INTERNATIONAL DESIGN CONFERENCE - DESIGN 2014
Dubrovnik - Croatia, May 19 - 22, 2014.

THE INFLUENCE OF CREATIVE SELF-EFFICACY ON CREATIVE PERFORMANCE

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Keywords: efficacy, creativity, questionnaire

1. Introduction

Does a person's confidence about the own creativity influence his or her creative performance? This question raises attention as creativity seems to be one of the main characteristics, which is seen as important road to success across almost all fields and disciplines such as business and industry, research and science. Thus, enhancing creativity of the individual person is seen equivalent with success in terms of performance not only in a specific creative task but across different kinds of problems with ill-defined, wicked or and complex nature. The 'application' of creativity in the product development context is – what in industry usually is agreed upon as the origin of innovation – by large the determining factor for the survival of companies in the today's highly competitive environment.
Thus, for human resource management in companies there are two main interesting questions in terms of steering innovation and promoting individual creativity: firstly, how to assess or diagnose creative persons before hiring and secondly how to enhance the creative skills of (less creative) persons working in the company. Accordingly companies depending on the creativity of their employees might gain competitive advantage if they are able to apply methods or tools on the one hand to select the creative applicants, to assign the appropriate tasks to the correct personskemployees for assigning tasks with mainly creative requirements to them and to enhance the creativity of less creative employees, on the other.
However, there are major obstacles to follow these suggestions: first of all, the concept of creativity itself is not clearly defined yet, and second, deriving from that, there are even less clear formulated rules of how to measure creativity [Runco 2004]. Why is that the case? The concept of creativity is difficult to grasp, because creativity can be expressed within different forms of representations such as writing, painting or reasoning. Furthermore, there are multiple potential influences, which may vary from one situation to another, e.g. in a team setting a "usual creative" person might not deliver creative ideas, because the person doesn't like working in a social complex environment. Finally, also the evaluation of creative performance is not necessarily a clearly defined part of the process.
The traditional definition [Guilford 1967] is probably the most well-known and most often used approach to describe and accordingly to measure creativity. Guilford defined creativity as "divergent production", as number of varied responses in a test item; thus the higher the score in the test, the higher the level of creativity. In order to gain a high score, the participant must explore a given problem in many different directions from the initial problem state. Research has shown moderate correlations between participants' scores and other judgments of their creativity. This measure does not assess whether the solutions meet other criteria of creativity which are named by other authors [Torrance 1974], [Guilford 1967], such as novelty and originality, high quality, and usefulness. Often the assessment of creative performance is based on one single criterion mainly fluency or originality,

however it is also mentioned that originality is a necessary but not sufficient criterion for creativity [Runco 2004].
One of the objectives of the study reported here was to analyse in how far the individual person is capable to assess the own creativity and then to check whether this self-assessment is connected to the creative performance which was measured as the person's creative output during solution generation in two individual assignments.

2. Theoretical background

The term creative self-efficacy is derived from the term and theoretical context of self-efficacy that has been introduced and defined by Albert Bandura [Bandura 1977]. Bandura defines self-efficacy as "a person's belief that he or she can successfully perform in a particular setting". Accordingly we define creative self-efficacy as the belief the person has in his own ability to produce creative outcome in a specific setting or in general.
Bandura claims that self-efficacy is a strong condition for creative performance, because self-efficacy increases the motivation which gives priority in weight and emphasis of the own thinking and acting. Thus, the individual motivation triggers two aspects, first, the choice of a certain behaviour and second, the pursuit of that kind of behaviour.
There are further concepts with a similar meaning, such as self-image, self-esteem and self-confidence. All these concepts are related to the individuals' general self-image but creative self-efficacy is different in so far as it is related to the creativity-specific self-efficacy which we assume differs from general self-efficacy, which is the overall belief in one's capability to cope successfully with different task requirements across domains. Further theoretical considerations on the link between self-efficacy and creativity have been brought up by Ford [1996] who defined self-efficacy as a key motivational component in his model of individual creative action.
A similar concept as creative self-efficacy termed "creative confidence" has been recently brought up as one main ingredient of design thinking. This "new approach" mainly but now with more emphasis on the introduction of these thoughts into public by David Kelley, founder of IDEO and Professor of Design at Stanford University [Kelley 2012], in his role as manager of the IDEO group. He believes the creative potential of people and organizations can be unlocked by enhancing peoples' creative self-confidence. In a TED talk in 2012, Kelley compares the lack of creative confidence to a phobia that can be overcome by taking small steps to confront the person with the subject of the phobia like it is done in behaviour therapy. By this procedure which is similar to the confrontation therapy, the person gains confidence experiencing she can address the given problem and will not be afraid of it anymore. According to Kelley the same accounts for creative self-efficacy: if a person confronts her fear of being creative, she will gain confidence [Kelley 2012]. The person won't be afraid to be creative anymore and therefore she will come up with more and better ideas.
Following up on Kelley's theory, it is important to find out whether creative self-efficacy is related to creative output. If a significant relationship can be found, it means that a person can become more creative by enhancing their creative self-efficacy.
As there is a lack of empirical research about the relation between self-efficacy and creative performance; it should be interesting to specifically analyse the link between the variables, creative self-efficacy and creative performance in a creative task which is not related to a specific knowledge area. In a study by Tierney and Farmer [2002] it was shown that there is a conglomeration between the belief in the own domain knowledge and the assessment of creative self-efficacy.

3. Research approach

In this research study we aimed to analyse the relation between creative self-efficacy and creative performance, where creative performance is measured by the individual outcome in a creative task, and creative self-efficacy is assessed by a questionnaire, which has been constructed based on the assumption that creative self-efficacy consists of assumptions and beliefs about the own creativity and on evidence-based judgment of own creative behaviour as another component of the general concept "creative self-efficacy".. The participants were first asked to fill in the questionnaire followed by the assignment measuring the creative performance.

3.1 Set-up of the questionnaire

After a review of existing questionnaires which aim assessing creative self-efficacy [see for example Karwowski 2011] an own questionnaire had been developed as almost all questionnaires mainly focus on general self-efficacy [Teeuw and Schwarzer 1994], [Schwarzer 1997]. The questionnaire consists of the following 15 items which had to be answered on a 5-point Likert scale [Garland 1991].

Table 1.Two scales of the questionnaire on creative self-efficacy (QCSE)

Personal assumptions / beliefs about own creativity	Evidence-based assessment of creative self-efficacy
I am not afraid to express my ideas	I am a creative person
I have a positive self-image	I can solve problems efficiently even complicated problems
I am confident that I could deal with unexpected events.	I trust into my creative abilities
I feel very self-confident working on a problem even when others are present	Compared to my friends my ideas are outstanding
I consider myself to be innovative	Many times I proved I can find at least one solution for any difficult situation
	I can deal with problems requiring creative thinking
	I am good in proposing "out of the box" solutions
	I am confident that I can develop creative ideas for almost any problem
	When I am confronted with a problem, I can usually find several solutions.
	I don't consider myself as creative

The questionnaire consists of 2 parts; the first part asks demographic questions (i.e. gender, faculty, etc.) and the second part entails 15 items as self- rated questions about the personal assumptions and beliefs of creative self-efficacy. Out of 15 self-efficacy questions, 10 were about creative self-efficacy, of these, nine were phrased in a positive and six in a negative manner. All questions were answered on a Likert scale from one to five. To compute a final score, all grades of positive questions were added up, and finally, the grade of the negative question was subtracted from that number. For creative self-efficacy the possible score lies between 4 and 44. The personal self-efficacy score was computed in rather the same manner. In order to arrive at a final score, all results were added up.

3.2 The participants

Forty-nine students took part in the research study, all students were from the Netherlands, forty-four students from the TU Delft, and five students came from different universities. Thirty students were male and nineteen were female. Related to the study disciplines the students were divided into two categories; eighteen students were students of the so-called creative disciplines and thirty-one students of technical disciplines. Assuming that creative self-efficacy influences the creative performance of persons, it is likely that this interrelation may also lead to different choices in life, for example related to the choice of a specific study discipline.

Furthermore, there exist pre-assumptions about different disciplines in terms of creativity, for example students from more creative-related faculties (such as Industrial Design Engineering or Architecture) should show higher scores in their ratings of their creative self-efficacy compared to students from less creative-related disciplines such as Mathematics and Aerospace Engineering.

In addition we were interested to do another comparison what compare the relationship between gender and creative self-efficacy of the female and male participants. Although almost all studies on gender differences in terms of creative performance didn't reveal any significant differences (for an overview see [Piirto 2004]), studies show that females often underestimate their own competencies.

3.3 Set-up of the assignment measuring creative performance

Many different methods and techniques exist to measure creative performance. In this research it was chosen to use two "how can you" assignments [DelftDesignGuide 2013], which allow assessing the three criteria measuring creativity: fluency, flexibility and originality [Guilford 1967].
From the results of a pilot study the following two assignments were chosen out of sixteen different questions because they showed the highest variance of answers:

- *How can you get an apple into smaller pieces?*
- *How can you cross a river without getting wet?*

Participants were provided with an A3 sized paper for each of these two questions. The two questions had to be answered in a consecutive order, two minutes to answer each question. No specific instructions were given about how to present the answers, writing or drawing, the participants were free to use their own way to how to express their ideas. The participants were told that there were no wrong answers and that they could answer whatever came to their mind [Manske and Davis 1968]. The creative performance was measured based on the elementary categories of divergent thinking [Guilford 1967].

1. *Fluency* is the ability to generate a large number of ideas: Fluency was measured by counting the number of ideas. This number is the score of the participants' fluency.
2. *Flexibility* is the ability to generate a variety of ideas: Flexibility was measured by grouping similar ideas of one participant and the flexibility score was the number of different groups. For example an airplane and fighter jet are grouped but hot air balloon and an airplane is a different category.
3. *Originality* is the production of unusual ideas: Originality was measured by giving each group of ideas from the flexibility measurement a certain amount of points. This amount is equal to:

   Flexibility = 1 / X * 10

   X is the number of times the category occurs. By adding these numbers for each participant, a score for originality is created.

4. Results

In this section the results of the study are presented. First, we take a closer look on the two scales of the questionnaire, second we analyse the relationship between the individuals' self-ratings and the performance by the measures fluency, flexibility and originality of creative performance. In the third part differences in relation to study disciplines, gender and representation modes are discussed.

4.1 Creative self-efficacy and personal creativity

The results indicate that there is a significant correlation between individual creativity judgment based on evidences and the personal confidence into the own creativity based on beliefs and assumptions. Creative self-efficacy is correlated to the personal self-efficacy $\tau = 0.25$, $p < 0.01$ (one-tailed). This moderate significance means that the self-efficacy of a person and the confidence in the own creative abilities are significantly correlated. This result confirms the hypothesis that creative self-efficacy is an integral part of general self-efficacy. The personal confidence score is not representative for creative confidence, because the correlation is too low; therefore creative confidence is compared to the creativity of the participants.

Table 2. Kendall's tau_b correlation between creative self-efficacy and personal self-efficacy (n = 54)

	Creative self-efficacy	Personal self-efficacy
Creative self-efficacy sig. (1-tailed)	1.0	.25** (p=.006)

4.2 Self-efficacy and the creative performance

The creative performance has been assessed with two kinds of brainstorm tasks. The first assignment was: How can you get an apple into smaller pieces? (see Table 3). The second assignment was: How can you cross a river without getting wet? This assignment was more challenging than the apple assignment, because the possible solutions were less obvious. Interestingly only with the river question (see Table 2) the correlation between creative self-efficacy and the creative performance shows significant results on all three creativity measures fluency, flexibility and originality.
This result can lead to two different conclusions: by enhancing creative self-efficacy the creative output can be increased or the creative performance increases creative self-efficacy.
Now the question arises: why do we find a significant correlation between creative self-efficacy and the river question but not between the apple question, as both creative tasks have the same structure and seem not to be different. We explain this result with the low task difficulty, as the answers are too evident, and thus the participants could not be very creative [Cropley 2000].
We assume that this result is caused by the different contextual embedding of the two assignments. The assignment of the apple task was less challenging than that of the river, because the solution ideas could be gained from everyday life and thus the ideas were more common and easier to access in the mind than in the case of the river question. The number of answers that were given decreases rather quickly over time if the question is less challenging, what results in a smaller amount of solution ideas compared to the more challenging river assignment [Manske and Davis 1968].

Table 3. Creative self-efficacy and creative performance for both tasks, the apple and river assignment

	Apple			**River**		
	Fluency	Flexibility	Originality	Fluency	Flexibility	Originality
Creative self-efficacy	0.17 (ns)	0.09 (ns)	0.00 (ns)	0.21*	0.28*	0.21*

*ns=not significant (p > .05), *p<.05; N = 49*

4.3 Correlation between gender, creative performance and creative self-efficacy

There is a wide range of studies on gender differences however the topic of creativity seems to be of less interest, at least in terms of empirical investigations. In gender research one result occurs in different situations, what is that female persons express less self-confidence than their male colleagues but when they perform the output is often better than the performance of their male colleagues.
To determine whether gender has an effect on creative performance and creative self-efficacy a correlation coefficient between the creativity measures in the river assignment and the rated creative self-efficacy has been conducted.
As can be seen in Table 4 there are no significant correlations between gender and creative performance; but there is a significant relationship between gender and creative self-efficacy. Furthermore the control of the variances shows a significant result what means male participants have stated higher creative self-efficacy than women, however from the comparison of the creative performance (t-test) it cannot be concluded that males actually perform better.

Table 4. Correlations between gender and creativity in the river assignment

	Male (n)	Male (M)	Male (SE)	Female (n)	Female (M)	Female (SE)	R
Questionnaire: Creative self-efficacy	33	31.18	0.79	21	28.52	1.08	0.27*
Fluency	29	8.00	0.57	20	8.20	0.67	0.03(ns)
Flexibility	29	6.00	0.40	20	5.95	0.37	0.01(ns)
Originality	29	39.47	5.36	20	37.21	4.37	0.05(ns)

ns=not significant (p > .05), *p<0.05

4.4 Study discipline, creative performance and creative self-efficacy

Students from creative studies e.g. Industrial Design Engineering and Architecture were compared to those from studies that were considered as less creative studies e.g. Mathematics and Physics in order to determine whether there is a difference on the creative self-efficacy and creative performance between the two samples, the independent samples test was used here as well (see Table 4).
There was no correlation found between the different disciplines with creative self-efficacy and the creative performance categories. According to these results there is no difference between creative and less creative studies concerning creative self-efficacy and creative performance (see Table 4).

Table 5. Correlations between study discipline and creative performance

	Creative Faculties (N)	Creative Faculties (M)	Creative faculties (SE)	Less creative faculties (N)	Less creative faculties (M)	Less creative faculties (SE)	R
Creative self-efficacy	29	31.55	0.51	20	28.70	1.35	0.37^{ns}
Fluency	27	7.89	0.58	17	8.18	0.73	0.05^{Ns}
Flexibility	27	6.11	0.34	17	5.71	0.53	0.10^{Ns}
Originality	27	38.37	5.04	17	39.87	6.67	0.03^{Ns}

*ns=not significant (p > .05), *p<.05, **p<.01, ***p<.001*

This result is also consistent with the statement of Negus and Pickering saying that creativity is needed in every business domain [Negus, Pickering 2000].

4.5 Representation of generated ideas: writing or drawing or writing and drawing

Interestingly one aspect which was not thought about before the conduction of the experiment seems to be highly relevant, the way how the generated ideas were represented by the participants in terms of drawing, writing or drawing and writing. More participants from creative than those from technical disciplines drew their solutions of the creative output (see Figure 1).
Furthermore, there is also an interesting result concerning the different modes of representations and the measures of creative performance (see Table 6). Fluency is higher when the participant wrote down his solution ideas what can be explained by the fact that writing takes less time than drawing. Students of so called creative study disciplines are taught to use drawing technics to come up with better ideas in comparison to technical studies and thus are not used to draw overall sketches.

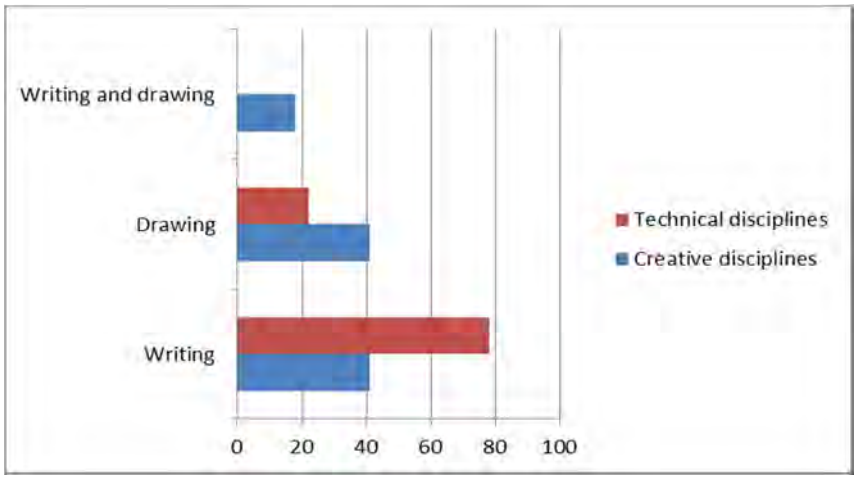

Figure 1. Representations of solution ideas chosen by students of technical and creative disciplines (in percent of the whole ideas of the group

It could be even possible that the participants of the creative disciplines performed worse, because the drawing took more time and therefore the participants could come up with less answers.

Table 6. Modes of representation

	Writing (N)	Writing (M)	Writing (SE)	Drawing (N)	Drawing (M)	Drawing (SE)	R
Fluency	30	9.53	0.50	14	5.57	0.43	0.67**
Flexibility	30	6.80	0.34	14	4.57	0.40	0.52**
Originality	30	46.19	4.91	14	27.67	5.25	0.37**

ns=not significant (p > .05), *p<.05, **p<.01, ***p<.001

5. Summary and discussion

This study provides insight how creative self-confidence is related to creative performance. 49 participants did an individual brainstorming task in two "how-to-do tasks". The two minutes tasks are a very limited representation of a real design task; however, while both tasks also showed different results and by this we learned also the importance of challenging tasks when using brainstorming or closely related methods.

There is of course another issue that questions the validity of the chosen task. Can we compare the real design situation when ideas generation are only one aspect of very complex and intransparent process with the tasks used in this study? In how far can the results be generalised. Whereas a design task or even design project does show many more different requirements than the type of brainstorming task we used. However we can claim that the idea generation itself may be dependent on.

Thus, we can conclude, that creative self-efficacy goes along with a higher creative performance. As we expected, participants who assume or see themselves as very creative actually produce a larger amount of ideas, more diverse ideas and more original ideas. As the correlation measures only implies a connection but no direction it cannot be said, whether high creative self-efficacy causes higher creative performance or whether high creative performance increases the creative self-efficacy – probably it works both ways.

Furthermore, students of so called technical studies were compared to students of creative studies; the results indicate no difference between creative performance and creative self-efficacy in the two groups. It was expected that students, in fields were creativity is demanded, would perform better, so this result is interesting as it says the opposite. Obviously there is no creative or non-creative discipline. Each domain requires being creative, everybody can and need to be creative to a certain level. In technical disciplines it seems that the participants are less aware of themselves as innovating producer of creative solutions. In creative disciplines such as Industrial Design Engineering, the students are fully aware of the need to be creative as a designer and also aim for this in their educational process [Dorst and Cross 2001].

It could be also shown that the creative performance was higher when participants wrote down their answers. We explained this result that there is less time needed when writing down the answers than drawing them. Of course, there could also be a more direct line of associations which might be supported during writing.

The way of how the answers were placed on paper might have influenced the creative output scores of the participants in a different way in a negative way. As 59% of the students of creative studies drew the answers did only 22 % of the students of the technical studies produced an answer by drawing – but drawing takes more time than writing it down. Meaning the creative students could have performed better when the tasks were divided in a more equal level. For instance it can be compensated by making the amount of time compatible longer for drawers or compel the participants only to be allowed to write down answers.

Finally, the most interesting result is the gender evaluation of the own creative self-efficacy, which was higher in the male group than in the female. However men did not produce a larger amount of ideas, not more diverse ideas nor more original ideas. For clarification: men overestimated their

capabilities and/or women underestimate their creative capabilities [Blanch et al, 2008]. This interesting result would need further investigation about the development of different self-evaluation processes, and the question how stable these self-evaluations are.

Acknowledgments

We like to thank the participants for taking part in the study.

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