be able to raise the level of creative thinking, I first need to break the goal-oriented mind-set of most of the design engineering students. I do this by showing them how their behaviours and attitudes affect their flow. Then I need to rebuild their mind-set by giving guidance and explanations followed by letting them practice themselves by focusing on the stimulation of their own and other group members’ creative flow. They need to learn how to put themselves in a flow-generating mind-set, where openness, curiosity and risk taking are allowed and encouraged.

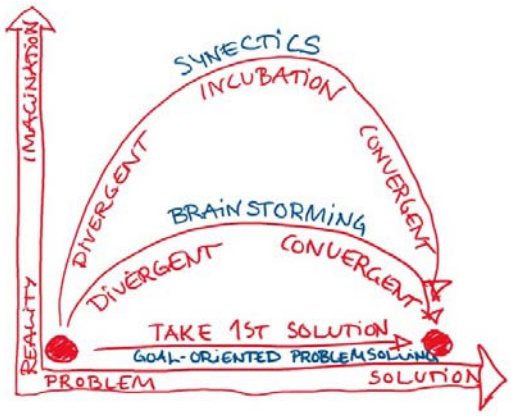

Figure 2. The difference in the level of imagination affects the flow and thereby the number of new unique ideas depending on the process used. If the different elements reinforcing creativity are included in the process, this increases the chances of creating a better flow

Rebuilding a mind-set is easier than breaking an old one. Some students do not want to change their mind-set at all, which is their full right. You cannot force someone to be creative, can you? Being open and taking risks are scary ventures that require courage; both are connected with strong negative feelings. For a student to follow this, they must really believe that what I teach is of value for their ongoing learning, or else I will fail to motivate them. The meaning and reasoning behind what I am trying to instil in them needs to be made explicit. By repeating the group-thinking process several times (7-8 times in the workshop), the students’ are shown that there is space and time for improvements, so it does not need to be perfect the first time. By applying this self-reflective method to gradually change and improve the process, the students are taking one step at a time in learning about their own abilities and how to take control over their own process or preferred way of working. When they are only given 10 minutes to solve a problem, it hinders them from reaching design fixation; 10 minutes is enough time, though, if one works on the right things in a conscious and very

well-structured manner to generate many solutions. In the beginning when the students are unfocused on the process, they deliver 1-3 solutions. Later, when they are focused on controlling the process in order to achieve flow, they can deliver 30-50 solutions in the same amount of time. Feeling and experiencing that change of capacity is crucial to believing that one has the capacity at all – the capacity to avoid the most common obstacles one encounters in creating flow: fear of failure, fear of making mistakes, fear of being wrong. Instead, one can learn to view these as opportunities to do something new and creative.

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