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creatIef, Creatiever, creaTiefst? Onderzoek naar het belang en de werking van creativiteitstraining bij Bachelor of ICT-studenten
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Part I

Research on the *importance of creativity training* among *Bachelor of ICT-students*

Chapter 1: Creativity. This first chapter begins with an explanation of the phenomenon of Creativity. It is an introductory chapter that is actually a kind of informative summary of existing knowledge about the phenomenon of creativity. Besides contributing to the insight that creativity is important for people, it adds insights that are important for the empirical research (see *Part II*) of this dissertation.

Chapter 2: General importance of creativity. The second chapter discusses the usefulness and importance of creativity and innovation for society. This literature study also contributes to the answer to the second research question.

Chapter 3: Training creativity. This third chapter is a presentation on creativity development in education and contributes to the foundation for more attention to creativity in education in general. In this way, this chapter provides insight into the various training courses and teaching programmes that are available to teach people, including students and professionals, to think more creatively and thus to be more creative. It also discusses the importance and state of affairs regarding creativity development in education.

Chapter 4: ICT, innovation & creativity. This chapter provides insight into: (i) the general interest of *ICT & ICT-professionals*, (ii) the relationship between *Innovation & ICT*; and (iii) the interconnectedness of *ICT & Creativity*. The insights gained will help underpin greater attention to creativity in ICT-education, *Bachelor of ICT-programmes* in particular, and thus the relevance of creativity.

Chapter 5: Creativity training in ICT education. Section five specifically addresses the importance of creativity training in ICT-education, *Bachelor of ICT-programmes* in particular. The central question here is: "What do ICT-programmes actually do in terms of creativity development?" Of course, this chapter also contributes to the research into the importance of creativity training among BICT-students. This fifth chapter concludes with the answer to the first research question, with which the first research question is actually completed.

Chapter 6: Intermezzo. After the above-mentioned completion, this chapter builds a bridge between *Part I* and *Part II*. It deals with two unanswered questions. The first question is: "Why is it that such training courses occur so infrequently in BICT-curricula?" The other question is: "Why should creativity training not work for BICT-students, while in *Part I* (see the introduction to *Chapter 3*) it was shown that creativity training works in general?" In other words: "Why is the research of *Part II* actually necessary?"

This dissertation presents the results of my research into the importance of creativity for ICT-students of Dutch *Universities of Applied Sciences* (in Dutch: *Hoger Beroepsonderwijs*, HBO), and the functioning of training courses that aim to promote creative abilities is highlighted.

Creativity is a generic skill of individuals. For example, it underlies extraordinary achievements in the arts and sciences. In general, creativity enables individuals and groups of people to adapt to changing circumstances. The ability to generate new and potentially useful ideas and problem-solving skills as a result of creative thinking is an important driver of human evolution. According to many, creativity is a very valued and sought-after accomplishment for today's society and for the future.

In addition, computers, and everything related to them, have become an integral part of society. This phenomenon, together with *Information and Communication Technology* (ICT) - which of course forms the basis of technical developments in the field of computing - is one of the most important innovations in the history of mankind, comparable to, for example, the art of printing. Computers have radically changed our lives in recent decades, and it is highly probable that these developments are far from ended. All around us, ICT is visible, or its products in the broadest sense of the word. In this day and age, it is hardly conceivable to innovate without ICT. It is therefore logical that ICT-professionals play an extremely prominent role in our rapidly and constantly changing society. This applies in particular to students taking a *Bachelor of ICT*-course (BICT) in a Dutch *University of Applied Sciences*, because they are trained as leading IT-specialists in the business world. And since creativity is an essential building block for innovation, it is to be expected that BICT-curricula pay ample attention to the development of the creative and therefore innovative capacity of BICT-students.

The phenomena described above led to two interrelated research questions. The first of these questions is: "Is *Creativity Training* important for students *Information and Communication Technology* at Dutch Universities of Applied Sciences?"; and the second one: "Does *Creativity Training*, as it is integrated in the curriculum of students of *Information and Communication Technology* at Dutch Universities of Applied Sciences, work?"

Each of these questions will be dealt with in a separate section. Thus, *Part I* of this dissertation deals with the first research question (summarized: *the Importance*). And in *Part II*, the second research question is central (in other words: *the Effects*). Both questions also raised substantial questions. A separate chapter has been devoted to each of these questions, including the corresponding sub-questions.

Part I consists of five chapters and an intermezzo, and *Part II* consists of seven chapters. Finally, *Part III* is added. This final part brings together the findings from *Part I* and *Part II*, leading to conclusions, discussion, reflection and recommendations. All in all, *Part III* makes the explicit connection between both research questions clear (see *Figuur 3*, of the introduction to this dissertation). An introductory chapter precedes the three parts mentioned above. This introduction contains, among other things, an explanation of why this dissertation was started and its approach.

Part II

*Research on the effects of creativity training
among Bachelor of ICT-students*

Chapter 7: Literature study on creativity research. This first chapter of *Part II* is an introduction to the empirical research of this dissertation. It provides insight into whether and how creativity - and creativity training in particular - could be researched, within the domain of *Creativity Research*. It is introduced by a concise history of creativity research; followed by an inventory of methods that can be used to study the second research question.

Chapter 8: Multiple empirical research. Whereas the previous chapter investigated which methods can be used to test creativity, this chapter explicitly discusses the possibilities of doing a so-called *Multiple Research*. Despite the fact that there appear to be more ways of investigating creativity, and that each approach has its limitations, in *Creativity Research* one usually opts for a single method, *Divergent Thinking Assessment*. It is logical that the limitations ensure that only a part of what the researcher in question is trying to find out; in other words, explicitly for this research: that these limitations cast a limited eye on the possible effect of the creativity training to be researched among *Bachelor of ICT*-students. In order to be able to minimize these limitations, a multiple approach seems the most obvious, because the advantages of one method can (partly) cancel out the limitations of another. First, this chapter discusses the type of research of this thesis and a description of the possibilities of a multiple research approach. Next, we will discuss how the results of *multiple research* can be interpreted. To conclude this chapter the results are presented and a brief introduction to the operationalization of empirical research.

Chapter 9: Fluency-study. This chapter is the description of the research that, partly based on the findings from *Chapter 6: Intermezzo*, was carried out in order to gain insight into the possible backlog of BICT-students compared to students of creative HBO-programmes. The assumption in this dissertation is that BICT-students can be expected to be at least as creative as students of creative HBO-programmes in this day and age, given the prominent, sector-transacting role of *the ICT* in innovation. To conceive fewer ideas could (i) indicate a lower degree of creativity, and (ii) indicate that BICT-students are indeed lagging behind (see *Chapter 6*). This study is actually part of the answer to the first research question (in other words, that study is also in the context of the *the Importance*). Moreover, the results of the *Fluency-study* are relevant when interpreting the results of the practical relevance in *Chapter 13*, just like the other findings of *Part I*. The *Fluency-study* focuses on the following question: “Are BICT-students less creative than students of a creative HBO-program?”

Chapter 10: Intervention-study. The purpose of this chapter is to experimentally find out what the direct effect is of creativity training among BICT-students. In this study this is done by having students perform so-called *divergent thinking tests* (DDT’s), directly before and/or directly after a creativity training (and/or the respective intervention). In the context of the *Multiple Research*, this is the first of the three empirical studies conducted as an attempt to answer the second research question. The *Intervention-study* consists of two sub-studies: (i) the *Prepost-Intervention-study*

and (ii) the *Postonly-Intervention-study*. This study was partly chosen to study whether the pre-test can have an influence on the post-test results. The specific question in this study is: “Do BICT-students think up more ideas after a creativity training?”

Chapter 11: Survey-study. This study deals with the opinion of BICT-students about the creativity training they followed from the curriculum. By means of a survey, an attempt is made to examine their opinion about that training. The chapter begins with an explanation of *Self-Assessment* in relation to the meaning of *intrinsic motivation* in the development of creative abilities and study performance. This is followed by a description of the second of three empirical researches carried out within the framework of the multiple approach; again, to answer the second research question, even though a number of survey questions relate to the first research question (i.e. in the context of *the Importance*).

Chapter 12: Experts-study. This chapter deals with the opinion of *creativity experts* on the degree of creativity of ideas generated by BICT-students - in this specific case: the ideas that BICT-students came up with during the Intervention study (*Chapter 10*). Therefore, like the *Intervention-study*, this research consists of two sub-studies: (i) the *Prepost-Experts-study* and (ii) the *Postonly-Experts-study*. The *Experts-study* is the third study that is part of the multiple experimental research approach to answer the second research question. The central question in this chapter is: “Do *Bachelor of ICT-students* think of more creative ideas through creativity training, according to creativity experts?”

Chapter 13: Practical-relevance-study. This chapter is the description of the last study of the multiple research approach. It deals with the research synthesis, of the results (with emphasis on *effect sizes*) from the three studies mentioned above: The *Intervention-study*, the *Survey-study* and the *Experts-study*. This chapter also explains the difference between *statistical significance* and *practical relevance*, which, confusingly enough, is also called *practical significance*. This explanation is important for this dissertation study because it precisely deals with the effect of something (in this case creativity training); and because very small effects (may) also matter. For example: a medicine that only works for five out of 1000 people. That is anything but *statistically significant*, but *practically* speaking that result is relatively very *relevant* (*practically relevant*). The *Practical-relevance-study* connects the results of the three studies mentioned above. By combining the results of the three studies, an overall picture is created from a qualitative perspective. The specific question in the *Practical-relevance-study* is: “What is the joint effect size and the so-called practical relevance of the functioning of creativity training with *Bachelor of ICT*-students?”

Part III

*Conclusions, discussions, reflection, relevance & recommendations of
this research on the importance and the effects of creativity training
among Bachelor of ICT-students*

Chapter 14: “creative, more Creative, most creative?” This concluding chapter, or *Part III*, is a compilation of the most relevant findings from all the previous chapters. In fact, *Chapter 14* answers the two research questions of this dissertation: (i) Is *Creativity Training* important for students *Information and Communication Technology* at Dutch Universities of Applied Sciences?; and (ii) “Does *Creativity Training*, as it is integrated in the curriculum of students of *Information and Communication Technology* at Dutch Universities of Applied Sciences, work?” In addition, this chapter makes clear the strong correlation between both research questions (see *Figuur 3*, at the *Introduction* of this dissertation). *Chapter 14* begins with the dissertation’s conclusions. This is followed by various discussions and reflections on aspects of the research. Next the possible social and scientific contributions are described; and lastly concrete recommendations are made.