

DISSERTATION THESIS

**Ideas are Craftwork:
Development of an Innovation Training Course and its
Evaluation with female and male Journeymen**

GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN
FAKULTÄT FÜR WIRTSCHAFTSWISSENSCHAFTEN

vorgelegt von
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**Ideas are Craftwork:
Development of an Innovation Training Course and its
Evaluation with female and male Journeymen**

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und dessen Evaluierung mit angehenden Handwerksmeister_innen**

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SUMMARY (IN ENGLISH)

This doctoral dissertation is comprised of three autonomous studies all aiming at answering the research question of “Which ideation techniques enhance the idea quality in idea generation?”.

A systematic literature review utilizing the Cochrane review methodology serves the systematic search and summary of all experimental and quasi experimental research ever conducted on ideation techniques affecting a measure related to idea quality. Results indicate that brainstorming is not the tool to be preferred in interactive group settings, rather analogy or brainwriting as well as mind maps or brainsketching should be applied.

Based on these findings, a concept for an innovation training course was developed by focusing on organizational practice. The innovation training concept (ITC) is thoroughly described, ideation tools are explained step-by-step, aiming for immediate implication in practice.

The introduced ITC was then field tested with 217 female and male journeymen from the German crafts sector. Two empirical studies were run afterwards:

- (a) A follow-up study based on the Kirkpatrick evaluation framework (Kirkpatrick, 1979) comprising of Likert scales and open-ended questions, was administered to participating journeymen one year after conducting the innovation training course. Resulting data were quantitative and qualitative, hence were analyzed with a mixed methods approach. Participants had clearly liked the ITC, and – stemming from the qualitative analyses – have implemented ideas from the ITC to their own benefit.
- (b) A quasi experimental research design with 2 by 2 factors – comparing traditional brainwriting with a new category of ideation techniques called Semantic-Cognitive Jumping – in either heterogeneous – varying age, gender, nationality, and profession – or homogeneous groups of journeymen was run at five different German chambers of trades and skilled crafts. Results showed that Semantic-Cognitive Jumping enabled participants to achieve significantly higher originality even when controlled for the feasibility of ideas.

This thesis allows for the conclusion that to create ideas of higher originality participants shall be encouraged to activate knowledge that is usually not activated in the light of a particular ideation task.

ZUSAMMENFASSUNG AUF DEUTSCH

Die drei Studien der vorliegenden Doktorarbeit widmen sich allesamt der Fragestellung “Welche Kreativitätstechniken erhöhen die Qualität von Ideen während der Ideenfindungsphase?”.

Entlang der Cochrane Methode erfolgt eine Literaturanalyse aller experimentellen und quasi-experimentellen Studien, die je untersucht haben, welchen Effekt eine bestimmte Kreativitätstechnik (Ideenfindungstechnik) auf ein Qualitätsmaß der Ideen hat.

Darauf aufbauend wurde anschließend ein Konzept für ein Innovationstraining (ITC) entwickelt, das an die organisationale Praxis angepasst ist. Das ITC wird detailliert beschrieben, die darin vermittelten Ideenfindungstechniken werden Schritt-für-Schritt erklärt.

Das vorgestellte ITC wurde anschließend in einem Feldexperiment mit 217 Handwerker_innen erprobt, woraus zwei eigenständige empirische Studien entstanden:

- (a) Eine Follow-Up Studie, die auf der Grundlage des Evaluierungsmodells von Kirkpatrick entwickelt worden ist (Kirkpatrick, 1979). Der selbst entwickelte Fragebogen umfasste Likert-Skalen und offene Fragen und wurde den Handwerker_innen, die am ITC teilgenommen hatten, ein Jahr später zugeschickt. Weil die gewonnenen Daten sowohl quantitativ als auch qualitativ waren, wurde zu deren Analyse ein Mixed Method-Ansatz gewählt. Die Teilnehmer_innen hatten durchweg positiv auf das Training reagiert und haben – so die Antworten auf die offenen Fragen – bereits Ideen für ihre eigenen Betriebe umsetzen können.
- (b) Eine quasi-experimentelle Studie mit vier verschiedenen Bedingungen sollte den kausalen Zusammenhang zwischen Ideentechniken und der Qualität der gewonnenen Ideen untersuchen. Die Handwerker_innen erhielten randomisiert entweder ein Training mit Brainwriting oder mit den vier Techniken namens Semantic-Cognitive Jumping und waren dabei in entweder heterogenen Gruppen mit Varianz in Alter, Geschlecht, Beruf und Nationalität oder in homogenen Gruppen. Die Analysen zeigen, dass die Teilnehmer_innen in der Semantic-Cognitive Jumping Bedingung signifikant originellere Ideen kreierten als die in der Brainwriting-Bedingung.

Diese Doktorarbeit kommt zu dem Schluss, dass, um Ideen von höherer Originalität und mindestens gleicher Umsetzbarkeit zu kreieren, semantische Konzepte aktiviert werden sollten, die eine bestimmte Ideenaufgabe normalerweise nicht aktivieren würde.

“If at first the idea is not absurd, then there is no hope for it.”

Albert Einstein

“Erfolg hat drei Buchstaben: TUN!“

Johann Wolfgang von Goethe

PREFACE

Twelve years ago – at that time most students used StudiVZ as their social media network, and facebook was only adopted by very few people in Germany – I was studying at the Otto-von-Guericke-University of Magdeburg. One of the lectures that I was attending was called Idea Engineering – an approach applying the straightforward IPO model: Ideas can be produced analogue to how cars are manufactured – input process output: ideas. I can still hear Prof. Graham Horton tell his students: “Don’t ever take the straight road to ideas.”

Because my English was sufficient, I got invited to freelance for Zephram – a company that offers ideation facilitation and workshops – and so eventually it was me who kept telling our clients: “Don’t take the straight road to an idea.”

Since then, the question of “Why not?” has stuck with me and so, after graduation I looked for a way to answer my questions (Why not brainstorm? What other technique should be preferred over brainstorming?).

Because brainstorming is a group process of generating ideas, in social psychology, brainstorming has been investigated for more than 60 years by now dating back to Taylor’s comparison between interactive and nominal brainstorming in 1958 (Taylor, Berry, & Block, 1958). Since then, Taylor’s results have been replicated various times. It struck me then, that although for so long we have known brainstorming to be ineffective organizations keep applying it, still today. And worse, practitioners’ guides on creativity techniques (Nöllke, 2015) or design thinking (Lewrick, Link, Leifer, & Langensand, 2017) keep suggesting brainstorming as the tool to apply.

Why is brainstorming so popular in practice? It is because people believe they would generate better ideas in a group than individually (Paulus & Dzindolet, 1993) – later called the illusion of group productivity (Nijstad, Stroebe, & Lodewijkx, 2006).

So, I soon started asking the question of which ideation technique would lead to better ideas than brainstorming – better in terms of originality, novelty, uniqueness and feasibility, effectiveness, utility. This is how my research questions evolved.

Now that I had my research question, I was overwhelmed by the vast number of different ways the variables could be operationalized and the methods that could be applied to answer those questions. I was stuck between two paradigms of how research should address and interpret data: one is the natural scientific paradigm, the other based on the social constructing of experience and knowledge. To conduct research with the

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natural scientific paradigm means to measure the world as precisely as possible, to operationalize variables, derive and test hypotheses. Because the measuring devices are precise, natural scientists can replicate their experiments at different places at a different time allowing for results to be compared. The aim of natural science is to generalize results and to be able to predict phenomena. The scientist's subjective perspective is not an appreciated source of insight, but an interfering variable, that needs to be controlled. Subjective perceptions are unscientific, scientifically speaking in this paradigm.

The second paradigm is the sociological heuristic. Sociology does not ignore the social constructedness of knowledge or controls it as an interfering variable, but rather acknowledges social constructedness to be part of the data and part of scientific insight. When researchers – even natural scientists – develop experiments, these are human acts resulting from a complex interplay of actors in social contexts. The dimensions under which scientific research is conducted are not just controlled but are an appreciated source of insight.

The scientist's intention is considered, what scientists even perceive is already part of the reflection. When a certain effect is assumed, a phenomenon expected, it is possible that the scientist perceives just that effect. The selective process of sensing the world might cause the scientist to see only hypothesis confirming data. A sociologist considers the experimental results in a way that informs the researcher about her/his way of seeing the world, her/his way of assuming things to be true. That characterizes the second paradigm – called the social constructedness of world. Thinking in both paradigms simultaneously is challenging and has challenged all my work as a researcher.

For example, with my research I also addressed the question of how different group compositions affect the creativity performance in idea generation. If that were the case, it would mean that ideation would benefit from a highly diverse group composition with people of different age, nationality, education, religion, skin color, health state, etc. That result might affect diversity research and gender studies, it might affect the societal debate on refugee policy or the debate on opening up the universities. Based on social psychological research, racism might be dampened, and entrepreneurs might be made aware how important it is to appreciate diversity.

No matter how the results, those cannot be turned into a general finding, they have to be doubted, because constant doubt is what drives research forward – to question assumptions and to learn.

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This dissertation lies in the area of conflict between academia and application in practice. With my research, I attempted to transfer knowledge between academia and practice. That is why I conducted my research with female and male journeymen.

What affected my decision? Was it to create a research gap? In psychology and engineering, no one has tested ideation techniques with journeymen before. Or was it because I am a disciple of Hannah Arendt's "vita activa" (1998) and was therefore determined to implement more "vita contemplativa" into the crafts sector, which is characterized by labor and work (Arendt & Canovan, 1998)?

I was born in the eastern part of Germany. My parents worked hard to maintain a good lower middle-class life. Their income was little and still is, compared to the wages in the western part of Germany. As a daughter to a carpenter and a secretary, granddaughter to a locksmith and gardeners, I was raised in a habitus shaped by crafts jargon and working-class lifestyle. When I entered university, I had to learn a new way of thinking, speaking, and acting. Moreover, I was constantly hiding my family background, believing it would somehow reveal me as not fitting into this academic world and might cause disadvantages.

Today, having finished this dissertation, I know it was partly because of my crafts shaped habitus, the jargon of the female and male journeymen, but also the hard work that I have seen in my parents and my grandparents who constantly put one foot after the other, who taught me to stay on track, to get up and get walking again after having slipped (for example, after discovering that a whole data set is of no use because a biunique identifier was missing) and – most importantly – who have taught me that a profession will never make a whole person, only parts of her/him.

This in addition to my academic socialization have enabled the reciprocal knowledge transfer between the university and the chambers of small businesses and skilled crafts. Both institutions have long traditions, their own organizational cultures, their sets of values, norms and communication. I assume that knowledge transfer would not succeed if each institution insisted on its own way of acting and communicating and insisted on its own quality system.

This dissertation cannot be perfect in the sense of academic quality and scientific rigor and cannot fit perfectly to the chambers of small businesses and skilled crafts at the same time. Of course, it would have been high-quality science if I had invited 200 female and male journeymen into a laboratory at the university to control for all confounding variables. There are various reasons why one can doubt that I could have

collected enough data to gain any insight except from: a six hour lasting experiment does not seem attractive enough for professional practitioners to attend to.

What quality criteria should this dissertation be subjected to then? Quality systems are not static but dynamic, and to determine good or bad science should rely on quality systems that progress in the interplay between science and society (Schneidewind & Singer-Brodowski, 2014).

So with this thesis, I present an attempt to at least to some extent satisfy the quality criteria of science and crafts sector practice simultaneously. I kindly ask the reader for forgiveness at points, where I do not live up to the expectations.

Acknowledgements

Writing a doctoral thesis like any other creativity product is never the work of one person alone but depends on supervisory support, financial resources, external and internal cooperating partners, family support, etc.

So, despite the very uncreative act of doing what everyone else does, I felt the urge – increasing with every step towards finishing this thesis – to thank. The road was long – it took me four and half years to get here – but it was not rocky. Although I had a few valleys full of tears and misery, most of the time, I enjoyed the view from a nice, exhaustive plateau on which I put one step after the other.

First of all, I thank my supervisors, Prof. Dr. Margarete Boos, Prof. Dr. Kilian Bizer and Prof. Dr. Susan Seeber, for instructing me, guiding me but also letting me go to create the experiences on my own.

Prof. Dr. Margarete Boos, I thank her for being my role model as a scientist and as a mother, as a leader, as a colleague, as a woman. I thank her for pushing me hard and when necessary touching me gently. When I first met her, I knew, it would be her as my supervisor or there would be no PhD at all. It was like an epiphany. Regarding the quality of my dissertation, I have always pictured Margarete Boos as the reader and judge. If it was not for her I would have started every introduction into innovation and creativity with the all-time favorite globalization-bla-bla. I thank you for every “Julia, how are you proceeding?” – and there have been many such dialogues within the last four years. Moreover, when I had finished and finished my most final versions, you have still encouraged me – and continue to encourage me – to review and enhance my texts.

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Prof. Dr. Kilian Bizer I thank for always being supportive, except for the one time that he was strict and criticizing. Fortunately, it was at the beginning of the dissertation phase when there was room enough to change directions. Also, it is for him that I was able to cooperate with five different chambers of small businesses and skilled crafts, because he has presented my topic in his networks and thus introduced me to my future cooperation partners and research subjects. Since there is no field testing without access to the field, the importance of that act cannot be overestimated.

I want to thank my colleagues in the Social and Communication Department of the University of Göttingen. Thank you for making me a part of the team, for supporting and welcoming me. This team has really felt like friends.

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LIST OF ABBREVIATIONS

AUT	Alternative Uses Task
EBS	Electronic Brainstorming
Ideation	Idea Generation
ITC	Innovation Training Course
MLE	Maximum Likelihood Estimation
p./pp.	Page/Pages
ROI	Return on Investment
S-CJ	Semantic-Cognitive Jumping
SMEs	Small and Medium Sized Businesses

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I. CHAPTER 1

GENERAL INTRODUCTION: CREATIVITY AND INNOVATION

1.1 Introduction

Although often used interchangeably, innovation and creativity are two distinct concepts. Innovation—the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace (Baregheh, Rowley, & Sambrook, 2009)—is at the core of today’s business world. How new—measured by originality—the output of this multistage process called innovation will be is influenced by the way ideas are generated in the idea generation phase. This is the phase, that demands creativity – the generation of ideas that are original and appropriate (Runco & Charles, 1993). Originality is the most important creativity metric (Runco & Jaeger, 2012). Creative ideas become innovations only after they are implemented.

The question of how to enhance both, the originality and appropriateness of ideas, is of great practical interest as they fund the success of innovation. Unfortunately, both creativity dimensions are negatively correlated – the more original the less easy it is to implement and the less feasible the idea, and vice versa (Nijstad, Dreu, Rietzschel, & Baas, 2010; Rietzschel, 2005). That is why any innovation framework must balance between these two quality dimensions of creative ideas.

For example, the Design Thinking (DT) innovation framework is of growing interest to practitioners because it constantly focuses on the later customer who the product or service is designed for. Hence, DT assures the created product or service to be highly fitting the target group. Therefore, the feasibility dimension of the idea is well considered by the DT innovation framework. However, how original and novel the product or service will be, is determined during the idea generation stage of the DT process. Therefore – like any innovation framework – DT depends on the creativity performance within the creation phase.

How to enhance creative output of the creation phase has been of scholarly interest for more than sixty years by now, dating back to Osborn’s influential book *Applied Imagination* published in 1953 which has since been edited various times (Osborn, 1979). He introduced brainstorming as an innovation method for creating ideas in

groups, in which participants verbalize their ideas, in which freewheeling is welcome, judgement to be delayed and self-criticism to be ruled out.

Shortly after Osborn's brainstorming proposal, Taylor and his colleagues (1958) – comparing brainstorming in groups (called interactive brainstorming) with brainstorming alone (called nominal brainstorming) – showed how the nominal groups created significantly more ideas and ideas of significantly greater quality than the interactively brainstorming groups (Taylor et al., 1958). The conclusion that brainstorming in groups is not as effective as when done individually has since been backed by experiments conducted after Taylor's (Barki & Pinsonneault, 2001; Diehl & Stroebe, 1987; Dunnette, Campbell, & Jaastad, 1963; Putman & Paulus, 2009). Only few experiments yielded inverted results like, for example, Morgan (1996), showed that interactive groups produced more ideas than nominal groups, but found no significant differences in terms of idea quality (Morgan, 1996). Offner and colleagues showed how trained facilitators could enhance interactive brainstorming to be as effective as nominal groups in creativity performance (Offner, Kramer, & Winter, 1996).

Scholars have hence investigated the reasons why nominal brainstorming groups outperform interactively brainstorming groups and have identified production blocking, social loafing/free riding, and evaluation apprehension (Herrmann & Felfe, 2014; Nijstad, Diehl, & Stroebe, 2003; Nijstad & Stroebe, 2006) to be known as the most important factors hindering group ideation productiveness.

Despite 60 years of research from psychology and engineering, mostly, showing the ineffectiveness of brainstorming, it is still the most widely used ideation technique in organizations and continues to be recommended as ideation tool for design thinking ideation (Lewrick et al., 2017) or as a creativity technique (Nöllke, 2015). Considering the vast amount of other techniques, that practitioners could choose over brainstorming – VanGundy lists more than 100 such ideation techniques (VanGundy, 2005) – makes it even more surprising that organizations still prefer brainstorming. Moreover, when considering that every organization wants to profit from their unique product or service portfolio, applying the same ideation technique, is questionable. The creative output from different organizations will likely be similar in terms of originality and feasibility when the same methods are applied.

One reason for brainstorming's persistence is the phenomenon of participants to feel as if they generated better ideas when brainstorming in groups and feel as if they had an over proportionally high share in the group output (Paulus & Dzindolet, 1993).

Nijstad (2006) later called this phenomenon the illusion of group productivity (Nijstad et al., 2006).

1.2 Research Objectives

This dissertation was designed to answer the research question of how to enhance the creativity performance during the ideation phase in innovation processes.

To answer that question, the first objective of this thesis was to review all existing scientific research that had investigated the effectiveness of ideation techniques on the creativity performance of participants. Because during the innovation process not all ideas are implemented but rather a small number of the qualitatively best ideas will be chosen for implementation, I assumed that organizations are not interested in creating as many ideas as possible but rather as good ideas as possible. That is why the literature review focused on studies that had looked at one of the two quality dimensions of ideas: originality on the one hand, and feasibility on the other.

Secondly, the knowledge obtained from the literature review was applied to develop an innovation training course (ITC). In this thesis I hence report a detailed step-by-step instruction of the innovation training that I have developed, so that it can be applied in human resource development practice. It is precisely described, also because it is supposed to be implemented as inhouse training without requiring further facilitation from external trainers, which is lowering implementation costs and hence increases return on investment (ROI).

Not only did I intend to describe the innovation training, but also to raise the probability of it being implemented by systematically evaluating the training course. Therefore, 16 ITCs were conducted at five different training centers for the German crafts sector. Afterwards, utilizing the Kirkpatrick model of evaluation trainings (Kirkpatrick, 1979), a questionnaire with items focusing on each of Kirkpatrick's four levels, plus the additional ROI-level (Phillips & Phillips, 2005) and the level related to societal good (Watkins, Leigh, Foshay, & Kaufman, 1998) was sent to participants in a follow-up.

In addition to these self-reported data the more objective method of a quasi-experimental research design was applied. Ninety objective raters (blind to hypotheses and treatments) assessed the ideas' originality and feasibility. Based on the spreading activation network theory (Collins & Loftus, 1975), I compared the effectiveness of the new

ideation technique category called Semantic-Cognitive Jumping (S-CJ) with brainwriting. Brainwriting was chosen as a benchmark over brainstorming, because brainwriting grants the benefits similar to those of the nominal brainstorming technique.

1.3 Outline of this thesis

This cumulative dissertation thesis is composed of different independent studies. That is why there will be redundancy throughout the thesis because, for example, introductions to the innovation topic are similar. Those papers that were submitted to research journals are marked with a footnote.

In Chapter 1, the main topics – ideation and creativity in innovation – and the research objectives of this dissertation are presented.

In Chapter 2, the first independent research paper (“How Ideation Techniques affect Idea Quality: A Cochrane Review”) is displayed. It comprises a systematic review of all experimental research from psychology and other fields (such as design or engineering) in which the ideation technique was manipulated, its effectiveness on the idea quality (instead of quantity) was investigated, statistical results reported. In total, 405 studies were screened, of which 83 studies met the inclusion criteria and were then reviewed by means of the Cochrane Review methodology.

The third Chapter comprises the second autonomous research paper (“Innovation Training in Organizations: A ready-to-implement Concept“ (submitted in British English)). Building on the findings from the literature review and by utilizing the design thinking framework, an innovation training course (ITC) was developed aiming at enhancing the creativity performance of ideating interactive groups and addresses human resource development practice (HRD) and organizations interested in increasing their employees’ innovation skills. It is also designed for ideation facilitators who are interested in effective ideation techniques.

In Chapter 4, based on a literature review on evaluation frameworks for innovation training Kirkpatrick’s evaluation model (Kirkpatrick, 1979) is applied to develop a follow-up questionnaire that was run online one year after training. Here, because quantitative and qualitative data were gathered, a mixed methods design for data analyses is applied.

In Chapter 5, with a focus on rigorous objective evaluation, a 2-by-2 factor quasi-experimental design was applied, which is presented in the third independent

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paper to this cumulative thesis “Maximizing Creativity Performance: How Semantic-Cognitive Jumping Enhances Idea Originality”. This paper was co-authored by Margarete Boos. The statistical results obtained demonstrate the positive influence of S-CJ ideation techniques as opposed to brainwriting on the originality and feasibility of ideas. Group heterogeneity – different professions, ages, genders, and nationalities – or homogeneity – one craft type with minor variations of age, gender, and nationality – did not affect the idea quality.

In the last Chapter, the main results of this thesis are summarized, and implications for colleagues from academia and practice are discussed.

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II. CHAPTER 2

HOW IDEATION TECHNIQUES AFFECT IDEA QUALITY: A COCHRANE REVIEW

2.1 Introduction

Innovation – the generation, acceptance, and implementation of ideas, products, processes, or services (Thompson, 1965) – is of growing interest to practitioners, because it is known to yield competitive advantages (Anderson, Dreu, & Nijstad, 2004; Hender, Dean, Rodgers, & Nunamaker Jr, 2002). Large organizations turn to startups to adopt the smaller companies' innovative work organization, to become more agile and faster in producing and commercializing their products or services. Organizations have started to install so called creative spaces where people can collaborate on new innovation projects. Innovation hubs are popping up in which large organizations and smaller companies gather together to co-create and design new services or products.

Along the same line, tools that increase the innovation outcome become more important, resulting in an increase of practitioners' guides on innovation and idea generation and a growing market for consulting services and innovation facilitators. When screening practice-oriented handbooks and websites, tools for enhancing ideation performance are merely listed (Nöllke, 2015). That is problematic as it creates the impression that ideation techniques are affecting the outcome of ideation phases equally strong. That is not the case.

Ideation research has been examining the effectiveness of various ideation techniques on creativity performance for more than sixty years. Starting from 1958, when Taylor and his colleagues have published their highly influential study on the superiority of individually brainstorming participants over interactively ideating groups (Taylor et al., 1958) an exhaustive body of research has evolved, clearly stating that some ideation techniques are more effective than others.

Ideation techniques' effectiveness can be measured in numerous ways. Mostly, researchers have adopted measures related to the product of the ideation process, namely ideas. Ideas that are novel or original and potentially useful to or relevant for the organization (Oldham & Cummings, 1996) are considered as high creativity performance.

The creation of ideas, however, is only one part of the whole innovation process. To become an innovation, an idea must be implemented (Anderson et al., 2004; Anderson, Potočnik, & Zhou, 2014; Nijstad, 2015). Whereas innovation performance is a metric assessed on the organizational or even the macroeconomic level, creativity performance is measured on the participants or group levels (Oldham & Cummings, 1996).

Therefore, in this study, only the individual and group levels and only how ideation techniques affect the creativity performance are considered. However, it is to acknowledge that ideation techniques might not only affect the outcome of the creation phase but of the innovation process as a whole, thus gaining significance for practitioners and scholars in the field of innovation research.

2.1.1 Research Objectives

The main goals of this review are

- (1) to systematically search and review all existing experimental and quasi-experimental primary studies on ideation techniques affecting the ideation outcome of either groups or individuals, and
- (2) to – backed by empirical evidence – identify such techniques that are to be preferred over others during the creation phase in innovation processes.

To accomplish these two goals the Cochrane methodology – a standard in healthcare research guiding the process of reviewing previous interventions – is utilized.

2.1.2 Outline of this Chapter

The chapter is structured as follows: at first, the methodology of searching and including studies in the dataset is presented. Afterwards, starting from the most frequently investigated ideation techniques, the results of the experimental or quasi-experimental studies on each technique are presented one by one. In the fourth section, a sketch note is provided in which the most important techniques are displayed allowing for their comparison, and practical implications are derived.

2.2 Method

The review followed along the guidelines of the Review Manager 5.3.3 (RevMan) – a software that facilitates the preparation and maintaining of a Cochrane review (The Nordic Cochrane Centre, 2014).

2.2.1 Searches in Electronic Databases

To identify research reports that were within this paper’s scope, various scientific databases were searched¹ for “innovative thinking” or “creative thinking” or “more creative” or “more innovative” in titles to yield studies that dealt with the enhancement of creative output from experimental research designs. Additionally, the databases were searched for “treatment” and “experiment” in all text, with the treatment limited to “idea generation techniques”, or “idea generation methods” or “idea generation tools” in all text from scholarly peer-reviewed studies dating from 1997-2017 in academic journals only, written in English. There was no interest in suicidal ideation, therefore the term “suicide” caused the exclusion of these studies. Additionally, a filter was set to limit the results to empirical, quantitative, qualitative or interview studies.

In a comparable manner, various more searches were conducted– summarized in Table 1.

Table 1: Systematic electronic searches in scientific databases (otherwise specified).

Search Number	Terms	Results
2	“idea generation technique” or “ideation technique” in abstracts	30 studies were added to the database 4 removed because of suicidal ideation
3	“cognitive stimulation” and “idea generation”	
4	“cognitive stimulation” and “idea generation” – in Google Scholar	55 studies
5	“Meister Craftsmen” and “idea generation technique”	no results
6	"Master Craftsman" and "idea generation technique/method/tool" in the whole internet	316 results majority being advertising or marketing pages, Pinterest and such. The only seemingly scientific result (Lehne, 2004) mentioned “Master craftsman” once but referring to God as being a Master craftsman
7	"analogy" in abstracts as well as "idea generation" and "creative" in all text	from 8 results, 4 were included
8	"provocation" in abstract as well as "idea generation" and "creative" in all text	no results
9	"reverse" in abstract as well as "idea generation" and "creative" in all text	4 results, all were included
10	"adapt a role" or "Mr. X" in abstract as well as "idea generation" and "creative" in all text	no results

¹ Psyndex, psycarticles, psychology and behavioral sciences collection, econlit, business source complete, and the ebscohost ebook collection.

Search Repetition

In February 2018, the procedure was repeated to gather newly published papers. Databases² were searched for “idea generation method” or “idea generation technique” or “creativity method” or “creativity technique” in abstracts yielding 34 newly obtained papers, of which four were included for analysis. Another Google Scholar search with “idea generation technique” in titles, excluding patents and quotations, yielded four hits. Two were already part of the data set, another two were included.

After all electronic searches, the dataset comprised 13 reviews with a research scope similar to this dissertation thesis (Goldenberg & Wiley, 2011; Heilman, Nadeau, & Beversdorf, 2003; Jalil, 2007; Lamm & Trommsdorff, 1973; Mullen, Johnson, & Salas, 1991; Mumford, Connelly, & Gaddis, 2003; Mumford, Mobley, Reiter-Palmon, Uhlman, & Doares, 1991; Sawyer, 2011; Scott, Leritz, & Mumford, 2004; Smith, 1998; Timbadia & Khavekar, 2017; Vernon, Hocking, & Tyler, 2016; Vissers & Dankbaar, 2000; Vissers & Dankbaar, 2008).

These I scanned for empirical papers that were not yet part of my primary data set.

Table 2: Number of studies which I included after screening previous literature reviews.

Number of Studies included from prior Reviews	
(Smith, 1998)	17
(Goldenberg & Wiley, 2011)	28
(Mumford et al., 2003)	1
(Vernon et al., 2016)	19
(Vissers & Dankbaar, 2000)	2
(Vissers & Dankbaar, 2008)	1
(Timbadia & Khavekar, 2017)	0

² PsycArticles, American Antiquarian Society (AAS) Historical Periodicals Collection: Series 2, Business Source Premier, eBook Academic Collection (EBSCOhost), eBook Collection (EBSCOhost), EconLit, MLA Directory of Periodicals, MLA International Bibliography, Psychology and Behavioral Sciences Collection, PsycINFO, PSYINDEX: Literature and Audiovisual Media with PSYINDEX Tests, The Nation Archive (DFG), The New Republic Archive (DFG).

Searching other resources

Library searches were also conducted, resulting in books written for practitioners. Only some of these reported on experimental or quasi-experimental ideation research. The ones that did, were included for further examination.

In March 2018, I posted on research related online communities asking for unpublished manuscripts on ideation techniques affecting idea quality including researchgate.com, linkedin.com, and I sent an email to the so-doc psychology community, yielding no results.

All searches combined led to a dataset comprising of 405 papers.

2.2.2 Selection of Studies

Selection Criteria

Out of the 405 resulting papers, only experimental or quasi-experimental research designs investigating idea generation techniques’ effectiveness on an idea quality-related outcome measure (not quantity) were of interest for this paper.

Table 3: Selection criteria for inclusion of studies.

Selection criteria	
Types of studies	experimental quasi-experimental
Types of participants	healthy participants no children
Types of interventions	ideation techniques/tools/methods thinking instructions templates/ design heuristics
Types of outcome measures	idea quality originality, novelty, uniqueness feasibility, elaboration, usefulness
Types of quality assessment	ratings not just statistic infrequency but rated quality not just non-redundancy

Reasons for Exclusion

An overall number of 322 studies was excluded for several reasons. For example, I excluded studies without control groups or without manipulation of the ideation technique. I further excluded studies from the International Journal of Creativity & Problem Solving, because the website could not be accessed and there was no way of subscribing to the journal since the landing page was written entirely in Asian. I furthermore did not consider studies concerning mental illnesses or other diseases, or studies

conducted with children (younger than 18). Moreover, I excluded studies, which had only investigated the number of ideas as the creativity performance metric. Assuming that in innovation not the amount of ideas is the main goal but to have a few high-quality ideas, I was explicitly looking for quality-related outcome measures and thus reporting only overall production led to exclusion of the paper. Note, that I justify the exclusion of every study (see Appendix I).

2.2.3 Overview of Included Studies

An overview on sample sizes, sample diversity, ideation tasks and quality measures applied in all 83 included studies is reported in the Table “Literature Review Summary” (see Appendix II). As the table is too large for being shown here, only brief summaries of participants and ideation tasks are displayed in the following sections.

Participants

From the 83 primary studies included, the majority had been conducted with undergraduate students as participants (see Table 4). Most students were majoring in psychology, engineering or business. This is due to ideation research as well as brainstorming research being a field that psychologists, engineering designers and economists are interested in. Additionally, because the literature was focusing on experimental or quasi experimental research, there are only a few studies run in the field with actual professional innovators (see Table 5). Only recently, the number of online community members as participants has grown because online participants seem convenient to researchers and service providers are increasing (see Table 6).

When examining the Tables 4-6, note, however that because in some studies undergraduate and graduate students or professional designers and students had partaken, the number of studies exceeds 83. Therefore, numbers reflect how often this kind of participant has taken part.

Table 4: Number of studies with student samples from the 83 included studies.

Number of studies	Student Samples				
	Overall	Psychology	Engineering	Business	Others
Undergraduate students	63	18	9	11	11
Graduate students	9		2		2

Table 5: Number of studies with professionals as samples from the 83 included studies.

Number of studies	Professionals				
	Overall	Designers	Teachers	HR	Others
Overall	83				
Professionals	14	7	1	1	5

Table 6: Number of studies with opportunity samples or online community members.

Number of studies	Opportunity Samples			
	Overall	Online Communities	M-Turk	Others
Overall	83			
Opportunity Samples	5	2	1	2

Ideation Tasks

Whereas the samples of the 83 included studies were rather homogeneous, the tasks that the participants had to solve were rather heterogeneous. I divided these tasks into three categories: product design tasks, problem solving tasks and others (see Table 7).

2.3 Results: Ideation Techniques Affecting Idea Quality

As mentioned before, the final dataset comprised 83 primary experimental or quasi experimental studies on how ideation techniques affected a measure related to idea quality. The totality of studies (sample sizes, sample populations, idea quality measures, techniques) is presented in Appendix II.

Depending on how many studies had investigated a particular ideation technique, the results are presented in descending order – starting with the most researched techniques, ending with the least frequently investigated ones.

2.3.1 Brainstorming

Brainstorming – a technique for generating a large quantity of ideas – was introduced by Osborn in the 1950s; the book “Applied Imagination” has been marked as the cornerstone of brainstorming and has been revised various times (Osborn, 1979). In brainstorming sessions, participants vocalize their ideas on a specific brainstorming task under the guidance of so called brainstorming rules:

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Criticism is ruled out

Freewheeling is welcome

Quantity is wanted

Combination and improvement are sought (Putman & Paulus, 2009).

Table 7: Tasks that participants had to solve in the 83 included studies that investigated the effectiveness of ideation techniques on a quality metric of ideas.

Tasks					
Product Design	20	Problem Solving	24	Others	17
tubular map case	2	improve university	5	AUT	7
table to alternate between sitting and standing	2	increase tourism	4	(dis)advantages of additional thumb	4
baby ointment	1	maintain quality of education during declining teacher numbers	2	business model invention	2
mattresses		improve or maintain health	2	create advertisement	2
drinking glasses		university's parking	2	TTCT	2
Swiss army knife		series of steel manufacturer problems	1	RAT	1
a creative invention	1	recruiting ways for insurance company	1	create a job advert	1
chair		ease transition to college		BSE Barrons Symbolic Equivalence Task	
toothbrushes		reduce environmental impact of outdoor lamp		Thinking Style Inventory	
car seating mechanism		suggestion about saving money		Utopian Situation Task	
machine to crush aluminum cans		social media for business strategy		Insight Task	
IoT products or services		homeless people problem		ideas for a gift	
design a product		make an excellent team		create category names, list uncommon features, list new examples	
architecture design		windows that shade for sun but allow view		phenomenal change in stature stabilized further	
leg immobilization device		enhance dine-in experience of restaurant		increase not expected – consequences?	
commuting diner device		raise awareness of modern day slavery			
facilities to enhance communication in a park		retain restaurant customers			
milk frother		improve environment			
hybrid armor		prevent accidents with bicycles			
recreation or medical center		reduce pollution			
device to collect energy from human motion		prevent injuries			
drawing table		freezing of LED lights in winter			
changes for a thumbtack		healthier lifestyle			
changes for a kitchen sink		environmentally friendlier atmosphere			
changes for a door knob		improve the psychology department			
device to hide wires in a table					

Nominal Brainstorming better than Interactive Brainstorming

After brainstorming was introduced, the aforementioned study from Taylor and colleagues was conducted (Taylor et al., 1958). Here, 96 Yale undergraduate psychology students had generated ideas on three different tasks (increase tourism to the city, ensure quality of education in case of declining teacher numbers, (dis)advantages of an additional thumb). The students used brainstorming and were assigned to either an interactive group condition or to brainstorm individually – called the nominal brainstorming technique. Results showed that the nominal group technique was significantly superior to interactive brainstorming on significance, effectiveness, generality and feasibility of ideas (Taylor et al., 1958).

After Taylor, other scholars have replicated his findings. Dunnette and colleagues (1963) – utilizing two of the same tasks as Taylor – as well as Manning (1998) had shown nominal brainstorming groups to achieve significantly higher idea quality means (Dunnette et al., 1963; Manning, 1998). In another study, nominal groups had attained significantly higher mean originality and had selected top five ideas that were significantly more original than interactive groups (Putman & Paulus, 2009). Only recently, Haley – comparing four different ideation techniques (nominal brainstorming, brainwriting, brainsketching, random stimulus) – had demonstrated, that nominal groups had generated the largest quantity of quality ideas (rated on feasibility) than the other three techniques (Haley, 2014).

Nominal Groups vs. Interactive Dyads

Whereas the previously reported studies had worked with larger interactive groups, Rietzschel (Rietzschel, 2005) demonstrated the superiority of nominal groups over interactive dyads (groups of two) in terms of idea originality but also showed that interactive dyads were able to produce ideas of significantly higher feasibility than nominal dyads (Rietzschel, 2005).

Nominal Groups as effective as Interactive Groups

On the other hand, as of late, the Taylor findings have been contradicted. In a few recent studies, the superiority of the nominal groups over interactive brainstorming groups did not reach statistical significance on creativity scores (Jung, Looney, & Valacich, 2007), on mean idea originality (Baruah & Paulus, 2008), or on mean idea feasibility, usability, or outcome of implementation (Morgan, 1996), as well as on mean idea quality and the number of good ideas (above mean quality) (Haats, 2012).

Brainstorming Rules

Some scholars have tested the effects of the brainstorming rules proposed by Osborn. Whereas the brainstorming rules led to more good solutions – operationalized as ideas that were unique and of value – as compared to no-instruction conditions (Parnes & Meadow, 1959), the introduction of additional rules (stay focused on the task, do not tell stories, do not explain ideas, keep the brainstorming going, return to previous categories) does not seem to yield significant effects on the creativity performance of groups – operationalized as idea originality (Putman & Paulus, 2009).

Interestingly, the brainstorming rules themselves seem to have different impact on idea quality – as shown by Goldenberg and her colleagues (Goldenberg, Larson, & Wiley, 2013). They had participants brainstorm under (1) all four brainstorming rules, or under (2) the freewheeling condition (freewheeling was emphasized, rule to combine and improve ideas was dropped), or under (3) the build-on condition (freewheeling was dropped, combine and improve rule was emphasized). The build-on condition had yielded higher numbers of highly practical ideas than all four rules or the freewheeling rule, pointing to the importance of the combine and improve when it comes to idea practicality.

The results on the brainstorming technique have led scholars to contemplate the factors causing nominal groups to create ideas of as good or even higher quality as interactive groups. Production blocking, evaluation apprehension, and social loafing/free riding are known to be the most important factors (Diehl & Stroebe, 1987; Herrmann & Felfe, 2014; Nijstad, Diehl et al., 2003; Nijstad & Stroebe, 2006; Santanen, Briggs, & Vreede, 2014; Shih, 2011).

2.3.2 Brainwriting

Brainwriting was introduced to overcome the aforementioned brainstorming deficits by utilizing written communication instead of oral articulation (Coskun, 2011; Heslin, 2009; Paulus & Yang, 2000). However, there are only very few studies examining the difference between brainstorming and brainwriting on the idea quality.

For example, Chulvi and colleagues (2012) compared brainwriting to brainstorming (raising hands before articulating ideas) and other techniques like SCAMPER, or functional analysis showing that brainwriting yielded better novelty, usefulness, and creativity than the other techniques (Chulvi, Mulet, Chakrabarti, López-Mesa, & González-Cruz, 2012), except for idea usefulness in problem one and creativity in problem

two (Chulvi et al., 2012). However, in Haley's dissertation thesis, brainwriting and nominal brainstorming had resulted in almost equal numbers of high quality ideas (Haley, 2014).

To engage in a plenary group brainwriting rather than brainwriting first alone and then as a group resulted in a larger number of good ideas (above scale midpoint in both, idea originality and utility), but did not cause differences in average idea novelty or average idea utility (Paulus, Korde, Dickson, Carmeli, & Cohen-Meitar, 2015).

Other scholars have utilized the brainwriting technique to test further factors such as priming for achievement goals versus neutral priming (Dennis, Minas, & Bhagwatwar, 2013). As priming is an ideation technique itself, it will be discussed in a separate section.

2.3.3 Electronic Brainstorming (EBS)

Whereas there are only a few studies in which oral brainstorming was compared to brainwriting, there are some in which brainstorming was compared to electronic brainstorming (EBS), resulting in contradictory findings. Some found evidence for the verbal brainstorming being significantly superior to keyboard typing in terms of idea quality as well as the number of high quality ideas (Jung et al., 2007).

Others found no difference:

Two different EBS settings, utilizing Microsoft NetMeeting software (simulated a text based chat) and Whitepine Cu-SeeMe software (simulated a videoconference) were compared to a face-to-face setting (like brainstorming) yielding no significant differences with regard to originality or elaboration of ideas neither for the setting nor for the number of people (three person groups or individuals) (Kristensson & Norlander, 2003).

EBS, based on the AOL instant messenger, and the nominal group technique did not differ significantly in terms of idea novelty or utility (Kohn, Paulus, & Choi, 2011). However, in a similar EBS environment, when exposed to other people's ideas, participants created ideas of significantly less originality than when no other ideas were shown (Paulus, Kohn, Arditti, & Korde, 2013). Idea utility was not affected by the exposure to other people's ideas in that study. On the contrary, if the ideas of other people were rare rather than common, more novel, more impactful, and also more feasible combinations were generated (Kohn, Paulus, & Choi, 2011).

In a 2-by-2 factorial design in EBS, participants were presented either homogeneous stimuli (of a previous experiment, selected from only two semantic categories) or diverse stimuli (selected from 34 different semantic categories) or no stimulus ideas (Nijstad, Stroebe, & Lodewijckx, 2002). Idea diversity was significantly higher in the diverse stimuli condition than the control or the homogeneous stimuli condition (Nijstad et al., 2002).

The amount of ideas displayed in an EBS setting seems to impact the utility of ideas. When participants had ideated with the topic commenter tool (a full page displaying all ideas) rather than the EBS tool (ideas spread over six pages) they attained marginally higher utility scores. Additionally, when participants were contributing their ideas anonymously rather than identifiable, they attained a significantly higher number of good ideas (Pissarra & Jesuino, 2005). However, for the number of good ideas, there was no main effect for the type of tool, hence the six page or one page condition did not differ significantly (Pissarra & Jesuino, 2005).

Similar to this, total quality scores of groups under four technology conditions (verbal brainstorming vs. nominal vs. EBS anonymous and non-anonymous) differed significantly with nominal groups outperforming the anonymous EBS groups as well as the EBS non-anonymous groups and verbal brainstorming which had yielded the lowest total group quality scores. The only non-significant contrast was that between the two EBS conditions (Barki & Pinsonneault, 2001). The same was reported for the number of good ideas – above mean quality. Nominal groups had produced the highest number of good ideas, followed by the anonymous and the non-anonymous EBS conditions. Again, verbal brainstorming led to the lowest creativity performance in terms of the number of good ideas (Barki & Pinsonneault, 2001).

In contrast, Ziegler and colleagues reported that virtual groups had achieved marginally significantly higher means in originality than nominal groups, but not in feasibility or effectiveness (Ziegler, Diehl, & Zijlstra, 2000).

Visualizing the connections between ideas with a virtual rope on an EBS tabletop device caused participants to create ideas of significantly higher originality as compared to not visualizing connections between ideas with rope (Jaco, Buisine, Barré, Aoussat, & Vernier, 2014).

In EBS, having participants (either high or low in creativity) pair up with partners in either upward comparison (majoring in arts) as opposed to downward comparison (majoring in science) yielded interaction effects (Michinov, Jamet, Métayer, & Le

Hénaff, 2015): high creative participants produced more original ideas in upward than in downward comparison; and high creative participants produced more original ideas than low creative participants in the upward comparison but not in the downward comparison condition. Interestingly, the individual creativity did not significantly affect the quality of ideas produced (Michinov et al., 2015).

Wang and colleagues investigated the impact of leaders' motivating language on the quality of ideas in an EBS setting (Wang, Hsieh, Fan, & Menefee, 2009). Whether leaders employed direction-giving language or empathetic language or mixed-using language, did not affect feasibility of ideas, but did however affect the originality and elaboration of ideas: when leaders used both, direction-giving and empathetic language in the virtual environment, participants yielded higher originality and elaboration scores (Wang et al., 2009).

2.3.4 Analogy

Analogy Technique Superior to other Techniques

Analogy in Product Design

An analogy technique called MindLink – part of synectics – (Gordon, 1981) described as “looking for things or objects in an alternative problem area similar to parts of the current issue” (Karni & Shalev, 2004) was shown to be superior in terms of number and percentage of quality ideas over other techniques such as brainstorming (Osborn, 1979), IdeaFisher (Fisher, 1996) and a product improvement checklist (VanGundy, 1988) (Karni & Shalev, 2004).

Only recently, comparing bio-inspired analogies written on so called biocards and brainstorming (Keshwani, Lenau, Ahmed-Kristensen, & Chakrabarti, 2017) resulted in empirical evidence in favor of the bio-inspired analogy: novelty of ideas on car collision reduction and novelty of ideas for a sun shade were significantly higher when participants had used biocards rather than brainstorming (Keshwani et al., 2017).

In study 2 of Dahl and Moreau (2002), the authors had manipulated the amount of analogies (single vs. multiple analogies) to existing products (one vs. several), had engineering students create analogies (one vs. multiple) and asked them to use these for developing new design concepts. Additionally, participants were either primed (sketch of a possible design solution) or not. Those who were not primed and had created

multiple analogies had produced designs of statistically higher average originality than those in any other condition (for detailed report of conditions, see Table 8).

Table 8: Idea originality and perceived customer value (willingness to pay for invented product), study 2 results from Dahl and Moreau (2002, p. 55).

Dahl and Moreau, Study 2 (2002) Results		
Conditions	Originality	Willingness to pay
No prime/ multiple analogies	4.70	63.10 \$
One prime / multiple analogies	3.93	44.01 \$
No prime / single analogy	3.97	47.58 \$
One prime / single analogy	3.87	33.26 \$.
Control	4.27	55.53 \$

Dahl and Moreau conclude that small changes in originality may have some meaningful influence on an innovation’s value to a firm (Dahl & Moreau, 2002).

In line with Dahl and Moreau (2002), analogy-based rather than example based idea generation resulted in significantly better ideas (Yu, Kittur, & Kraut, 2014).

For the design of a low cost, easy to manufacture energy generating device, distance of analogies (far field patents not directly serving the purpose of electricity vs. nearfield patents directly serving the generation of electricity) as well as example commonness (likely or unlikely to be encountered by the target group) were manipulated (Chan et al., 2011). People who had received far-field patents rather than nearfield examples generated solution concepts that were significantly more novel on average, and participants who had received less common rather than more common examples were also more novel and achieved the most novel solution concepts. Both main effects were qualified by a significant interaction: the combination of far-field, less common examples increased novelty compared to the control condition for both, mean novelty as well as maximum novelty (Chan et al., 2011).

In line with Chan and colleagues (2011), analogy was also superior to assumption reversal (Hender et al., 2002), as analogies had produced ideas of significantly higher creativity than the reverse technique. Although also ranked higher than brainstorming, the difference in creativity scores between analogy and brainstorming did not reach statistical significance in Hender and colleagues’ experiment (Hender et al., 2002).

Analogy in Architecture

In a think aloud study with videotaping of sessions, architectural design students and professional architects created architectural designs with or without the explicit requirement to use analogies that were visually displayed (Casakin & Goldschmidt, 1999). Note, visual displays of analogies were present in both conditions. Participants who were required to use analogy, produced design ideas of significantly higher design quality than those who were not required to use the analogy (Casakin & Goldschmidt, 1999).

Analogy in Advertisements

Focusing on newness and significance, Goldenberg and colleagues (1999a, Study 1) identified the 200 highest quality ads out of 500 different advertisements. Their analyses revealed six creativity templates: pictorial analogy, extreme situation, consequences, competition, interactive experiment, and dimensionality alteration (Goldenberg, Mazursky, & Solomon, 1999a). They then experimentally investigated the effects of training these creativity templates as compared to free association or no training (Goldenberg et al., 1999a) showing template training to be superior to no training and free association training on creativity of advertisement ideas. Specifically, replacement analogy (a subtype of pictorial analogy) yielded the highest humor ratings of created advertisements (Goldenberg et al., 1999a).

Use of conventional metaphors in advertisements resulted in significantly higher ratings of these adverts in terms of perceived creativity, perceived complexity and appreciation of these ads, whereas irony did not affect perceived creativity and ad appreciation (Burgers, Konijn, Steen, & Iepsma, 2015).

Analogy Technique as Effective as other Methods

Novelty scores after being shown a bio-inspired analogy or a human engineered example – although both have significantly increased novelty as compared to a control condition – did not significantly differ from each other (Wilson, 2008).

2.3.5 Priming

Priming for Related or Unrelated Categories

Students were presented lists of either related or unrelated categories (Baughman & Mumford, 1995) and produced more original exemplars when subjects had been

asked to list additional features of their new category before generating exemplars than when they were asked to proceed directly to exemplar generation (Baughman & Mumford, 1995).

Applying a similar method, Kohn and colleagues (2011) came to comparable results (Kohn, Paulus, & Korde, 2011). Their participants had received related and unrelated problems (repeated measures design) and created more novel examples (Kohn, Paulus, & Korde, 2011) as well as more original labels (Kohn, Paulus, & Korde, 2011) for unrelated problems than for related problems.

Rietzschel (2005) had primed his participants with open ended questions on hygiene, sports and nutrition (Rietzschel, 2005). Conditions did not differ significantly in terms of number of high quality ideas. However, the sports prime had increased originality of sports ideas, the nutrition prime had increased the nutrition ideas, but hygiene priming did not increase hygiene ideas' originality (Rietzschel, 2005). He replicated these results in study 3.2: nutrition ideas were more original in the nutrition prime condition than in the heterogeneous condition (hygiene prime) and more original than in the control condition. Originality of hygiene ideas was only marginally more original in the hygiene prime condition than in control or heterogeneous (nutrition prime) condition (Rietzschel, 2005).

Somewhat different from these results, participant's answers to the Alternative Uses Task (AUT) did not differ significantly in terms of total creativity or originality although participants had been primed with either common or uncommon usages of an object (Colombo, Bartesaghi, Simonelli, & Antonietti, 2015). Additionally, Colombo and colleagues had also manipulated the neural stimulation (cathodal vs. anodal vs. sham) with electrodes. This neural stimulation had indeed caused differences between the anodal and the sham condition related to idea originality; these findings, however, are not within this thesis' scope (Colombo et al., 2015).

Priming for Goals

In an EBS setting, priming participants for achievement goals vs. neutral priming (Dennis et al., 2013) or priming for causes vs. priming for input (Potter & Balazard, 2004), showed that ideas were more novel as well as more relevant, and more workable in the achievement prime than in the neutral prime. Logically, also the number of novel ideas, the number of workable ideas, and the number of relevant ideas were

significantly greater in the achievement prime condition than in the neutral prime condition (Dennis et al., 2013).

Related to that, priming with creativity goals (do your best vs. difficult creativity goal) resulted in higher creativity (novel and appropriate) than without priming for a creativity goal (Shalley, 1991). This main effect was qualified by a significant interaction: no creativity goals and low personal discretion had led to significantly lower creativity than any other condition (Shalley, 1991).

In line with these results, priming for low vs. moderate vs. high creativity goals under either low or high perceived supervisor support yielded significantly different innovativeness scores (Škerlavaj, Černe, & Dysvik, 2014). Highest innovativeness was achieved under moderate creativity goals and high perceived supervisor support, followed by high creativity goals and high supervisor support (Škerlavaj et al., 2014).

In contrast, Litchfield and colleagues (2011) who had also advised novelty goals to participants could not reject the null hypothesis. They had compared ideas from three conditions: novelty goal, brainstorming rules only, and brainstorming rules and the difficult novelty goal resulting in no significant between-condition differences (Litchfield, Fan, & Brown, 2011).

Value focused thinking (priming for gains and objectives) rather than alternative focused thinking (no gains and objectives) led to significantly higher mean innovativeness (Selart & Johansen, 2011). Ideas were more long-term oriented and visionary rather than cost effective or money oriented as in the alternative focused thinking condition (Selart & Johansen, 2011).

Priming with Examples decreases Creativity Performance

However, when priming with examples fixation effects were obtained. For instance, in Dahl and Moreau's second study, priming with exemplary designs led to diminishing idea originality and less perceived customer value of product designs (Dahl & Moreau, 2002). Their third study produced similar results: students not shown a prime and encouraged to access multiple analogies produced designs with significantly higher average originality than those with one prime or several primes. Additionally, primed students accessed significantly less far analogies than non-primed students, which is important as the percentage of far analogies yielded a small but significant effect on originality (Dahl & Moreau, 2002).

In an EBS setting, ideas on how to reduce accidents between bicycles and motor vehicles were rated significantly higher on quality (creativity, effectiveness, and feasibility) when participants had been primed with causes for these accidents rather than with other people's ideas and rather than when they were not primed with causes or when neither they saw others' ideas nor were primed with causes (Potter & Balthazard, 2004).

For business model innovation, Eppler and Hoffmann (2012) primed participants either with an interactive template for business model innovation (canvas-template), with physical objects (everyday objects, office supplies, toys) combined with sketching with chalks, or an empty PowerPoint slide (control condition). Participants in the template condition reported to be significantly less creative than participants in the objects or the control condition (Eppler & Hoffmann, 2012). Note, that the dependent variable was a self-developed creativity scale – participants self-assessed their perceived creativity – not an objective idea quality measure.

No significant between-group differences were found in terms of creative performance, when the amount of examples or the amount of objects were manipulated (Hung, Chen, & Chen, 2012). If participants could see examples (or not) and if they had unlimited access to objects (or to no objects) did not affect their product ideas' quality (Hung et al., 2012).

2.3.6 Sketching

Comparing four ideation techniques (nominal brainstorming, brainwriting, random stimulus and brainsketching) Haley (2014) demonstrated the effectiveness of brainsketching as it led to the highest percentage of quality ideas (feasibility, only) (Haley, 2014).

However, dissecting a product that is to be redesigned can be even more effective than observing and drawing a product (Toh & Miller, 2013). The combination of physical interaction with the product and sketching led to ideas that were more novel than being less involved with the product (Toh, 2014).

To think about an idea using imagery alone vs. sketching assisted by text caused no significant differences (Sun, Xiang, Chai, Wang, & Liu, 2013). Adding stimuli during the stuck period (after participants had not entered new ideas for a certain amount of time) vs. in regular intervals vs. no stimuli in an electronic sketching environment

resulted in evidence favoring the stimuli over no stimuli when it comes to idea differentiation (Sun, Xiang, Yang, Yang, & Lou, 2014).

2.3.7 Incubation

Not entirely an ideation technique, incubation has still drawn substantial research attention. Having participants solve spatial mental rotation rather than verbal anagram tasks during an incubation period has enabled them to create better ideas on the AUT (Gilhooly, Georgiou, & Devery, 2013).

Participants who solved sudoku during an incubation break created more above median ideas on the creativity scale than participants without incubation (Schütmaat, 2014); and sudoku as incubation task was even better than reading a comic and better than no incubation (Schütmaat, 2014).

Similar results were obtained, when participants had been asked to either walk outside or on a treadmill (Opezzo & Schwartz, 2014). Walking had a large effect on creativity. For example, creativity scores significantly differed between people who walked after they had been sitting and people who remained seated (Opezzo & Schwartz, 2014). Whether people walked first, then sat and then generated ideas or whether people sat, then walked and then generated ideas, did not make a difference for creativity (Opezzo & Schwartz, 2014).

Quite a different result was obtained by Fink and colleagues (2010). Here, participants achieved higher originality scores when they were stimulated by other people's ideas rather than undergoing an incubation condition (Fink et al., 2010). However, the incubation was operationalized as a time in which Fink's participants could contemplate their ideas, therefore this condition was not really an incubation phase, in which the creative process is paused, and people engage with something different.

2.3.8 Design Heuristics

Overall, six design heuristics (merging, rescaling, substituting, changing configuration, repeating, and nesting) were either presented one at a time (in serial order 1 or serial order 2), or displayed simultaneously on a list (choice condition), or no heuristic was presented (control condition). Yilmaz and colleagues (2010) only included such ideas that were rated 5 or higher on the 7-point creativity scale, and utilizing a general linear mixed model showed that the heuristics choice condition produced ideas of highest creativity, significantly higher than no heuristics, however, not significantly higher

than serial order 1 or 2 (Yilmaz, Seifert, & Gonzalez, 2010). In contrast, when it comes to idea practicality, the ideas of the control group were rated significantly more practical than the heuristics conditions (Yilmaz et al., 2010).

Warren and Davis (1969) compared a design heuristic (morphological synthesis) with Osborn's checklists (long and short) and a control group. The four groups did not differ much in terms of idea originality or practicability. Only for the number of ideas above scale midpoint in originality and above scale midpoint in practicality significant between-group differences were obtained: morphological synthesis led to the highest number of ideas above midpoint in originality and practicality, followed by Osborn's short checklist version. The control condition and Osborn's long checklist yielded the least ideas above midpoint on the originality scale as well as practicality scale (Warren & Davis, 1969). The Osborn Checklist, in an earlier study, had enabled participants to create ideas that were rated significantly higher on the creativity scale than the brainstorming technique (Davis & Roweton, 1968).

In study 1 of Goldenberg and colleagues (1999b), participants either used the attribute dependency template, the lateral thinking or random stimuli, whereas in study 2, participants either used the attribute dependency template, or the HIT technique (Tauber, 1972) or no technique (control condition) (Goldenberg, Mazursky, & Solomon, 1999b). Results of study 1 showed that the template yielded higher originality and value than lateral thinking or random stimuli, results of study 2 replicate this finding, the template group produced better ideas than the HIT technique or the control condition in terms of originality and value (Goldenberg et al., 1999b).

2.3.9 Mind Maps

Mind maps are an ideation technique based on visualization. Starting from a concept or a task in the middle of the page, more concepts are added to the center item, hence, ideas are not simply listed but are branching out from more centered concepts.

Malycha and Maier (2017a) assigned participants to a mind map condition (drew their own mind map), or to a mind map template condition (a blank ready to fill in mind map), or to a control condition (note taking). The two mapping techniques had enhanced the uniqueness and diversity of the ideas compared to the note taking control condition (Malycha & Maier, 2017a). Additionally, in another study of the same year, Malycha and Maier (2017b) compared the mind map technique with a random-input technique and a hybrid which they called the random-map technique (Malycha & Maier, 2017b).

Here, at first, a mind map is created, later a random word is introduced which is then connected with the mind map. This hybrid led to a higher degree of ideas' diversity and originality than the mind map or the random-word technique on their own.

Malycha's results (2017a, b) are in line with Wu and colleagues' earlier study (2013), in which mind maps had yielded better innovation scores than other techniques (Wu, Hwang, Kuo, & Huang, 2013). Here, participants had either used a mobile version or a computer based mind map called Mindtool or a conventional collaborative learning tool for creating business plans (Wu et al., 2013).

To test whether the group structure impacted the creativity performance (originality and feasibility) of the mind map technique, McGrath (2015) had individuals as compared to interactive groups create mind maps on "how to use social media for implementing a business strategy" (McGrath, 2015). However, no significant difference between conditions was reported.

2.3.10 Whole Creative Thinking Courses

A few studies did not compare one ideation technique with another but taught many ideation techniques (Lin & Wu, 2016; Moon & Han, 2016; Sun et al., 2016). For example, Moon and colleagues taught participants a large number of different techniques (see Table 9).

Participants in the experimental group could use all of the idea generation techniques that are listed in Table 9. The methodology significantly affected novelty and relevance of ideas. The percentage of ideas with high scores in novelty and relevance was always greater in the experimental than in the control group (Moon & Han, 2016). Note, however, that brainstorming was part in both, the experimental and the control group conditions, rendering the results less valid.

In a pre-post-test experimental design, trained participants achieved significantly better scores on the post-test than the pre-test referring to higher originality in a divergent thinking task (Sun et al., 2016).

Comparing conventional teaching and a creative thinking course showed the latter to positively affect the creativity of ideas (elaboration) (Lin & Wu, 2016).

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Table 9: Moon taught a large number of different techniques to participants in the experimental group (Moon et al., 2016), introducing different ideation techniques for different purposes: such as future envisioning, opportunity identification, ideation control, etc.

Future Envision	Opportunity identification/analysis	Ideation Techniques for Individuals	Ideation Techniques for Groups	Ideation Control	Control Group
Scenario writing	How to's	Collage	6-3-5 method	Creative Whack Pack	Roadmapping
Persona	Poetic imagery	Concept fan	Brainsketching	Fresh eye	Technology trend analysis
Extreme characters	Squeeze and stretch	Concept-mapping	Brainstorming	Idea triggers	Market research
Storyboarding	Draw a picture of the problem	Examine it with the senses	Brainwriting	Photo-excursion	Competitive intelligence analysis
	Experience kit	Forced relationship	Brainwriting pool	Purposeful activities	Scenario planning
Idea Expansion for Individuals	Fishbone diagram	Free association	Crawford slip method	Provocation	Brainstorming
Design heuristics	Why-why diagram	How-How diagram	Creative leaps	Redefining the opportunity	
Inventive templates	Rewrite objectives in different ways	Individual brainstorming	Nominal group technique	Rolling in the grass of ideas	
Osborn's checklist	5W1H	Look for opposite	Excursion technique		
Product improvement checklist	Inverse brainstorming	Mind-mapping	Gallery method		
Relational words		Napoleon technique	Gordon-little technique		
SCAMPER		NM method	ICR grid		
		Relatedness	Idea board		
Idea Expansion for Groups		Superheroes/ Cartoons	Lotus blossom technique		
SIL method		Two-words technique	Mitsubishi brainstorm		
		Visualization	NHK method		
		What-if	C-Sketch		
		WordTree method	Phillips 66		
			Reverse brainstorm		
			Six Thinking hats		
			Synectics		
			Take five		
			Theatrical improvisation		

2.3.11 SCAMPER

SCAMPER (Eberle, 1972) – an acronym for substitute, combine, adapt, modify, put to another use, eliminate, and reverse – has produced somewhat contradictory findings. López-Mesa and colleagues (2009) found higher percentages of non-obvious solutions when people had been inspired by SCAMPER than when inspired by graphical stimuli (López-Mesa, Mulet, Vidal, & Thompson, 2009). SCAMPER has been outperformed by, for instance brainwriting (Chulvi et al., 2012), TRIZ and brainstorming in terms of idea novelty (Chulvi, González-Cruz, Mulet, & Aguilar-Zambrano, 2013). SCAMPER only resulted in more utility (Chulvi et al., 2013).

2.3.12 TRIZ

In a pre-post-test design, graduate mechanical engineering students produced solutions to the LED light problem (LED lights freeze in winter, because they do not radiate warmth). Their solutions prior to and after teaching the TRIZ contradiction matrix were compared. After TRIZ instruction, the traffic light ideas were of significantly higher originality than before (Dumas, Schmidt, & Alexander, 2016).

As mentioned earlier, TRIZ was shown to be more effective than SCAMPER in terms of novelty, but was less effective than brainstorming in Chulvi's experiment (Chulvi et al., 2013).

2.3.13 Adapt-a-Role

Embodying someone else might raise idea quality. For example, creating gift ideas for a distant other rather than for a close other or for themselves had enabled participants to come up with more creative ideas (Polman & Emich, 2011).

Six thinking hats – each color assigning a different role to people for producing and judging ideas – did not cause significant differences as compared to reversal technique or random stimulus on the quality of ideas between trained and untrained participants (Culvenor & Else, 1997).

2.3.14 Provocation/ Reversal

Provocation technique has led participants to produce ideas of better quality than brainwriting (Herrmann & Felfe, 2014), but was outperformed by EBS and analogy technique in terms of idea creativity (originality and paradigm relatedness) in another study (Hender et al., 2002). Reversal technique based ideas did not differ significantly from six thinking hats based ideas in quality (Culvenor & Else, 1997).

2.3.15 IdeaFisher

IdeaFisher software (Fisher, 1996) yielded highest novelty scores, significantly higher than the IdeaTree – similar to mind maps – or the Harvard Graphic method (a software control condition) (Masseti, 1996).

2.3.16 Random Stimulus

How random words (divergent thinking with a list of 120 keywords randomly drawn from a database) as opposed to convergent thinking (past campaign information) affected idea quality (appropriateness) was investigated with different types of participants (creatives, students, and executives) (Kilgour & Koslow, 2009). Convergent thinking raised the appropriateness of ideas but lowered their originality, which could be counteracted by a random stimulus (divergent thinking) technique (Kilgour & Koslow, 2009).

2.3.17 Open Innovation Online Communities

Huber (2014) investigated the effect of collaborative enhancement of ideas in online innovation communities and concluded that commenting and assessing ideas online caused higher elaboration of ideas (Huber, 2014).

2.3.18 Appreciative Inquiry

Appreciative Inquiry Discovery technique – look back on a situation in which you were recognized – and Appreciative Inquiry Synergenesis technique – look back on a situation in which you were recognized and write up a story in 1st person – were compared to brainstorming (Bushe & Paranjpey, 2014). Synergenesis yielded highest interesting means and practicality means, however, novelty of ideas did not differ significantly (Bushe & Paranjpey, 2014) maybe due to having participants focus on past experiences.

2.3.19 Gallery Method

Participants utilizing the gallery method – 15 minutes of individual ideation, 15 minutes of group discussion, 15 minutes of individual ideation, and 15 minutes of group down-selection of ideas – outperformed participants who had used one of two other nominal brainstorming versions (20 minutes of individual ideation, 20 minutes of sketch display, 20 minutes of individual ideation; or 13 mins individual, 10 mins sketch display, 13 mins individual, 10 mins sketch display, 13 mins individual) in terms of ideas’

average quality (Mathew, 2013). Timing the gallery method did change its enhancing effect on idea quality (Mathew, 2013) the least average quality was obtained in a 5-day long gallery method session, whereas 60 minutes with shortly timed sessions or 60 minutes without time restrictions produced ideas of more average quality (Mathew, 2013).

2.3.20 Eco-Ideation Tool

Eco ideation refers to creating ideas for environmentally friendlier products or services. From the three eco-ideation tools – EcoASIT, LiDS Wheel and Eco-compass – that were compared, the EcoASIT had resulted in the most ideas that were considered original and most ideas that were considered environmentally relevant (Tyl, Legardeur, Millet, & Vallet, 2015).

2.3.21 Problem Construction

Reformulating a given problem (problem construction condition) only added to the feasibility dimension of ideas, whereas brainstorming groups created ideas of higher originality (van Eijs, 2016).

2.3.22 Established Groups vs. Non-Established Groups

In a brainstorming session, established groups generated ideas of significantly higher quality than non-established groups (Levine, Heuett, & Reno, 2017).

2.4 Conclusions and Implications

Figure 1 displays the most important findings from the systematic literature review and also shows the research gaps in experimental and quasi-experimental ideation research.

As for the results, it became quite evident that analogy technique might be the best ideation technique to choose when it comes to creating ideas of high quality. It has been experimentally tested and has not been outperformed by other techniques, yet. Instead, it was superior to brainstorming, IdeaFisher, Product Improvement Checklist, and Assumption Reversal. However, in one study, analogy had not been significantly better than interactive brainstorming, although ranked higher (Hender et al., 2002).

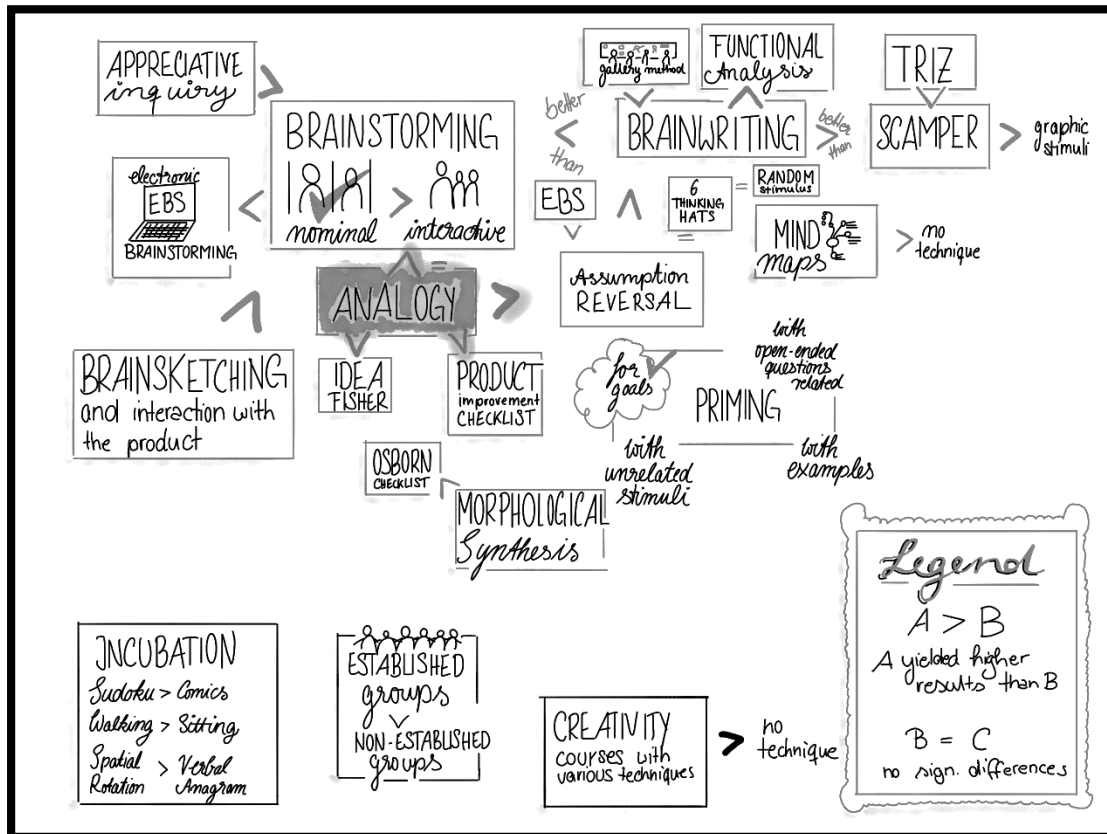


Figure 1: Sketchnote from the most important findings resulting from the literature review, "A < B" means A is less effective than B, "A > B" means A is more effective than B and "A = B" means there were no significant differences between the ideation techniques.

Other than in that study, interactive brainstorming was usually outperformed by nominal brainstorming, by appreciative inquiry, by brainwriting, and brainsketching. In conclusion, if brainstorming is done, the nominal technique is to be preferred.

Brainwriting is a moderately good method to create ideas of high quality. It was shown to be more effective than SCAMPER and Functional Analysis but performed poorer than the Gallery Method and Assumption Reversal.

SCAMPER – as just mentioned – is rather ineffective in producing creative ideas. It was outperformed by brainwriting but also by TRIZ and was only superior to graphic stimuli.

Assumption Reversal, although better than brainwriting, was found to be as effective as the Six Thinking Hats and these are as effective as Random Stimuli. Checklists seem to produce ideas of less quality than, for example Morphological Analysis or Analogy. Mind maps seem more effective as compared to no technique.

However, Figure 1 also points to the research gaps in experimental and quasi experimental ideation research:

Brainsketching, Mind maps, Morphological Synthesis, Six Thinking Hats, Gallery Method, and also sketching methods are still under researched in the sense that there are only very few studies comparing these techniques. Moreover, there are techniques that have not been tested at all such as 635, Fast Forward Steps, SIT, Walt Disney method etc. (the mentioned techniques are explained in Chapter 4).

Additionally, although the majority of studies were conducted with multiple groups in each condition, statistical analyses were mostly done as ANOVAs or MANOVAs. Only very few studies had utilized general linear mixed models (GLMM) (Yilmaz et al., 2010). Since in ANOVA group effects are not considered in the statistical analysis, these studies are considered less valid as compared to the GLMM when participants are nested in different groups.

Another issue of ideation technique research relates to the homogeneity of samples. Of 83 included studies, 69 had been conducted with undergraduate students (mostly majoring in psychology, business, or engineering). Thus, it is possible that results such as creativity performance are confounded by other factors which have also affected their choice of study programs. Besides, students are a special group of the world's population. Basing findings entirely on that group limits the external validity of ideation research.

Therefore, future experimental research on how ideation techniques affect the idea quality should either invite more practitioner samples into the laboratories or despite being a less controllable setting, should be done in the field as applied research.

That is why in this thesis' studies, professionals from the German crafts sector were invited to participate in quasi experiments in the field.

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III. CHAPTER 3

INNOVATION TRAINING IN ORGANIZATIONS: A READY-TO-IMPLEMENT CONCEPT³

3.1 Introduction

Innovation is the multi-stage process whereby organizations transform ideas into new/improved products, services or processes, in order to advance, compete and differentiate themselves successfully in their marketplace (Baregheh et al., 2009). The primary stages of innovation are (1) the creation of original and appropriate ideas – called idea generation – and (2) the implementation of these ideas.

Creative ideas are both original and appropriate, with an emphasis on their originality dimension (Runco & Charles, 1993), as originality is the most important creativity metric (Runco & Jaeger, 2012). The idea generation stage comprises two phases: a divergent thinking phase aimed at generating a large quantity of creative ideas and then a convergent thinking stage (Cropley, 2006) aimed at selecting those ideas that seem most original and appropriate for the solution of the problem at hand.

Since idea quantity and idea originality are significantly correlated (Baruah & Paulus, 2008), multiple ideas and/or solutions to a problem should be produced in the divergent phase, while only a few original and appropriate ideas are the desired outcome of the convergent phase. To come up with truly original ideas during the divergent stage, there are tools at hand – ideation techniques – that both facilitate idea generation and increase their originality. Van Gundy lists more than 100 such ideation techniques (VanGundy, 2005).

In their attempt to introduce metrics for measuring ideation effectiveness, Shah and colleagues distinguished between two modes of ideation; each method is briefly described below (Shah, Smith, & Vargas-Hernandez, 2003):

Mode 1: ideation is based on problem decomposition and analysis. Here, ideation relies on technical databases and the use of science and engineering principles or solution catalogues (logical methods – see Table 10).

³ This study has been submitted to a research journal.

Table 10: Logical ideation techniques – author’s own compilation based on Shah et al. (Shah et al., 2003).

Logical Ideation Techniques		
Cate- gory	<u>History Based</u>	<u>Analytical</u>
Basic Princi- ple	Uses past solutions catalogued in database	Systematically analyze basic relations, causal chains, and (un)desirable attributes
Exam- ples	<p>Catalogues of both, physical effects and solutions as collections of known and proven solutions (Pahl, Beitz, Feldhusen, & Grote, 2007)</p> <p>TRIZ (Altshuller & Shapiro, 1956) – the “Theory of Inventive Problem Solving” inventive principles that were basis to patents, three key concepts: contradiction, ideality and evolution patterns(Haley, 2014).</p>	<p>Forward Steps also called divergent thought, starting from a first solution attempt, following as many paths as possible to produce further solutions (Pahl et al., 2007)</p> <p>Inversion “standard method used in kinematics to create new types of mechanisms” (Shah, Smith, & Vargas-Hernandez, 2003) (Shigley & Uicker, 1995)</p> <p>SIT developed out of TRIZ and Israeli Method towards Israeli SIT, Ford SIT towards final USIT (Sickafus, 2001). 1. Problem situation, 2. Problem definition, 3. Problem analysis, 4. Problem solution, applying techniques focused on objects, attributes and functions (Sickafus, 2001).</p>

Mode 2 – intuitive methods (Table 11): ideation techniques aimed at breaking mental blocks and creating new patterns from scratch (Shah et al., 2003).

As the two tables indicate, the variety of ideation techniques is vast. Ideation techniques are increasingly applied due to enhanced agile methods and also Design Thinking (DT) – especially in light of digital innovation. Ideation and creativity handbooks that address organizational practice (Eppler, Hoffmann, & Pfister, 2017; Gray, Brown, & Macanuso, 2010; Nöllke, 2015; Seelig, 2015; Sherwood, 1998) continue to list ideation techniques with no mention of their differences in effectiveness towards the quality of ideas.

Despite being widespread in practice, the differences in effectiveness of ideation techniques remain under scrutiny (Kilgour & Koslow, 2009). Of the 70 ideation studies they reviewed, only three relied on non-student samples (Kilgour & Koslow, 2009).

Table 11: Intuitive ideation techniques – author’s own compilation based on Shah (Shah et al., 2003).

Intuitive Ideation Techniques					
<u>Category</u>	<u>Germinal</u>	<u>Transforma- tional</u>	<u>Progressive</u>	<u>Organiza- tional</u>	<u>Hybrid</u>
Basic Principle	Producing ideas from scratch	Modifying existing ideas	Repeating the same steps many times	Generate ideas in some meaningful way	Combining different techniques
Exam- ples	<p>Morphological Analysis – (Zwicky, 1969) alternating between analysis and synthesis. Analysis: identifying and defining most important dimensions of problem, parameters, conditions and underlying issues (Ritchey, 2011)</p> <p>Brainstorming & SCAMPER – (Osborn, 1979) Substitute, Combine, Adapt, Modify, Put to another use, Eliminate and Reverse (Eberle, 1972).</p>	<p>Checklists – (Osborn, 1979)</p> <p>Random Stimuli – (deBono, 1970)</p> <p>PMI Method – (deBono, 1970) Plus, Minus and Interesting; requires looking at problem from three different perspectives: What is positive, what negative, what interesting about the problem?</p>	<p>6-3-5 – (Rohrbach, 1969) based on brainwriting, 6 people, 3 ideas in 5 min., sheets are passed around.</p> <p>C-Sketch – collaborative sketching, participants work independently, sketch solutions, pass around (Shah, Vargas-Hernandez, Summers, & Kulkarni, 2001)</p> <p>Gallery Method – individual work and plenary discussion alternate (VanGundy, 1988)</p>	<p>Affinity Method – also called the K-J Method after Kawakita Jiro (1967) – Brainstorm, cluster ideas and create labels for groups</p> <p>Storyboarding – (VanGundy, 1988) organize ideas in sequential order, as if preparing films.</p> <p>Fishbone Diagram – listing all possible causes for problem (Fogler & LeBlanc, 1995)</p>	<p>Synectics – (Gordon, 1961) combine different ideation techniques (Shah et al., 2003) Basic tools: different analogy types – such as direct analogy, personal analogy, and symbolic analogy.</p>

Basing effectiveness on student samples poses two problems:

- (1) practitioners such as innovation managers or Design Thinking facilitators have incomplete or even misleading guidance as to which ideation technique is organizationally appropriate, and
- (2) external validity of ideation technique research remains prone to error due to limited sample population in both size and diversity.

This paper focuses on a third mode of ideation techniques which activates knowledge that is semantically unrelated with the ideation task. These semantic-cognitive jumping (S-CJ) techniques have been shown to enhance the creativity performance of 217 professional female and male journeymen in a quasi-experimental research design (Gumula & Boos, submitted). Two treatments (brainwriting or S-CJ) were applied in either diverse (mixture of trades, age, gender, nationality) or homogeneous groups. Results showed that S-CJ enabled participants to create ideas that were significantly more original while at the same time as feasible as the ideas produced by brainwriting participants.

3.1.1 Research Objective

Because creativity is so essential in the “quest for competitive advantage in today’s world of quickly changing technologies and dynamic competitors” (Hender et al., 2002), we developed an intensive one-day innovation training course (ITC) that addresses organizations’ competitive requirement for innovation and creative ideas. The ITC is designed to empower employees to become innovators and to inspire them by approaching idea generation in ways different to traditional techniques like brainstorming. The ITC S-CJ techniques are presented here in a detailed manner so that organizations and human resource development (HRD) practitioners can immediately implement the tools in-house and without additional innovation facilitators.

3.1.2 Outline of this Chapter

The paper is structured as follows: in the next section, the ITC is described in detail to facilitate immediate application by an organization’s HRD. This comprises a theoretical summary on innovation and then a cognitive model that describes why the ITC’s S-CJ ideation techniques result in more original but still feasible ideas than brainwriting or brainstorming. The techniques are explained step-by-step and how I applied them in a practical field test. The last section provides a summary of this paper and questions for future research as well as implications for practical application.

3.2 Description of the ITC

The ITC (innovation training course) is designed for up to 40 participants, depending on the facilities. Even more people can be trained using eLearning. The ITC

requires about six hours and comprises an input and then a practical session. The input session begins with an introduction to innovation processes and creativity techniques. The practical ideation session includes a divergent thinking phase (the creation of multiple highly original ideas) and a convergent thinking phase (selection and presentation of ideas).

3.2.1 First Part – Setup and Introduction

The room should be equipped with round tables providing enough space for more than three people. Colored paper cards and pens as well as some refreshments should already be in place prior to the training.

The facilitator needs a computer and a projector as well as flipchart paper for the plenary sessions. Note that when conducted using eLearning, the setting must provide an electronic conferencing tool which displays other people's ideas so that participants can share their ideas. Messenger services which allow video conference and provide group chat functions might be suitable.

Step 1 – Introduction

Participants are welcomed to the training. The training day agenda and a brief introduction to the topic of innovation are provided by displaying a linear innovation process model consisting of four stages:

1. idea generation
2. idea enhancement
3. idea selection
4. prototyping

Then a playful way of introducing each other is suggested: an activating game – “*Say something unique*” – is played, meant to raise the participants' attention and also to perform an initial ideation as an introductory exercise in which participants learn something interesting about each other.

The whole group is asked to rise. To sit down, people are to reveal an asset about themselves that no one else in the room shares with them, their “unique selling proposition” so to speak. If someone else in the room shares the same asset, participants must continue self-revelations until they hit upon something unique to the group.

Step 2 – Spreading Activation Network Theory of Collins and Loftus

The spreading activation network theory (Collins & Loftus, 1975) provides an understanding of how idea generation relies on the so-called spreading activation from concepts closely related to the ideation task to other concepts that are also strongly associated with these first activated concepts. In time, as activation spreads, concepts are activated that have less associative strength with the ideation task. Hence, associative strength decreases, which enables more original ideas to pop up.

Moreover, by way of the spreading activation theory, the principle of the S-CJ techniques is explained: semantic-cognitive jumping describes the process of activating such concepts that are only weakly related to the ideation task. Hence, when activation spreads from these weakly related concepts to solve the given ideation task, new ideas might evolve that are more original. Furthermore, the spreading activation network theory also highlights the importance of paying attention to other people's ideas because they again stimulate a new spreading activation. This in turn enhances the synergy of the group's creativity by playing off each other's ideas.

Step 3 – Ideation Techniques: S-CJ

In the ITC, the following S-CJ techniques are introduced, knowing that there are potentially many more ideation techniques which also yield such semantic jumps:

Design-by-Analogy

Analogical thinking encompasses mapping and transferring information from one domain to another based on similarities between the stimulus and the target (Goldschmidt, 2001). For example, when searching for something that is difficult to find, we often refer to the analogy of finding a needle in a haystack.

Analogy – considered the core of cognition (Gentner & Kurtz, 2006; Hofstadter, 2001) – is also known to be a basis for creativity (Green, Kraemer, Fugelsang, Gray, & Dunbar, 2012) and design (Ball & Christensen, 2009; Ozkan & Dogan, 2013). Analogies are the basic principle of synectics – the term stemming from Greek, meaning “the joining together of different and apparently irrelevant elements” (Gordon, 1961). For more information on synectics, see explanations in the last column of Table 2.

Analogical reasoning moves from a known example to an abstraction and from an abstraction to a new idea to solve a problem (Casakin, 2004; Casakin

& Goldschmidt, 1999; Ozkan & Dogan, 2013). It is a process of establishing correspondence between concepts from different fields of knowledge (Doumas, Hummel, & Sandhofer, 2008; Gentner & Smith, 2012). Regarding creativity, Kao (2014) argues the more distant the analogies the more creative the outcomes (Kao, 2014).

For example, a large automotive company has launched a marketing campaign relying entirely on an analogy from nature. To promote their unique shock absorber system, they utilize the phenomenon of hens keeping their heads in place, even if their bodies are moved around. In this commercial, no car or technical device is shown. There is only the hen which is moved around by two gloved hands. The hen's head stays in place – that is the message promoting the effectiveness of their automotive shock absorber.

Step-by-step-Instruction of the Analogy-technique:

1. Consider precise assets of the issue/problem/task
2. Abstract from the precise issue/problem/task
3. Find analogies with similar problems/solutions/tasks
4. Apply the analogous solution to your issue/problem/task

For example, in her 2017 season, Tina Seelig from Stanford Innovation Labs challenged her podcast listeners to come up with ideas for creating as much value as possible from mismatched socks (Seelig, 2017).

S-CJ encourages participants to first come up with analogies for mismatched socks (see Table 12). Socks have lost their mates. Then ask, who/what else has lost his/her mate? A person who is single. Idea: throw a party at which people show that they are looking for a date by wearing a single sock.

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Table 12: Mismatched socks exercise from the podcast of Stanford Innovation Lab, Season 2017, hosted by Tina Seelig (Seelig, 2017).

Precise assets of mismatched socks	Possible analogies Who/What else is similar?	Solutions
lost their mates	dogs	put socks on dogs' feet in winter
	cats	put socks on cats' feet
	single people	wear a single sock to show you are single
keep something warm	take-away packaging	use socks to keep your coffee warm instead of to-go cups; more environmentally friendly
	sweatshirts, jacket	make jacket out of single socks
something passes, something is filtered	coffee-filter	filter coffee with clean socks filter tea
	sieve	press vegetables (tomatoes) through clean socks
	lamp shade	colorful light shades for small candle lights

Ideal Final Result

In the ideal-final-result technique (IFR), the ideal case is imagined. IFR is a variant of the design-by-analogy technique, because here again, the S-CJ is performed when searching for analogies that have mastered the IFR.

The fictitious ideal case is imagined as a system performing its function without negative side effects (Hipple, 2012), granting benefits, doing no harm, costing nothing, occupying no space, and requiring no maintenance (Domb, 1997). The technique is also included in TRIZ – the Russian acronym for theory of inventive problem solving (Altshuller & Shapiro, 1956).

Step-by-step-Instruction of the IFR

1. Consider the IFR related to your issue/problem/task.
2. Find analogies that have already accomplished the IFR in their domain.
3. Apply the analogous solution to your issue/problem/task.

For example, an airport is looking for new services for waiting passengers. The IFR technique has people activate concepts of situations in which passengers would not have to wait or in which it does not feel as if they are waiting because they are enjoying their time. What kinds of places or services already offer such fun times?

Time flies by in wellness hotels or while we sleep. People enjoy dancing or riding roller coasters in amusement parks. Using these airport-unrelated stimuli helps form novel solutions: Airports might offer sleeping cabins, amusement departments with roller coasters, or if only one feature of the amusement park can be applied, the escalators and moving staircases can be complemented by slides or ropes courses (see Figure 2).

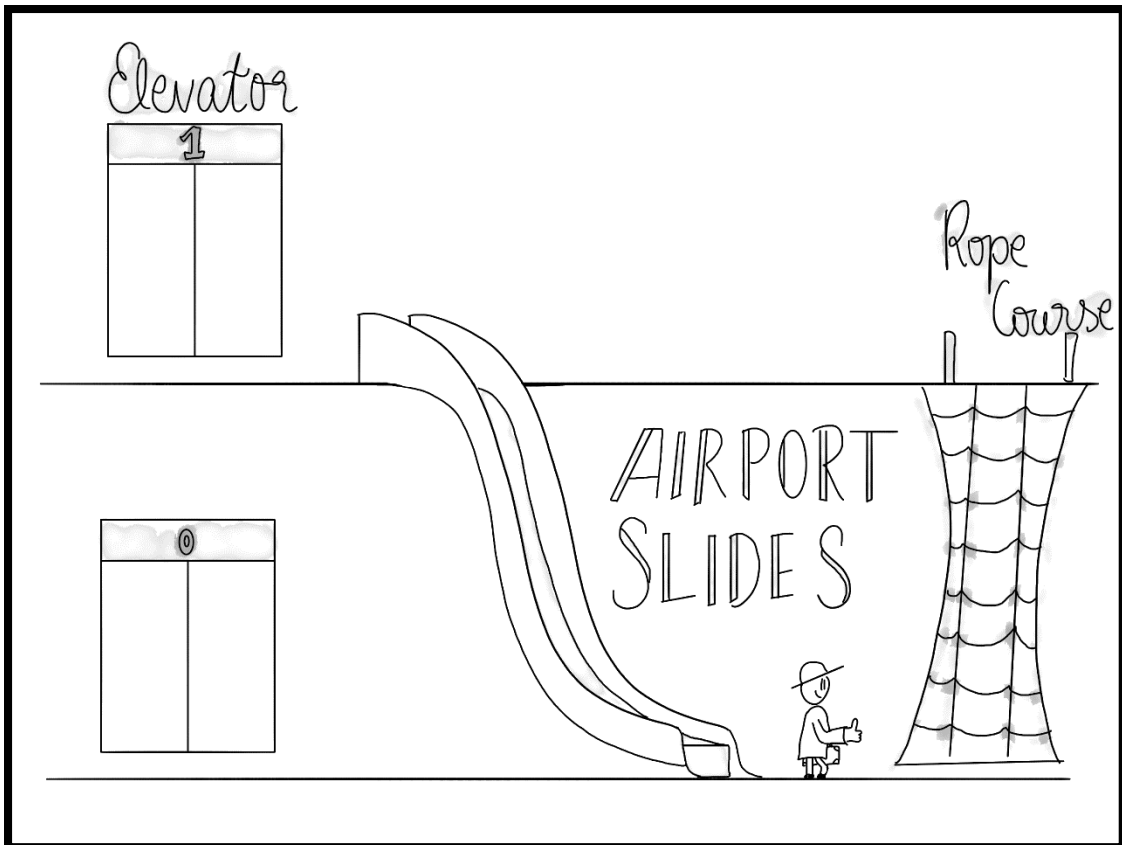


Figure 2: Example of a solution provided by IFR. Author's sketch.

Adapt-a-Role-technique

Adapting the customer's role is a core design principle; embodying the user, observing and interviewing her/him, is standard Design Thinking practice. But instead of simply changing the perspective towards the customer, in the adapt-a-role technique the S-CJ is accomplished by embodying a type of person other than ourselves: a movie star, a comic character, a politician, etc. People come up with more creative ideas when they embody a distant other than when embodying a close other or creating ideas for themselves (Polman & Emich, 2011).

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For example, think of how you would design a campaign that would grab the Dalai Lama's attention? What kind of co-working space would Sir Arthur Conan Doyle prefer for writing his novels?

These questions stimulate a S-CJ towards cognitive concepts representing the adapted persona and thus allow for spreading activation from concepts that are usually not activated by a different ideation technique.

Step-by-step-Instruction of the Adapt-a-role-technique

1. Choose any persona/superhero/comic character/celebrity/scientist
2. Imagine the persona solving your issue/problem/task. Or imagine you would solve the issue/problem/task *for* the persona – imagining her/him as the customer
3. Solve the issue/problem/task for the persona or by means of embodying the persona

Reverse technique/ Provocation

Assumptions that people have about problems, the status-quo, or constraints hinder innovative thinking and generating novel ideas. Therefore, questioning assumptions is another S-CJ technique. S-CJ is achieved by picturing things or assumptions functioning the other way around: water flows upstream instead of downstream, a bottle is inside the soda, the audience is on the stage while the singers are listening, etc.

Step-by-step-Instruction of the Reverse technique

1. List all assumptions that you hold true about the issue/problem/task
2. Reverse each of these assumptions
3. Use these reversed, sometimes awkward and unrealistic images as a basis for a more realistic solution to the issue/problem/task

For example: A husband, married to his wife for many years, struggles with innovative ideas for his wife's birthday gifts. Instead of asking what would make her happy, he reverses the task and asks what she would get angry about. If he invited her to his monthly poker night as her birthday gift, it would likely make her angry. Reversing

this opposite gift, innovative ideas evolve: organizing a poker night especially for women and inviting his wife's friends (see Figure 3).

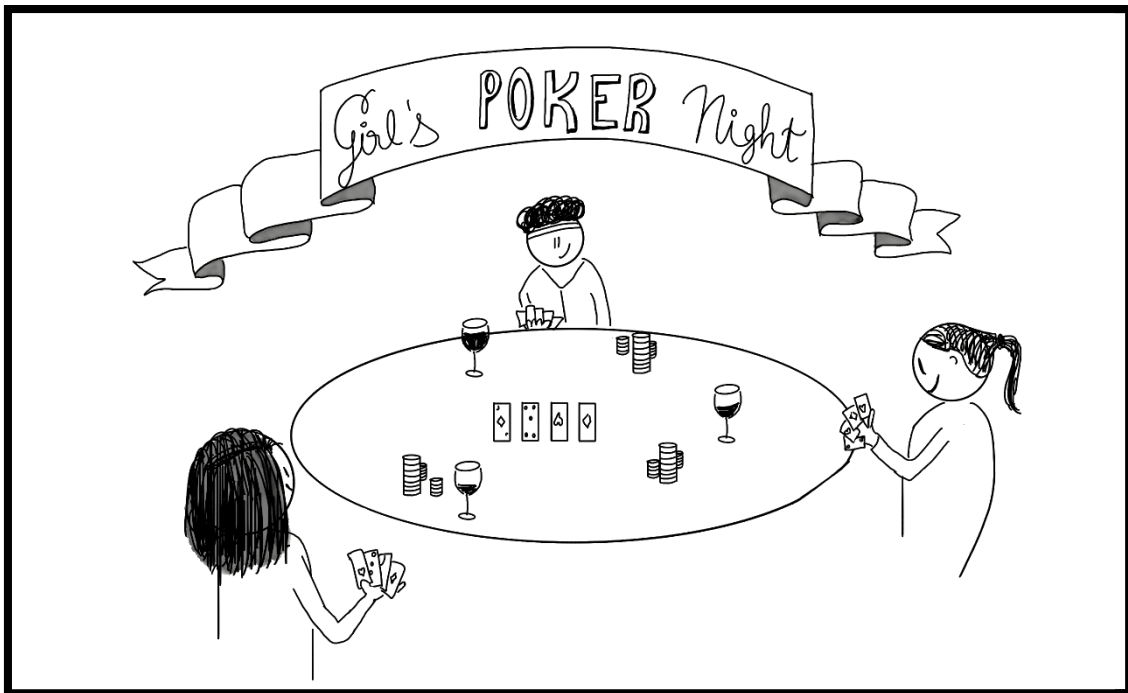


Figure 3: Example for a solution provided through reverse technique. Author's sketch.

Another technique also based on the reversal of assumptions is the provocation technique (deBono, 1970) and is known to lead to higher levels of creativity (Herrmann & Felfe, 2014). Again, all assumptions are listed and then each assumption is questioned by introducing a counter statement. This counter statement is marked by a “PO” – identifying it as the provocation. The activation spreading in semantically unrelated nodes is established because provocation technique makes the participants imagine unrealistic scenarios.

For example, a mechanical engineer wants to improve the precision of his machine. Assumption: to cut precise holes into workpieces, either the piece or the tool must be kept in place. One must stay in place while the other one moves. Provocation/PO: both move. Ideas generated from it: the two pieces move towards each other flexibly.

Exaggeration

Exaggeration requires overdoing one of the assumptions about a problem or an ideation task and then imagining the state in which a product or service would be that has these overdone features. Exaggeration is commonly used in advertising.

Step-by-step-Instruction of Exaggeration technique

1. Consider one or more assets about the issue/problem/task
2. Take the asset to the outmost extreme – imagine the asset to be, for instance, ridiculously strong or extremely weak
3. From this exaggerated asset, consider consequences that can be useful and apply them to your issue/problem/task

For example, hair conditioner strengthens hair. If this feature of hair conditioner was overdone, knives and scissors would break during the attempt to cut the hair. This image is visualized in an advertisement of the Wella-hair care company.

Step 4 – a Metaphor for the Innovation Process

Using metaphors that fit well to the context that they generate is a way of introducing something unknown with familiar images. In the ITC, the metaphor of gardening (familiar) is used to explain ideation (unknown) and to present the rules for the ideation session simultaneously (see Figure 4).

The aim of gardening is to have some appealing, high-quality sunflowers that can be sold at the weekly market in town. To accomplish that, questions are asked. The answers to these questions are the seeds. The more seeds cast the better because not all seeds will germinate. Once the seedlings have grown, the best ones are selected. These seedlings are watered and fertilized so that they flourish. When all sunflowers have matured, the best ones are selected for sale. At the market the best quality sunflowers are presented to the customers.

By way of using this metaphor the rules for the ITC – stemming from Osborn's brainstorming rules (Osborn, 1979) – are introduced:

- During the seeding stage, quantity is more important than quality. Quality of ideas is important later, during the selection stage.
- Talk and write first, then think. This rules out self-criticism and self-censorship.
- Develop ideas that are as crazy as possible.
- Pay attention to and enhance the ideas of others.
- “Yes, but...” is forbidden, making sure that unusual ideas are encouraged.

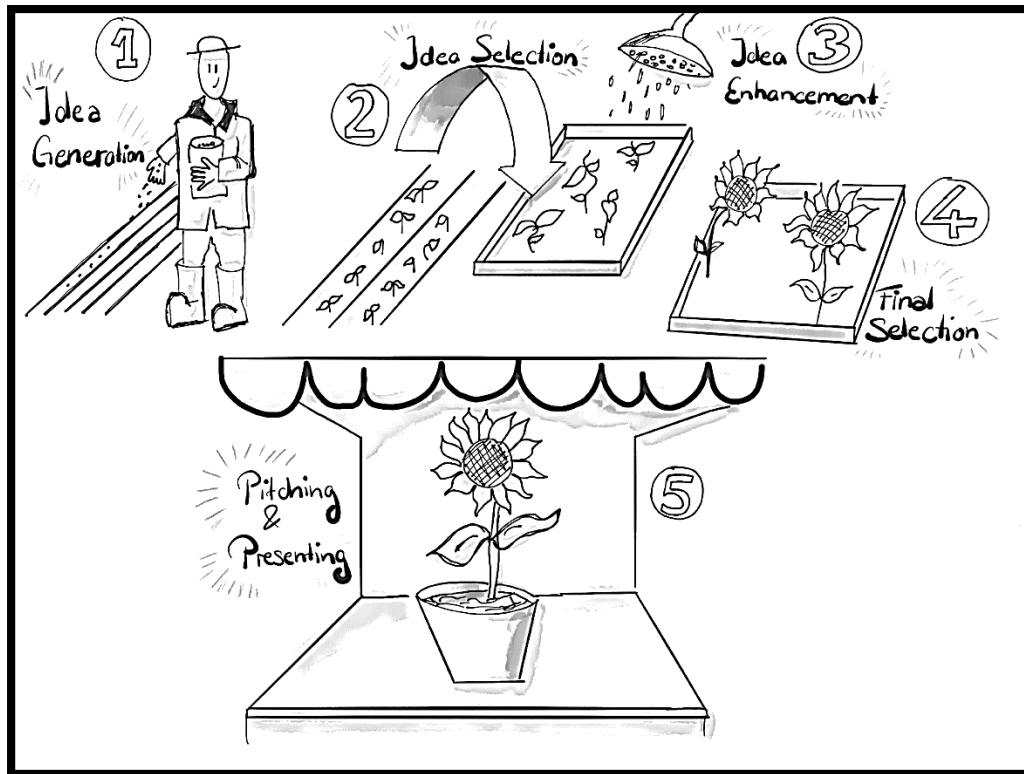


Figure 4: Author’s own sketch of the gardening metaphor applied in the ITC.

Step 5 – Activating Game “Grandma, Lion, Samurai”

Since the first part of the ITC is theory-laden, before entering the practical ideation phase, the participants are asked to join in another activating game comprising some physical activity. Oppezzo and colleagues have shown that physical activity (walking on a treadmill or outside) prior to ideation has a great effect on creativity (Oppezzo & Schwartz, 2014).

“Grandma, Lion, and Samurai” is played like “Rock, Paper, Scissors” but instead of only making hand gestures, people make a characteristic noise while embodying and mimicking a grandmother, a lion, or a samurai. The grandmother points her finger and scolds the samurai, the samurai raises his blade and beheads the lion, the lion’s roar scares the grandmother.

Two groups are formed, each selects their champion who then opposes the other team’s champion. Champions are selected in round robin fashion so that each group member has her/his turn.

3.2.2 Second Part – Put Theory into Practice

Step 6 – Ideation Tasks

Usually, scholars testing the effectiveness of different ideation techniques rely either on standardized tests such as the Alternative Uses Task (AUT) in which participants come up with unusual uses for everyday objects (Storm & Patel, 2014; Sun et al., 2016) or have participants think of ways to improve their university (Baruah & Paulus, 2008; Goldenberg et al., 2013; Paulus et al., 2013). Other scholars asked subjects to think of advantages and disadvantages of an additional thumb (Dugosh, Paulus, Roland, & Yang, 2000; Dunnette et al., 1963; Kohn, Paulus, & Korde, 2011; Paulus & Dzindolet, 2008). Since the ITC was not conducted in the laboratory but was designed as applied research, the ideation task was not supposed to benefit only scientific rigor by way of replicating previous methods but was meant to benefit private and public-sector organizations to improve their competitive edge by training their employees in effective creativity and innovation thinking.

Therefore, in the first field test setting of application held with male and female journeymen, two ideation challenges from this specific professional domain were presented to participants. In other domains, the ideation challenges most beneficial to their organization should be chosen. In our test, participants were presented two ideation tasks:

- (1) come up with advertisement for their own (future) business
- (2) identify real-world problems that they themselves or their clients might face and creatively develop solutions to these problems.

Advertisement task:

To ideate on advertising for their businesses, attributes and unique assets of their services, products, and their future companies are collected in a plenary session (see the first column in Table 13 for exemplary attributes).

Afterwards, participants work individually. They choose which ideation technique they want to apply and create advertisement ideas. Later they stroll through the room, read and comment on their colleagues' ideas and exchange feedback to further advance each other's solutions.

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For example, if participants want to apply design-by-analogy, they at first search for analogies of one of the assets collected during the plenary session (see Table 13).

Once they have identified analogies applicable to this asset, they then develop ideas that are based on these analogies: for example, create a poster in which the employees of the business are displayed on a soccer field wearing their trade's uniform with the headline, "*We never miss. A strong team for your sanitary installation*".

Table 13: Attributes and analogies for crafts.

Attributes of crafts businesses	Analogies
mostly male workers	soccer teams
one craft business in each village	churches
crafts can be recognized by their specific tools	dentists

Problem Solving Task:

The second task has two stages – a problem-identification stage, followed by a problem-solving stage. The problem-identification stage includes identifying problems that they or their customers are facing or might face in the future. This is done in a plenary session to help participants get started on their task by assisting them in gathering as many current and potential problems as possible.

In the problem-solving stage they individually list assumptions and attributes on one problem that they have decided to work on and then choose which technique they want to apply. Depending on that choice, they either reverse the listed assumptions or come up with analogies that also face the same problem. Afterwards, they again stroll through the room, comment on other people's ideas, combine their innovative solutions and exchange feedback.

Step 7 – Selection phase

Although each idea may function as an advertisement or may solve the problem task, selecting the highest quality ideas is essential. Instead of selecting ideas based on personal preference, the ITC provides selection criteria to guide towards the best ideas (see Table 14). From all ideas that pass these two individual selection processes, the participants may choose their favorite idea each to create prototypes.

Table 14: Selection criteria for convergent stage.

Levels	Advertising Task	Problem Solving Task
1	feasible	feasible
2	attention grabbing	solve the problem at hand
3	costs less than 200 Euros	
4	unique and novel	unique and novel

Step 8 – Prototyping and Final Presentation

Participants enhance the selected ideas and develop them into prototypes. There are various forms of prototypes such as sketches, 3D-models, storyboards, mock-ups, etc. For example, a dark horse prototype – based on the analogy of a dark horse contestant in a horse or political race who wins unexpectedly – is an attempt to produce a prototype of a seemingly infeasible idea, an idea that looks like it would not work but, in some cases, actually does. Dark horse ideas are risky and their implementation is usually expensive (Bushnell, Steber, Matta, Cutkosky, & Leifer, 2013). But in the end, the dark horse idea has been known to win the race and result in great commercial success.

Through prototyping, the ideas and the resources they require become tangible and people gain a mutual understanding of what they want the idea to look like in terms of which functions are mandatory. Since in our ITC field test there were only limited resources available, participants had to stick to pen and paper to create posters. But as organizations increasingly install creative spaces – places that provide various materials and media technology – idea prototyping should utilize the rich supply of creativity material available today.

Towards the end of the training course, participants present their prototypes to an audience of simulated trade experts and customers who in fact are fellow participants and the facilitator. The audience in turn provides feedback on the pitched solutions. If the feedback is rather negative, new ways to improve the idea are to be found, serving another iteration of steps 6 through 8.

In applied settings, it is advisable to have real customers engage with the prototype and collect feedback from them. If possible, pitching the idea to the management board might assure early sponsorship and supervisor support, raising the possibility of the idea being implemented.

Debriefing

Following the final step of the ITC – the above described presentation of prototyped ideas – participants are asked to provide feedback on the course so that the ITC itself can continuously be improved to meet customer requirements.

The ITC ends by thanking the participants for their attendance and feedback.

3.3 Discussion

A detailed description of the training course was presented allowing for its immediate application in HRD and entrepreneurship training. A few weak points of the ITC should be reported: for example, when addressing practice, complex models like the spreading activation theory (Collins & Loftus, 1975) might need more detailed explanation.

Interestingly, the knowledge provided in the ITC seems to be not very novel. Designers have long been applying design-by-analogy, also reflected in the fact, that for example the analogy based techniques called Synectics have been developed in the 1960s (Gordon, 1961). What is new, however, is the combination of the cognitive model (spreading activation network theory) and the ideation techniques in the light of this new ITC.

Although innovation covers the creation and implementation of ideas (Baregheh et al., 2009), the implementation phase cannot be covered by a one-day long workshop as has been proposed here. Only theoretical knowledge on the implementation can be provided, leaving the realizing of ideas obtained in the trainees' and organizations' responsibility. Future training concepts might focus more on implementation skill and controlling.

3.4 Conclusion

Life in the 21st century is characterized by uncertainties (Kashani-Vahid, Afrooz, Shokoohi-Yekta, Kharrazi, & Ghobari, 2017). Social, economic and technological changes make it almost impossible to predict the required skills in the future world (Beghetto, 2010). However, scholars agree that being able to deal with ill-defined problems is and will continue to be mandatory. This ability calls for creative thinking skills on both the personal and organizational level (Kashani-Vahid et al., 2017).

Despite the importance of innovation – organizations constantly search for original and appropriate solutions to problems (Kilgour & Koslow, 2009) – effective innovative training is still lacking in HRD, as diagnosed by Michaelis and Markham (2017). A possible explanation for this training gap might be the high costs of outsourced innovation training, coupled with the lack of immediate, measurable economic gains. Therefore, I developed this one-day ITC designed to provide the most effective ideation techniques in a way that can be taught by in-house HRD personnel. A quantitative evaluation of the ITC reasons that S-CJ (semantic-cognitive jumping) as an ideation technique is preferred over brainwriting (Gumula & Boos, submitted). The S-CJ was therefore applied by the innovation training course presented in this paper, allowing for its immediate application by both organizational HRD and entrepreneurship training.

Although innovation comprises both the creation and implementation of ideas, the implementation phase cannot be accomplished in the one-day innovation workshop presented here. The ideas are generated, prototypes are presented, but for implementation, only theoretical knowledge is provided. Hence, implementing the ideas remains in the trainees' and organizations' domain of responsibility.

3.4.1 Questions for Future Research

While ideation research dates back to 1958 (Taylor et al., 1958) and has expanded since, more research focusing on the implementation of ideas is needed.

There are two main aspects deserving additional scientific investigation: the why and how of successfully implemented ideas and the flipside of that topic – why ideas that, despite meeting the feasibility and originality requirements, have not been successfully implemented.

Future innovation research should address questions like:

On the innovation success side: what were the reasons that led to the implementation of ideas? Of what quality were the ideas that got realized? What selection criteria were applied during the convergent stage? Who felt responsible for the idea?

On the innovation failure side: at what point in time did the group members stop pursuing their ideas? What factors caused the innovation process abandonment? How were perceived financial resources and perceived supervisor support prior to abandonment?

Regarding social psychology questions related to the group processes involved in idea implementation: How do roles change over time within innovating groups? How

are people who implement the ideas supported/not supported by their supervisor? What are the values that best guide innovators? How is innovation implementation incentivized or stymied? How does personality relate to innovation implementation failure or success? How does group composition (diverse vs. homogeneous) affect innovation and the implementation of ideas?

3.4.2 Implications for Practice

Creativity and innovation skills are desired competencies for today's economic system. Especially with increasing automation, the ability to create ideas and to imagine new scenarios is highly attractive to employers.

Innovation trainings are proven to enhance participants' creativity outcome (Scott et al., 2004) and the S-CJ techniques introduced here have been shown to increase idea originality of journeymen regardless of gender (Gumula & Boos, submitted). Even small changes in the originality of ideas increase customer's willingness to pay a profitable price and thus raise the innovation's value for organizations (Dahl & Moreau, 2002).

However, as implementation and commercialization are as important as the idea creation stage, future training concepts should focus more on the implementation side of innovation. Here, skills such as project management, agile implementation methods and a different set of roles for the realization of implementation may be useful.

At the same time, long term innovation goals should be backed by incentivizing mechanisms that support this long-term orientation. When innovators are rewarded upon "selling" their idea, this might decrease innovators' motivation to implement their idea and thus eventually lead to a premature abandoning of the implementation stage of the innovation process.

For sounder organizational practice regarding innovation and maintaining an organization's competitive edge, the provision of in-house mentoring programs and counselling for innovating teams is suggested. That way, ideas which might win the race to market are not abandoned due to lacking support. Since highly original ideas are the explicit desired outcome of S-CJ techniques, their unusualness and novelty could cause them to be even harder to implement due to lack of existing organizational underpinnings. Innovating teams' need for management support and encouragement is likely to be positively correlated with the originality of their ideas, causing guidance and

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mentoring to become an essential organizational practice for surviving the uncertainty of the modern competitive climate.

IV. CHAPTER 4 IMPLEMENTING AND EVALUATING THE INNOVATION TRAINING COURSE (ITC)

4.1 Introduction

The ITC as described in Chapter 3 has been applied in practice; 217 female and male journeymen in training towards their master certificates took part in trainings that lasted about six hours. Sixteen such ITCs were run at five different training centers of the German chambers of small businesses and skilled crafts.

There were two versions of the ITC under differing group composition conditions. This 2-by-2 research design was chosen for evaluating the effectiveness of the ideation techniques (S-CJ vs. brainwriting). The objective data that were collected such as the ideas ratings and statistical analyses derived from the objective rating study are presented in Chapter 5. These data, however, do not reflect the trainees' perspectives on the ITC. That is why this chapter is dedicated to the systematic evaluation of the ITC based on self-reported data from the participants.

4.1.1 Research Objectives

A systematic evaluation of the proposed ITC (described in the previous chapter) by means of a follow-up questionnaire assessing the trainees' feedback is the objective of this chapter.

4.1.2 Outline of this Chapter

First, the method and results of a systematic literature review on existing evaluation frameworks addressing creativity trainings or ITCs are presented. Findings allow for the conclusion that evaluation frameworks explicitly addressing creativity trainings or ITCs are still lacking. A broader search scope brought up Kirkpatrick's evaluation framework (Kirkpatrick, 1979). After its brief introduction, Kirkpatrick's model serves as a basis for the development of a follow-up questionnaire that was later administered to 217 participating female and male journeymen. The resulting quantitative and qualitative data are then analyzed by a mixed method research design. However, only limited validation can be expected due to a major mistake when collecting the quantitative data. Forgetting to assign a biunique identifier code to the respondents, has caused the

participants to seem as one group although in fact they had partaken in different versions of the ITC.

4.2 Literature Review

Despite the fact, that ITCs positively impact innovation performance (Brogaard, 2016) and that the effectiveness of creativity trainings has been demonstrated in a meta-analysis (Scott et al., 2004), evaluation frameworks explicitly addressing ITCs are still lacking. Since participants spend their time in trainings, and organizations spend money on training facilitators, invested resources call for justification.

The literature search comprised “creativity training” as well as “evaluation” related keywords; its search method is described in Table 15. While screening the papers, further studies were included in the dataset. For this paper’s purpose, attention was paid to the criteria applied for evaluating ITCs.

Table 15: Methods and results of the literature search related to evaluation of innovation trainings.

Scientific Databases	Search Terms	Results	Added to Dataset	Authors
Psycarticles Psychology and Behavioral Sciences Collection	<u>In Abstract:</u> “training evaluation”			
	<u>In Text:</u> “innovation training” only peer-reviewed journals	3	1	Birdi, Leach & Magadley (2012)
Psycinfo Econlit Psycdex eBook Academic Collection (ebSCO host) Business Source Premier	<u>In Abstract</u> “training evaluation” “creativity training” only peer-reviewed journals	5	4	Birdi et al. (2012) Puccio (2004) Ness (2011) Scott et al. (2004)
	<u>In Abstract</u> “training evaluation” “Kirkpatrick” <u>in all text:</u> “four levels of evaluation”	3	3	Saks & Burke (2012) De Wolfe Waddil (2006) Russel, Wexley & Hunter (1984)
Preliminary Dataset			7	

From the seven search results, only three reported evaluation of innovation related trainings: (Birdi, Leach, & Magadley, 2012; Puccio, Wheeler, & Cassandro, 2004; Scott et al., 2004).

Scott and colleagues (2004) presented a quantitative meta-analysis of program evaluation efforts based on 70 prior studies and concluded that well-designed creativity training programs typically induce gains in performance. These effects held when

internal validity considerations were considered. Contributing factors to the relative effectiveness of these training programs are: focus on development of cognitive skills and the heuristics involved in skill application, and using realistic exercises appropriate to the domain at hand (Scott et al., 2004).

James and Roffe (2000) point out the difference between goal-free and goal-based trainings, in which explicit training objectives are specified during design and before delivery of a training (James & Roffe, 2000). They name two types of trainings in which goal-based training design and evaluation encounter difficulties: (a) training in creativity and innovation; and (b) innovative training initiatives (James & Roffe, 2000).

Birdi and colleagues (2012) investigated the ability to produce novel and useful ideas as short-term effects of a creativity training based on TRIZ –the theory of creative problem solving. They also assessed long-term effects such as improved levels of employee creativity (i.e. generation of new ideas) back in the workplace. Although acknowledging that there is little systematic evaluation of ITCs in the literature, Birdi and colleagues also do not rely on a systematic evaluation model but rather develop their own levels of evaluation (Birdi et al., 2012).

Puccio and colleagues (2004) evaluated the effects of a Creative Problem Solving-Program (CPS). They concluded that participants with strong Ideator preferences were more likely to associate higher levels of future value with the CPS. For their evaluation, they had utilized a distinct evaluation model – the Kirkpatrick evaluation framework (Kirkpatrick, 1979).

It is “by far the most popular approach to the evaluation of training in organizations today” (Bates, 2004) and since a distinct evaluation model for innovation trainings is still lacking, the Kirkpatrick approach seemed appropriate for the evaluation of the innovation training. In short, Kirkpatrick’s evaluation model covers four levels (Kirkpatrick, 1979): the trainees’ reactions, their newly obtained knowledge, their changes in behavior on the job and results related to the training.

Although scholars have questioned the underlying assumptions of causal interlinks or hierarchy between the levels (Alliger & Janak, 1989), its success stems from its simplicity as it only requires four levels of outcome-criteria to evaluate a training program and still covers short term and long term effects.

Another search was then conducted focusing on studies that had explicitly applied Kirkpatrick’s evaluation model, regardless of the topic of the investigated trainings. The included papers are displayed and briefly summarized in Table 16.

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Table 16: Studies from the literature search on Kirkpatrick and evaluation of training, this second column reporting whether obtained studies had referenced Kirkpatrick and what kinds of levels had been assessed in these evaluation studies (Kirkpatrick, 1979).

Authors	Reference to Kirkpatrick (1979)	Sample and type of training	Results
(Alliger & Janak, 1989)	yes	1, 2, 3, 4 Meta study examine the validity of Kirkpatrick's model, the frequency of each level in published evaluation studies, correlations from the literature	Level 1 and the others only correlate little, maybe due to the reduced variance typical of reaction measures
(Altarawneh, 2009)	yes	re-view review	investigated training evaluation practice in Jordanian banking organizations, showing Kirkpatrick's evaluation model to be the most important one, and filling in questionnaires to be the most frequently used evaluation method (M = 4.47, SD = .95 on 5-point Likert scales), practice mainly focuses on the trainees' reaction level (M = 4.50, SD = .69)
(Bates, 2004)	yes	no evaluation, critique on Kirkpatrick's framework	criticizes the inability of the model to effectively address both the summative question (Was training effective?) and the formative question (How can training be modified in ways to increase its potential for effectiveness?)
(Beinborn, Schmidt, & Harpeng, 2007)	yes	1, 2, 3, 4 qualification controlling tool based on the Kirkpatrick framework, five qualification trainings were evaluated (sales trainings, work organization)	Feedback sheets, knowledge tests, and data from an employee survey concerning learning transfer proved to be helpful, no clear results of actual performance data, »underperforming« trainings should be reviewed and adapted. Whether there will be any improvement will be shown in the next round of the qualification controlling process
(Birdi et al., 2012; Ness, 2011)	no	2, 3, 4 (TRIZ)-based creativity training program in a major international engineering firm. Cross-sectional, longitudinal and multisource evaluation strategies were used to assess the impact of the training on a sample of design engineers (n = 123) and to make comparisons with non-trained (n = 96).	participation in TRIZ training led to short-term improvements in both the creative problem-solving skills and motivation to innovate of engineers, and these were associated with longer term improvements in their idea suggestion in the workplace; variable support for the translation of these ideas into new innovations and improved performance at work
(Bramley & Kitson, 1994)	yes	- no evaluation	measuring only one level is criticized practice, evaluation should comprise all four levels because they each provide different kinds of evidence
(Brandt & Kallus, 2014)	yes	1, 2, 3 professionals: sales employee: sales trainings, personality and team development trainings, N = 76.	three of the four Kirkpatrick levels – reactions, learning and behavior. “Assessing the fourth level requires identification of useful and reliable result indicators which is often arduous”
(Brogaard, 2016)	no	3, 4 survey among 260 Danish public private partnerships (PPPs) on innovation training	innovation training has a significant effect on achieving innovation in PPPs, factors such as trust and institutional support only affect some innovation types
(Cordón-Pozo, Vidal-Salazar, & Torre-Ruiz, 2017)	no	4 panel of 176 Spanish firms in high-tech industries on innovation training	the positive impact of innovation training on product innovation performance occurs when firms are cooperating with external agents

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(Elliott, Dawson, & Edwards, 2009)	yes	4 and ROI	applied the extended framework on the evaluation of a software quality management system as a training course.	They extended Kirkpatrick's Framework with Phillip's ROI-dimension, calculated ROI and savings as results from the training
(Fiester & Morris, 2011)	yes	4	a self-paced generic interactive computer video program for injection molding machine operators	propose their own evaluation model based on Kirkpatrick but focus only on the fourth level – results – and collect business measures data
(Frash, Kline, Almanza, & Antun, 2008)	yes	1, 2, 3	applied a field study throughout a hotel company (N=564 hotels)	investigated all four levels by means of smile sheets, final certification activities and role-plays. They conclude that there are unambiguous positive relations between Kirkpatrick's four levels within their study
(Hattori & Wycoff, 2004)	no	1, 2, 3	practical guide for innovation training	
(James & Roffe, 2000)	yes	1, 2, 3, 4	no evaluation, overview paper	Distinguish between "goal" and "goal-free" training and highlight the significance of the latter for applications in training for creativity as well as with initiatives aimed at training innovation
(Legros & Galia, 2012)	no	4	1997 French Community Innovation Survey (CIS2) for 1994–1996, survey asks French manufacturing firms with more than 20 employees about how they have innovated as well as the origins and objectives of the technological innovations	results show that innovation, training and ISO 9000 certification have a positive and significant impact on firms' productivity
(Li, 2014)	no	2, 3, 4	investigates Chinese higher education impacting learning and innovation capability of students	without referencing Kirkpatrick but including learning (level 2), behavior (level 3) as well as results (level 4) (such as dissertation quantity and number of published papers) as evaluation criteria
(Michaelis & Markham, 2017)	no	4	conducted semi structured interviews with 30 senior managers of R&D and product development at 27 global Fortune 1000 companies with at least \$1 billion in revenues	explore managers' attitudes toward innovation success factors and innovation training, analysis indicated that innovation training is rarely done for either front-end or back-end success factors, but front-end training occurs significantly less often than back-end training
(Ness, 2011)	no	no evaluation, a review	pilot program to teach innovative thinking to health science students at the University of Texas	includes instruction in recognizing and finding alternatives to frames or habitual cognitive patterns, in addition to the constructs already mentioned, that academic health centers should implement and evaluate new methods for enhancing science students' innovative thinking
(Puccio et al., 2004)	yes	1, 2, 3	evaluate graduate and undergraduate students' (N=84) reactions to specific elements of a Creative Problem Solving (CPS) course, participants were asked to rate the CPS components, stages, principles, and tools for enjoyment and future value, examine whether participants' reactions to the CPS training varied in accordance to their cognitive style preferences	participants with strong Ideator preferences were more likely to associate higher levels of future value with the Prepare for Action component of the CPS process
(Ross, 2016)	no	-	no evaluation, overview paper	
(Russell, Wexley, & Hunter, 1984)	yes	1, 2, 3, 4	evaluate the effect of substituting managers for professional trainers on 44 male supervisors,	results showed that behavior modeling resulted in favorable reactions

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			22 supervisors were trained with six behavior modeling modules and the effect was compared to a control group consisting of 22 supervisors	and an increase in learning, but did not produce behavior change on the job, or improved performance results
(Safar, 2012)	yes	1	students in e-learning courses	high satisfaction rates with the courses
(Schultz, Sjøvold, & Andre, 2017)	no	3, 4	14 interviews with healthcare practitioners (9 municipal managers, 4 academic or research institutions, and 1 an influential governmental organization)	Municipalities need innovation training or competence. The most significant finding was that Norwegian municipalities' innovation strategy is clearly to facilitate the elderly living at home as long as possible by developing smart, in-home technology (improving the quality of care).
(Scott et al., 2004)s	no	4	quantitative meta-analysis of program evaluation efforts based on 70 prior studies	well-designed creativity training programs typically induce gains in performance with these effects, generalizing across criteria, settings, and target populations, effects held when internal validity considerations were taken into account, contributing factors to the relative effectiveness of these training programs: focus on development of cognitive skills and the heuristics involved in skill application, using realistic exercises appropriate to the domain at hand
(Thornhill-Miller & Dupont, 2016)	no	1	innovation facilitators were asked about the role of virtual reality environments for facilitating innovation and creativity	respondents stressed the possibility of gamification and to model innovation trainings as serious games. On the other hand, facilitators with most work experiences tended to be least appreciative of the benefits that the virtual word offered
(Waddill, 2006)	yes	1, 2, 3, 4	examine the impact of the action learning process on the effectiveness of management level web-based instruction (WBI), A leader-led, management-level course using face-to-face delivery was converted to web-based instruction where action learning was the delivery methodology	though challenging to facilitate, the action learning online method is effective and yields changes in participants' knowledge. However, contrary to expectations, online learning communities did not form.

Fourteen out of 26 studies had referenced the evaluation model proposed by Kirkpatrick (Kirkpatrick, 1979).

4.3 The Kirkpatrick Evaluation Model (1979)

The evaluation framework proposed by Donald M. Kirkpatrick (1979) is a well-known, widely applied model for evaluating training programs (James & Roffe, 2000), has become a standard for evaluating trainings in various fields like industrial, business, military, and government training (Watkins et al., 1998), and even for medical trainings. As Yardley and Dornan (2012) report, the „Best Evidence Medical Education collaboration” (BEME) had published 14 reviews, seven of which had used Kirkpatrick's model (Yardley & Dornan, 2012). It comes as no surprise then, when even called the

supermodel for training evaluation (Abernathy, 1999), it remains enduringly popular (Alliger & Janak, 1989) and is still listed as one of the four foundational evaluation-related concepts (Chyung, 2015).

4.3.1 Level 1 – Reactions

On Level 1 – *reactions* – participants express their feelings about the experience (Kirkpatrick & Kirkpatrick, 2010) and provide feedback concerning their satisfaction with the training, their learning experience as well as their plans of using their new knowledge, and provide suggestions for improvement of future learning experiences (Schumann, Anderson, Scott, & Lawton, 2001). Nonetheless participants' satisfaction with the course, or the instructor, the subject matter or the facilities constitute no evidence of participants having learned anything (Schumann et al., 2001). That is why *learning* is the next evaluation level.

4.3.2 Level 2 – Learning

Level 2 investigates the degree to which participants change attitudes (Schumann et al., 2001), improve knowledge, or increase skills as a result of the program (Kirkpatrick & Kirkpatrick, 2010). Questionnaires, tests or simulations provide information on how much the participants' learning was affected by the training.

4.3.3 Level 3 – Behavior

On Level 3 – *behavior* –, the degree to which learners have changed their behavior outside the learning setting is assessed (Kirkpatrick & Kirkpatrick, 2010). Since this behavior-level aims at analyzing whether and how much the participants apply new skills on the job (Schumann et al., 2001), it can only be surveyed after a certain period of time. And even then, other factors such as motivation and attention or management support might have influenced participants' behavior (James & Roffe, 2000).

4.3.4 Level 4 – Results

On level 4 – *results* – the degree to which the output of the participant's workgroup or organization has improved is investigated (Kirkpatrick & Kirkpatrick, 2010). Here, business measures such as output, quality, costs, and time as well as productivity, sales and profits (Schumann et al., 2001) are measured. This level comprises two perspectives: (1) the trainee's perspective according to his/her personal

success on the job, promotions, income (Schumann et al., 2001), as well as (2) the employer's perspective on productivity, work quality, lower costs, fewer accidents, higher profits from hiring trainees than hiring employees who did not participate in the training program. Here again, the question of whether the improving results were caused by the training or whether they resulted from other processes (Schumann et al., 2001) remains unanswered.

4.3.5 Level 5 – Return on Investment (ROI)

An additional fifth level not invented by Kirkpatrick but with growing popularity especially in the fields of business and industrial training is Level 5 – *Return on Investment*. Established by Phillips and Phillips (2005) it has become known as the Phillips ROI-level (Phillips & Phillips, 2005) and compares the benefits of a program to its costs. Positive ROI is established when the monetary value of the training exceeds its costs (Phillips & Phillips, 2005). The formula for training-ROI is:

$$ROI = \frac{\text{Total Program Benefits} - \text{Total Program Costs}}{\text{Total Program Costs}} * 100$$

Or

$$ROI = \frac{\text{Net Program Benefits}}{\text{Total Program Costs}} * 100$$

4.3.6 Criticizing Kirkpatrick's Model

Despite its numerous advantages Kirkpatrick's model has shortcomings (Kirkpatrick, 1979). Although acknowledging the potential of the model to simplify the complex process of training evaluation, Bates (2004) criticizes the model's shortage and oversimplifying (Bates, 2004). It measures only anticipated outcomes while ignoring unanticipated consequences (Yardley & Dornan, 2012). Reviewing 191 studies published during 1959 and 1988, Alliger and Janak (1989) showed that most articles had looked only at one single level and that the first level was not the most investigated one but level two and three, because scientific literature rather focuses on reporting behavioral results than learners' reactions. They also showed that level 1 only slightly correlates with the other levels ($r_{1,2} = .07$; $r_{1,3} = .05$); correlations between the other levels being a little bit larger ($r_{2,3} = .13$; $r_{2,4} = .40$; $r_{3,4} = .19$) (Alliger & Janak, 1989). They assume that the minor variation in reaction data contributes to these small correlations.

Kirkpatrick's model tends to lead to misunderstanding and overgeneralization (Alliger & Janak, 1989).

Also because of the larger effort needed for investigating behavior and results-criteria, many organizations evaluate only the first two levels (Saks & Burke, 2012) whereas in scientific research, these two levels are often neglected (Alliger & Janak, 1989). In 2000, Twitchell, Holton, and Trott (2000, p. 84) pointed out that evaluation practices had not changed over the past 40 years (Twitchell, Holton, & Trott, 2000). By now, in 2018, it has already been 58 years. Watkins and colleagues (1998) criticize the lack of giving attention to societal good and to the way training programs might contribute to communities, external clients or the society on the mega level (Watkins et al., 1998) and thus propose the Kirkpatrick Plus model. Here, another level is introduced focusing on the societal good or effects in communities or the environment that result from the training. Thus, it is advisable to consider more than economic results especially when evaluating ITCs or creativity trainings.

4.4 Evaluating the ITC – a Mixed Methods Approach

The systematic literature search related to ITCs and evaluation allows the assumption that evaluation frameworks explicitly addressing ITCs or creativity trainings are still missing and that Kirkpatrick's evaluation model may serve as a basis for ITC evaluation (Kirkpatrick, 1979). Therefore, Kirkpatrick's model and Phillip's ROI level as well as Watkin's societal good level were utilized to develop an evaluation questionnaire (Kirkpatrick, 1979; Phillips & Phillips, 2005; Watkins et al., 1998).

4.4.1 Research Question

This follow-up study attempts to answer the research question of "How effective was the ITC?" The evaluation study comprises the four levels proposed by Kirkpatrick plus the additional societal good level (Kirkpatrick, 1979). For each level, there are surveys available online with ready to ask questions – a quantitative approach. However, if I had only focused on quantitative data, I would have missed subjective perspectives from the very diverse sample. Additionally, since ideation research has never been conducted with journeymen before, a more exploratory, open-ended design seemed adequate. Therefore, I aimed at collecting evaluation data that were both, quantitative and qualitative. The resulting data were analyzed separately. Quantitative data were

subjected to statistical analyses (see Quantitative Study section), qualitative data were analyzed by way of coding and categorization (see Qualitative Study section).

4.4.2 Quantitative Study

Questionnaire Design

The Kirkpatrick evaluation framework (Kirkpatrick, 1979) and the advancements introduced by others afterwards (Phillips & Phillips, 2005; Watkins et al., 1998) served as a basis for the evaluation questionnaire that was to collect feedback from the participating female and male journeymen (see Appendix III for the questionnaire).

On level 1 – reactions – participants were asked how they had liked the training and the way it was presented to them. On level 2 – learning – participants were to estimate their knowledge on ideation techniques and innovation. The third level – behavior – was assessed by asking participants whether they have applied knowledge on the job, applied ideation techniques or whether they would apply them if they needed new ideas. On level 4 – results – participants were asked to estimate results that stem from implementing ideas or from having applied one of the new ideation techniques. A couple of items had assessed direct effects from the ITC on productivity, quality of their work, sales numbers and so on. Similarly, participants were to estimate costs and benefits so that the Return on Investment (ROI) could be analyzed which is calculated by dividing the training costs from the obtained quantified results and multiplying them by 100.

The additional sixth level – societal good – contained open-ended questions yielding qualitative feedback data (which are analyzed in the next section).

Hypotheses

In the research stream on the Kirkpatrick evaluation framework scholars have often looked at the statistical correlations between the levels within the framework. Because the questionnaire was designed based on Kirkpatrick's evaluation framework (Kirkpatrick, 1979) and on the theoretical assumptions described in the previous sections, it was hypothesized that the answers to the questionnaire items would correspond with Kirkpatrick's four levels. Note, that ROI is conceptualized as part of the results level, here.

- H 1: Items question 1-5 load on one factor relating to Kirkpatrick's first level (reactions).

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- H 2: Items 6 and 7 load on one factor relating to Kirkpatrick's second level (learning).
- H 3: Items 8, and 9 load on one factor corresponding with Kirkpatrick's third level (behavior).
- H4: Items 10-17 load on one factor relating to Kirkpatrick's fourth level (results).

Note, that the primary goal of the follow-up questionnaire was to evaluate the ITC. Testing the aforementioned internal consistency of the Kirkpatrick framework was only a secondary goal that would relate to the research stream on Kirkpatrick's evaluation model.

Method

Of 217 participating female and male journeymen, about 200 had revealed their personal data and consented to being contacted later for a follow-up survey. From 2016 until 2017 – about one year after the trainings had been conducted – a link to the Google-hosted online survey was sent via email mostly, WhatsApp or Facebook. Two months later, the same participants were reminded of the questionnaire and kindly asked to respond.

Because some items of the questionnaire contained 3-point scales, whereas others applied a 5-point scale, the scales were transformed before the statistics were computed: 5-point Likert scales were transformed to 3-point scales so that each scale was anchored between -1 and 1.

Unfortunately, it was not clear whether respondents had partaken in the S-CJ version or the brainwriting version of the ITC and whether their group composition had been heterogeneous or homogeneous in terms of nationality, profession, age, and gender. Hence, there was no independent variable in the data set; the responding participants had to be treated as if they were one group, although in fact, they were from 16 different ITCs. That poses two problems: no general linear mixed model could be calculated, no statistical significance could be tested, resulting in very low explanatory power of this quantitative study.

Results

Overall, 50 participants had responded to the online questionnaire – resulting in a return rate of 25 % which can be considered a success in the crafts sector.

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The analyses were partly conducted with SPSS 24.0, partly with R/RStudio (RStudio Team, 2015).

Descriptive statistics from the 17 quantitative items are displayed in Table 17. The 5-point scales had been transformed to 3-point scales anchored between -1 and 1 so that they could be compared with each other.

Negative skewness values indicate that there were many high values like in for example “How did you like the facilitation style?” or in “Knowledge on ideation techniques”. Positive Kurtosis values indicate that the data points were distributed with more data in the tails and a strongly peaked distribution as in the same two questionnaire items.

The more skewness and kurtosis values differ from zero, the less likely the data points are normally distributed.

Table 17: Descriptive statistics of the 17 quantitative items from the evaluation questionnaire (see the questionnaire in Appendix III). Items were 3-point scales anchored between -1 and 1.

Shortened Item Text	Variables	N	Mean	SD	Skewness	Kurtosis
How did you like the training?	1	48	0.85	0.36	-1.94	1.82
How did you like the facilitation style?	2	48	0.83	0.52	-2.90	7.01
Usefulness of content	3	48	0.67	0.48	-0.69	-1.56
Participating was wisely invested time	4	48	0.69	0.51	-1.24	0.44
Recommend to colleagues	5	49	0.67	0.75	-1.77	1.15
Knowledge on innovation	6	49	0.66	0.28	-0.02	-0.80
Knowledge on ideation techniques	7	48	0.55	0.46	-2.08	5.08
Have applied techniques	8	47	0.19	0.61	-0.12	-0.57
Would apply techniques	9	48	0.56	0.77	-1.30	-0.06
Quality of work	10	45	0.06	0.60	-0.29	-0.79
Productivity	11	48	0.02	0.54	-0.08	-0.62
Quality of working life	12	48	0.01	0.61	-0.11	-0.82
Interpersonal relationships	13	48	0.20	0.63	-0.12	-1.12
Sales	14	46	-0.17	0.63	0.21	-0.85
Working morale	15	47	0.05	0.60	-0.20	-0.83
Satisfaction with my job	16	44	0.08	0.71	-0.13	-1.22
Optimistic look into the future	17	47	0.32	0.63	-0.72	-0.40

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To reduce complexity of the totality of 17 quantitative question items, a factor analysis using the R-package “factanal” in RStudio was run. This, by default, uses the maximum likelihood estimation.

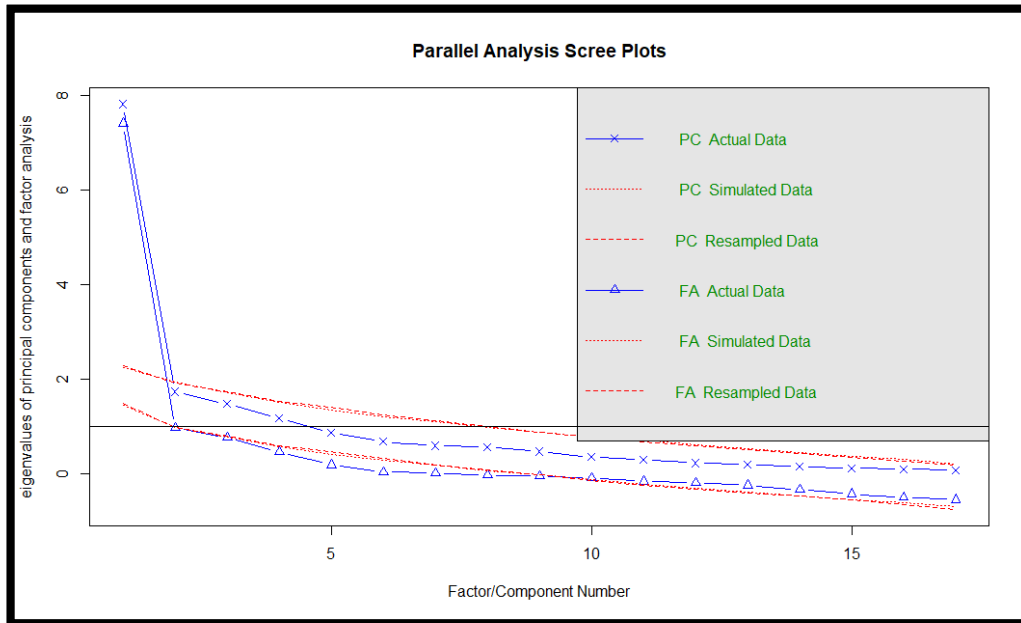


Figure 5: Parallel analysis scree plot from the 17 quantitative survey items, output from RStudio.

The scree plot (see Figure 5) suggests the extraction of two factors.

Factor analysis loadings are reported in Table 18, and to gain a better overview, are graphically displayed in Figure 6.

A couple of items – such as items 12, 13, 15, and 16 – load on both factors that were extracted, indicating that the factors are not entirely distinct from each other.

Table 18: Factor analysis – loadings from the 17 quantitative items from the follow-up study (see Appendix III), method: maximum likelihood estimation.

Shortened Item Text	Items	Factor1	Factor2
How did you like the training?	Q1	0.267	0.310
How did you like the facilitation style?	Q2		-0.248
Usefulness of content	Q3	0.744	-0.545
Participating was wisely invested time	Q4	0.683	0.172
Recommend to colleagues	Q5	0.675	
Knowledge on innovation	Q6	0.480	-0.219
Knowledge on ideation techniques	Q7		-0.432
Have applied techniques	Q8	0.628	
Would apply techniques	Q9	0.617	
Quality of work	Q10	0.912	0.222
Productivity	Q11	0.689	0.111
Quality of working life	Q12	0.847	0.359
Interpersonal relationships	Q13	0.684	0.372
Sales	Q14	0.758	0.281
Working morale	Q15	0.735	0.387
Satisfaction with my job	Q16	0.720	0.423
Optimistic look into the future	Q17	0.871	0.153

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Table 19: Loadings of the 17 questionnaire items on the two extracted factors in descending order.

Item Text	Item	Loadings on Factor1	Loadings on Factor2
Quality of work	Q10	0.912	0.222
Optimistic look into the future	Q17	0.871	0.153
Quality of working life	Q12	0.847	0.359
Sales	Q14	0.758	0.281
Usefulness of content	Q3	0.744	-0.545
Working morale	Q15	0.735	0.387
Satisfaction with my job	Q16	0.720	0.423
Productivity	Q11	0.689	0.111
Interpersonal relationships	Q13	0.684	0.372
Participating was wisely invested time	Q4	0.683	0.172
Recommend to colleagues	Q5	0.675	
Have applied techniques	Q8	0.628	
Would apply techniques	Q9	0.617	
Knowledge on innovation	Q6	0.480	-0.219
How did you like the training?	Q1	0.267	0.310
Knowledge on ideation techniques	Q7		-0.432
How did you like the facilitation style?	Q2		-0.248

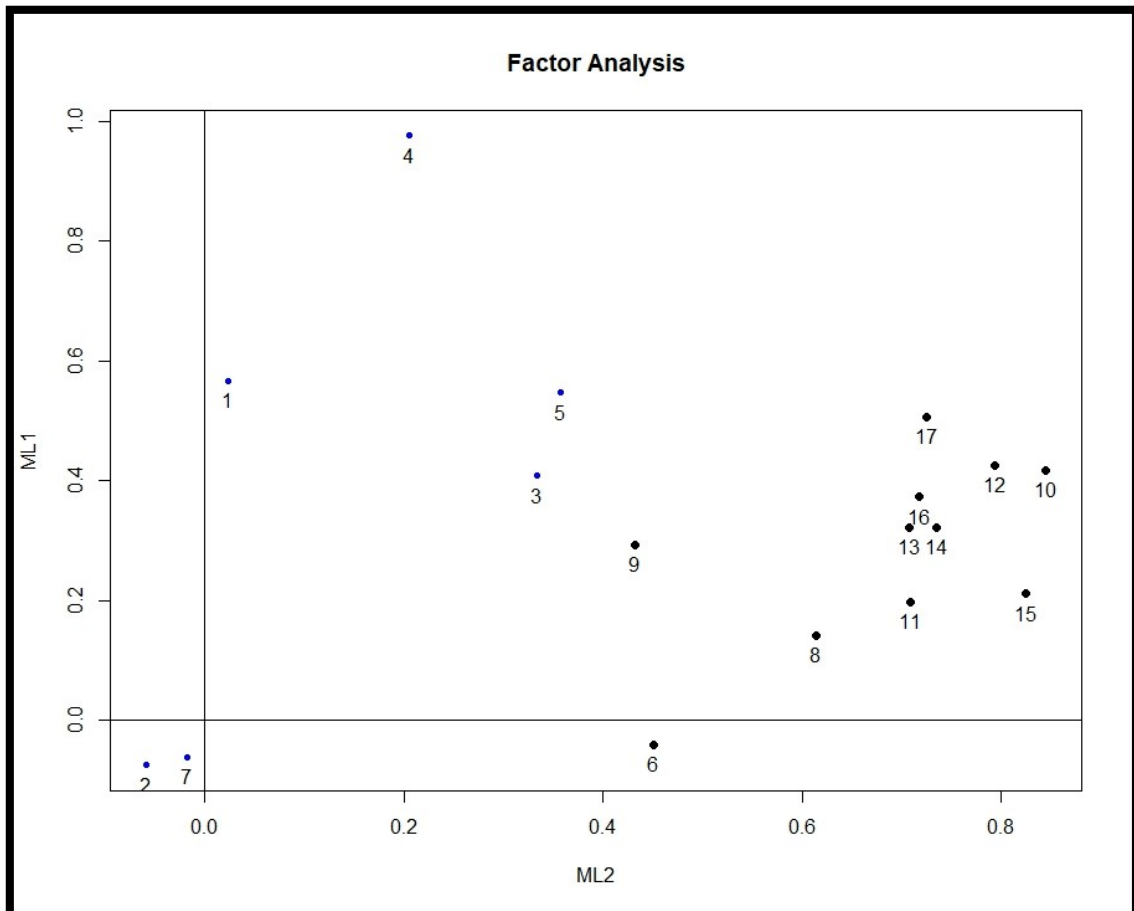


Figure 6: Factor analysis plot, varimax rotated, 17 items, two factors extracted, maximum likelihood estimation, RStudio Output.

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Based on the plot displayed in Figure 6, two different factors were grouped together:

Factor 1 – comprising items 6 (knowledge about innovation processes), and 8-17: 8 (have applied techniques), 9 (would apply techniques in the future), 10 (quality of work), 11 (productivity), 12 (quality of working life), 13 (interpersonal relationships), 14 (sales), 15 (working morale), 16 (satisfaction with job), and 17 (optimistic look into the future).

Factor 2 – covering items 1 (liking of training, 2 (liking of facilitation style), 3 (usefulness of content), 4 (participating was wisely invested time), 5 (recommend to colleagues), and 7 (knowledge about ideation techniques).

Hence, it can be concluded that participants' answers loaded on two factors, with the first factor being results-related and the second factor relating to the liking of training and usefulness of the obtained knowledge.

Hypotheses Testing

Regarding the four Kirkpatrick levels for evaluating training programs, there is only very little correspondence between the two factors extracted and the four levels (Kirkpatrick, 1979).

First of all, there are items that load on both factors, such as items 12, 13, 15, and 16. That indicates, that both factors are not entirely distinct from each other, and that there is little selectivity between the two.

H1, stating that items 1-5 would load together on one factor related to the reactions-level, is only partially supported. Only item 7 (knowledge about ideation techniques) was a level 2-related question and was not hypothesized to also load onto the reaction level.

H2, which stated that items "6" and "7" would jointly load on a factor related to Kirkpatrick's second level (learning), is thus rejected. Instead, items "6" and "7" are loading on two different factors.

Since items "6" and "8" through "17" are all loading onto the first factor, H3 – stating that items "8" and "9" would load on one factor corresponding with Kirkpatrick's third level (behavior) – is rejected.

Finally, H4 – assuming that items "10" to "17" would all load on one factor relating to Kirkpatrick's results level – is partially supported by the data. Items "10" through "17" do in fact load onto one common factor, but also do items "6" and "8"

Therefore, the quantitative data cover two main constructs, with a results-related construct on the one hand and a reactions-related construct on the other. Note, that four items loaded on both constructs, indicating less selectivity between the two factors.

Discussion

Due to a major flaw during data collection – I did not create biunique identifier codes – the explanatory power of the quantitative data analyses is very low. If these identifiers were created, a general linear mixed model with the treatments (S-CJ vs. brainwriting) and group composition (diverse vs. homogeneous) as group-level factors could have been calculated. That way, investigating how the treatment affected the follow-up evaluation data would have been possible. In an attempt to fix this, I had tried to manually identify the group IDs by way of analyzing the city where respondents had participated in the innovation training and their type of craft. However, there were many respondents who had taken part in the same city and were from the same craft, but the treatments that they had been assigned to could not be identified without risking a highly biased mismatch.

That said, the responses were treated as if stemming from one group that had worked under the same conditions, whereas in fact, they stemmed from 16 different groups under four different conditions. Therefore, the more specific research question, of how the S-CJ affected the evaluation data, cannot be answered. Only the general question of how the ITC had affected the evaluation data was addressed somewhat. How participants had reacted to the ITC (level 1), how useful they estimated the knowledge (level 2), whether they had applied the newly obtained knowledge (level 3) and finally, what results they had achieved because of the ITC (level 4) were explored. However, because I simply lacked independent variables, no statistical tests could be run, thus leaving the research question of how – statistically – the ITC affected the evaluative feedback unanswered.

Moreover, in line with Alliger and Janak's findings, there was little variance in the reaction levels (Alliger & Janak, 1989).

Secondly, the quantitative data from the Kirkpatrick model do not provide information on how to improve the ITC to increase its effectiveness as criticized by Bates before (Bates, 2004)

That is why the quantitative data were complemented by a qualitative data collection for gathering the participants' subjective perspectives on the ITC. The coding method and results stemming from the data analysis are reported in the next sections.

4.4.3 Qualitative Study

On top of the Likert scale items in the follow-up online questionnaire, the female and male journeymen were asked to answer 30 open-ended questions related to Kirkpatrick's evaluation levels (Kirkpatrick, 1979). These qualitative data also served to answer the research question of how participants evaluated the ITC (general research question).

Method

For the qualitative data an inductive method was applied. Prior to coding the answers, groups were created reflecting 14 different crafts. Then the answers to each question were extracted one by one and transferred into a word document.

Because the questionnaire had been designed along Kirkpatrick's evaluation model (Kirkpatrick, 1979), the answers were clustered according to the four levels plus the two additional levels "ROI" and "societal good" (Phillips & Phillips, 2005; Watkins et al., 1998).

The coding followed an inductive procedure within the given Kirkpatrick framework (Kirkpatrick, 1979). While scanning the answers for major constructs to be coded, the data were treated as if stemming from one ITC, although there had been four experimental conditions. At first, the main construct of each answer was identified to capture its sense. A distinction between answers that were positively evaluating the ITC and answers that offered perspectives on its shortcomings was made. When an answer neither praised nor criticized the ITC, it was coded as belonging to a third, neutral category.

After all phrases were coded, in a third step, the categories were clustered and sorted. The major categories were then labeled and further combined until a final structure of nine major categories had emerged. These could easily be related to one of Kirkpatrick's evaluation levels (Kirkpatrick, 1979), except for the "no effect" category.

Results

The totality of coding spreadsheets is attached in Appendix IV. Here, only the major categories and the subcategories are reported. Since the original questionnaire

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was designed along the Kirkpatrick evaluation framework (Kirkpatrick, 1979) plus the additional two levels, it came as no surprise that the coded data reflected this model.

Level 1 – reactions

There were two kinds of categories that were associated with the first Kirkpatrick level (Kirkpatrick, 1979). Those contained either (1) ITC related or (2) facilitator related comments.

ITC related

The remarks on the ITC referred to the (a) atmosphere, (b) the structure of the training, (c) the presentation style, and (d) the freedom in applying the tools.

a) Atmosphere

On level 1, participants expressed their reactions towards the ITC (Kirkpatrick, 1979). Mostly, they commented positively on the atmosphere, as being “relaxed”, “joyful”, “friendship like”, “fun”, “playful” and as “strengthening the group dynamics”. However, there was one participant who criticized the training to be “too childish in parts”.

b) Structure

Referring to the training course’s structure, there were two disapproving comments, which contradicted each other. One person expressed the wish to have smaller participant numbers whereas the other one wanted to have more participants in the ITC. This reflects the fact, that groups were not equally large, but varied from four to 30-person groups. The twelve approving comments referred to the ITC as running smoothly and straight for the preset goals, as being well structured, clear and precise but also that there was space for answering questions or for presenting ideas. People valued the feedback from others and expressed that they liked the training as it was not as dull as other trainings that they had participated in before.

c) Presentation

Comments on the presentation were entirely positive: it was said to be “good”, “very good”, and even to have “constantly drawn people’s attention so that it never got boring”. One participant pointed out that she/he had obtained new perspectives.

d) Freedom in applying the methods

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Interestingly, the female and male journeymen partly found it remarkable that they had been granted freedom in applying the methods and tools. There were five comments on how the ITC was only delivering the tools but the way that these were applied was left to the participants. This created the impression that this freedom to apply the newly obtained knowledge was somehow of high value to the female and male journeymen. This is worth further consideration.

Facilitator related

Facilitator related feedback is also part of the level 1 category (Kirkpatrick, 1979). Here, a few examples from this category are listed:

- Mrs. Gumula presents the topics in a special kind of way so that they become interesting!
- She pays close attention to the participants.” [This was stated by four different participants.]
- Spontaneity, humor, competency
- Mrs. Gumula’s endurance
- Her confident manner
- I became more curious minute after minute.

Not surprisingly, these comments were entirely positively connotated. This, however, cannot be due only to me being a great facilitator but rather due to the fact that respondents were very aware, that it would be me who was going to analyze the feedback data. It is very likely that this has influenced the way participants had answered.

Level 2 – learning

Linked to level 2 (Kirkpatrick, 1979), there were two sub categories that fit the learning level: (1) development of skills on the one hand, and (2) knowledge on the other.

Development of Skills

These comments cover some creativity related learnings (e.g. “to broaden my horizon”, “to look at things in a different way than other people who have been working here forever”, “to write down every idea and to sort out later”, “to be open-minded”, “feedback that I am creative” and “simplified thinking”).

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Others such as “to reflect their own profession”, “personal development”, “improving prospects”, and “I learned, that everything is a learning process and to never settle for less” refer to personal development topics not related to creativity or innovation.

Knowledge

There were seven comments indicating that people had not learned new knowledge, and eight comments indicating that people had learned new “facts”, “new tools for finding ideas”, had gotten new “input” or had “obtained methods on how to solve technical problems in a different way”.

Level 3 – Change of Attitudes and Behavior

There were two subcategories that fit the third Kirkpatrick level (Kirkpatrick, 1979): (1) “Change in Attitude towards others”, and (2) “Creativity and Innovation”

Change in Attitude towards others

This category is composed of three different subcategories referring to the change in (a) attitude towards others within the same craft, the change in (b) attitude towards others across crafts and change in (c) attitudes towards academia.

a) Attitude towards others within crafts

Whereas one person stated that competition was much stronger than she/he had expected beforehand and that there was close to no collaboration in her/his craft, most respondents answered in a neutral way, referring to no change of attitudes towards other female or male journeymen within the same craft. However, those who did report positive changes, made remarks deserving to be mentioned here:

- It has changed positively towards stronger cohesion.
- The sense of belonging has clearly grown.
- When approaching others, I am more open now and try to convince them.
- I must be different, but I must not be arrogant.
- A stronger commitment with my partners and to accept competitors.
- From what I have learned, I observe these things more objectively, now.
- I watch my competitors more closely, now.
- Everybody is individual. I wish, that everybody has the chance to develop freely.

b) Attitude towards others across crafts

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Some of the female or male journeymen who had taken part in the diverse conditions of group composition, commented on the ITC with colleagues from other crafts as follows:

- Attending a cross crafts training was new to me.
- To be able to exchange with other crafts.
- To have collaborated with other crafts without envying one another.
- Collaborating with others creates something new.

c) Attitude towards academia

Five participants indicated that they had positively changed their attitude towards scientists and academia:

- Positively, I would attend another training like that.
- Definitely, science in general is very important, and I want to keep working on that.
- Yes, positively.
- Extremely.

The following comment I could not make sense of in the light of attitude towards academia but found inspiring:

The human heart functions like an electronic sender. If you have endured tragedies like I have, and have transcended it without blaming others or circumstances, and have stayed in love, you delete your ego. You free yourself from old conditioned action patterns. You reach a higher level of conscience, you gain deep insight: remain in the moment. German language, precise language.

Creativity and Innovation

Furthermore, level 3 comprised categories related to (a) creativity, to (b) different perspectives and to (c) freewheeling.

a) Creativity

The creativity category comprised comments in which people indicated what they had obtained from the ITC and planned of applying in the future, such as:

- Search for different ways, without giving up, perseverance.
- Thinking more creatively.
- Intuition, arts thinking, to create something new.
- I learned how to produce ideas, as an individual or as part of a group.
- Semantic jumps.
- Higher creativity.
- More efficient idea finding.

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- Creativity has been applied in the working process due to the training!!!

b) Different Perspectives

Closely related to creativity is the applying of different perspectives:

- To watch things from different perspectives.
- I have been shown different perspectives, I liked that.
- Change of perspectives, creating own ideas.
- Small ideas from individuals can grow together to a great idea.
- Observe things from different angles.

c) Freewheeling

The freewheeling category contains comments on letting thoughts run free. It is closely related to Osborn's brainstorming rule of freewheeling (Osborn, 1979):

- Let thoughts run free.
- There is no wrongdoing.
- Free your mind.
- To go different ways, and explicitly not the ones that you have walked before.
- To give your own ideas some space.
- To contemplate problems more intensively.
- Value every idea, this is a credo that one should apply in daily business, to become more productive.
- Nothing is impossible.
- There is no such thing as can't be done.
- To express proposals even when they sound awkward.

Level 4 – Results

The primary outcome of the ITC were ideas. Therefore, the open-ended questions concerning Kirkpatrick's fourth level (results) mostly focused on ideas and outcome resulting from applying the newly obtained knowledge (Kirkpatrick, 1979).

Implementing Ideas and Applying Knowledge

Because there were two ideation tasks (advertising task and problem-solving task), respondents concentrated on either type of ideas.

a) Advertising Ideas

There were many comments that related to the advertising ideas. Overall, participants valued the creation of advertisements:

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- There were good ideas on how to do advertising.
- Positive mission statement
- A sound appearance in public.
- The right representation of the own business.
- Marketing, representation
- To think outside of the box, even when creating commercials
- Successful implementation, to sell well, what's truly important about advertisement and what to do.
- I'd best know who my customers are, what they expect and how to reach them
- Cost savings through self-developed advertising
- How to attract other colleagues' or the customers' attention.
- I have applied some of the tools for my business's representation, how do I present myself, how do I implement ideas, controlling.
- From the little of knowledge that I remember, I have applied as much as possible to attract customers.
- I was able to realize some ideas: create advertisements by simple means.
- How to create advertising that will reach my clients.
- Advertisement in the shop
- For my subsidiary occupation as a musician, I changed my online profile and such.
- For advertising
- We have created a little campaign.
- Have developed advertisement to attract students from the school next door.
- Company logo
- I wasn't aware how a company representation is affecting the potential customers' impression.

b) Application of Knowledge

There were five criticizing comments on how the knowledge of the ITC could not be applied in practice:

- Lacking practical relevance
- It is not always that easy to be creative, often, practicability can only be assessed afterwards; to not be distracted by external influences, to be barking up the wrong tree with one's innovation
- Ideation techniques do not apply in my job
- I could not apply it, because I am not freelancing, yet.
- For my profession, it was not applicable [road construction business].

On the other hand, there were also positive comments about the application of knowledge stemming from the ITC:

- To put heart into work
- To combine the existing with something new
- To work concentratedly on the own business and on implementation
- To write down ideas

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- You see the business through different eyes, now that you think differently
- It has unlocked some potential
- you are trying everything so that the employees stay satisfied and productive:
- yes, I have kept thinking about what to improve so that people feel better and more comfortable in the company
- I have given up stereotyped thinking!!!
- I'm acting more trustful and less controlling, that way, I stay balanced with myself and my environment, without having too high expectations, because high expectations already inherit disappointment.
- To pursue every idea and to see whether it can help the business
- Ideas for improving workflow
- Maybe applied a little
- For writing offers to customers!!!
- For the construction of a workshop
- A covered terrace on concrete columns
- For bathroom design
- For production optimizing
- For my hobby
- At home for my children
- Family life and free time
- My personal attitude!
- I'm in flow.

c) Implementing Ideas

Concerning the implementation of ideas that were produced during the ITC, 19 female or male journeymen answered that they had not implemented any idea, yet. Note, that these follow-up data were collected at least one year after the journeymen had participated in the ITC. One year might have been sufficient enough to implement ideas. The fact, that so many participants did not implement ideas poses the question of what kept the ideas from being realized. One person stated that the ITC came too early for her/him.

However, there were journeymen who have implemented ideas or were realizing ideas at the moment:

- Idea for a bathroom, functionality of the whole room
- Creative work: to set a meeting and to consider new ideas
- I am preparing my freelancing right now and I am going to implement ideas, then.
- The road of ideas
- I was able to implement all the ideas that I had, except for the car-idea, because I have to take some more exams.
- Productivity and ergonomics
- Collecting strengths and weaknesses
- To implement ideation techniques in everyday life
- It was so much fun, I might make a living with that someday.

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- To create ideas, that are different from others
- I implement ideas in every respect.

d) Would Implement

Only a few people answered the question if there were ideas that they would like to implement. Eight people stated that there were no such ideas; only five comments were made about ideas worth realizing:

- For example, to adapt proven principles
- Easier measuring
- Family-friendly show house park
- Show house park with a large playground
- Light transmitting concrete, or 3D floors

e) Reasons for not Implementing

Reasons for not implementing ideas ranged from the lack of money or lack of time over lack of collaborators, and others.

- No time and no collaborators
- No time
- Time and money
- Money, collaborators, time
- Lack of money
- Money
- No interest, not worth it
- Car marketing, because I still have to take exams
- The circumstances
- Not implementable in my environment
- No team work, people did not get that teams work better together
- I was not in the position to change anything
- The boss did not approve
- No possibilities
- I haven't pursued the idea, yet.
- No need
- Bureaucracy
- I am not employed
- Unfortunately, I am not back with the company, yet.

Level 5 – Return on Investment

The female and male journeymen were asked to estimate their costs for participating and also their profits and savings from the ITC. With that, the return on investment (ROI) was to be calculated (Phillips & Phillips, 2005).

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The costs for participating the ITC were seemingly easy to estimate, as the standard deviation is rather small (Mean = 209,10 Euros, SD = 130,77 Euros) indicating that the values were not scattered. However, when looking at the answers of the “estimate your savings” question, it became quite clear, that it was almost impossible to estimate the life spanning savings resulting from the ITC (M = 125,243.75 Euros, SD = 148,588.75 Euros). The SD exceeded the mean values showing how much the data points were scattered. Additionally, some people clearly stated that it was not possible to make that estimation.

Therefore, although ROI could have been calculated from that, that attempt was stopped, because the results would not add any serious insight to the evaluation of the ITC.

Level 6 – Societal Good

Following Watkins and colleagues’ recommendation, more than direct economic results were considered (Watkins et al., 1998). At the time of the follow-up study, the idea of conquering the shortage of skilled labor in the crafts sector by training and integrating refugees in crafts had come up. The shortage of skilled labor has been one of the most cited problems during the problem-identification stage in the ITC (see Chapter 3). Hence, two questions on that refugee integration in crafts idea investigated whether participants treated ideas – such as this society related idea – as a potential innovation that our whole society but also the crafts sector could benefit from.

How do you like the idea?

The first question asked, if participants had heard of that idea and how they liked it. The second question addressed the implementation of that idea. Eight female or male journeymen expressed their disapproval of the idea, compared to 22 positive comments on it:

a) Do not like the idea

- Useless, because qualifications AND attitude towards life are too different
- To be honest, I don’t like the idea, as it would diminish the overall value of the crafts sector and that would affect all female or male journeymen of that craft
- Yes, I’ve heard about that idea. I only like the idea of educating refugees in skilled crafts; experiences with other migrants (not refugees) show huge

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negative differences in quality and knowledge, that would set the construction progress back.

- Yes, I did, but I don't prefer that idea. If they supported our children and youth, there would be no shortage of skilled labor, our youth would be much more motivated. Instead, refugees are praised to the skies, and our youth lacks vigor, because they are not thanked like the refugees are...
- Refugees accomplish something, and the newspapers will report on that. Our apprentices accomplish something, there is no appreciation. That is why, with this topic, I disapprove.
- Absolute nonsense. So many young adults don't get into an apprenticeship because of bad grades. I think, this is where the crafts sector and the government should offer help. Because, if a person with a bad diploma cannot be trained, how shall a person who doesn't even speak our language and hasn't been trained in the German school system be trained? I have experienced that these people don't render the quality and service that the German crafts sector sorely needs, because of their mentality and attitude towards life.
- Yes, because of different education standards, different ways and tools for production, different ways of construction, you cannot call them "Fachkraft" [skilled worker]. Without adjusting the vocational training and advanced training, you cannot solve the shortage of skilled labor problem by integrating refugees into crafts.
- I assume there will only be a few businesses that will undertake this task because of the often differing mentality and attitude.

b) Somewhat dislike and somewhat like the idea

- Partly, I like the idea, partly I don't. Those, who are willing to work, shall come, the others may stay away.
- When I heard about that, I imagined the implementation to be very tough: language barriers, different knowledge levels. It will not be as easy as portrayed in the media but takes a long process of integration.
- For humanitarian purposes, that would be nice. In practice, it will only be successful in some cases. It is worth a try.
- I like the idea, if we can find immigrants who really want to work as journeymen. I don't like the idea, because the shortage of skilled labor might cause wages to go up which is desperately needed in the crafts sector.
- I think it to be barely implementable, at least concerning the shortage of skilled labor. On the other hand, I think it's important to integrate refugees into the German labor market.
- I like the idea. However, one should keep in mind, that in Germany there are many unemployed people who would like to work.

c) Like the idea

Three people indicated that they had not heard of the idea, yet. One of them stated, that she/he sees the idea as "a chance for the crafts sector. There are huge problems in finding apprentices; it would be 'dumb' not to try."

Overall, 22 positive remarks were made:

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- We are going to have less and less skilled journeymen, that's why I like the idea very much. Desirable for the future of Germany!!!
- I think this is a great idea. I am working with two refugees at the moment, who are my subordinates. Both are super nice and friendly.
- I have heard of it and I think it's good to integrate refugees in a different country.
- Yes, I've heard about it. The idea is good. I have worked with refugees myself, very good people! But, wages are held down, because these people earn less than apprentices for example. Most bosses make profit out of refugees. And you must not forget: where they have fled from, a craftsman is worth more than they are being paid here.
- I've heard of it and I approve.
- Good
- When an old system doesn't work anymore, ideas are always welcome, so that the system can rebalance itself. A new model replaces the old obsolete one.
- The idea is good, meaning change. The "how" is important.
- People, who really want to work and are prepared. In general, the SME [small and medium sized enterprises] and its image should be paid more attention, so that our youth would turn to the crafts sector, again.
- A good idea, and necessary from an economic point of view
- There are natural laws which energetically and physically explain the impact and its cause.
- Yes, I've heard of that technique and I am a big friend of that idea, because in my company, we – also suffering from shortage of labor – are discussing it with a few refugees. Unfortunately, their German skills are not as good, but both are working on it to finally start the apprenticeship.
- I have heard of it and I think, if you get the top candidates that stand out of the crowd, it can be very good.
- The idea is great, but only after people have learned the language, in order to avoid misunderstandings.
- Yes, I have heard about it. It's a good idea to create opportunities for them to learn something new. But doing it because of the shortage of skilled labor is not a good idea. For most crafts professions you need at least lower secondary school qualification. Probably, refugees at the age of apprentices have this kind of qualification, depending on their country of origin.
- Yes, I've heard about that idea and I like it.
- Of course, I have heard of it, you hear and read it everywhere in the media. We train young people who are eager to learn, no matter the migrant background.

How to implement it?

There were two negative comments on the implementation of the refugees in crafts ideas that were caused by a negative attitude towards the idea itself. "February 30th falls onto a Sunday...", "I don't want to comment on that".

The majority of participants, however, listed different steps of implementing the idea. That indicates that participants did treat the idea in a productive way and regarded

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it as a possible mechanism for conquering the shortage of skilled labor in the crafts sector.

Overall, 28 proposals were made on (a) politics, (b) language courses, (c) change of attitudes towards refugees, (d) refugees' adaption to the German crafts sector, (e) media representation, (f) others.

a) Politics

- We need political change.
- Motivate school graduates to learn a crafts profession by valuing more the German crafts in politics and in public.
- Cooperation between public offices needs to be simplified!!!
- Oh, that takes a lot of innovation trainings for people who create laws to realize that it's not just about words written on paper but that it's about people.
- Make wages binding, even when small firms are going to die.

b) Language Courses

- German courses for the different crafts professions that can be attended in parallel to the apprenticeship; to employ teachers/mentors who mediate and who counsel both sides about the countries' peculiarities and who moderate conflicts that arise because of undetected misunderstandings.
- Integration, language courses, investments in education and research/arts, resolving strict dogmas, awareness coaching, seminars, naturopathy.
- Integration, language courses, internships, resolving stereotypes against religion
- German lessons should not be cancelled as often as done right now.
- A lot of teaching German, people should get used to the high quality of work and be appropriately trained.
- We might need internships, language courses and assessments to investigate the fit between employee and employer.
- It takes more investment in teaching the language, and it takes more courage of businesses to hire the refugees.
- We need decent integration, German language courses for mutual understanding. The attitude of companies needs to change. Many of them are politically from the right wing or strongly conservative. They won't accept migrants. That's the main problem.
- It takes language skills and the readiness to adapt to the German way of working.
- The refugees need to learn our language and must be eager to get the job.

c) Change of Attitudes towards Refugees

- The attitude that people have towards refugees must change.
- At first, refugees should be accepted, and humanity must be highlighted. These are people, who want to make a living, not people who waste taxpayers' money. Refugees flee for a reason, they just cannot go back home.
- It takes a little more understanding and more flexibility! Time and rest!

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- Reduction of prejudices against religion.

d) Refugees' Adapting to the German Crafts Sector

- A basal introductory course for adjusting the standards, or a new training program.
- The refugees need to adjust to the German standards in the crafts sector.
- To create centers in which the refugees' skills and talents can be tested (independent from language barriers).

e) Media Representation

- Press should report more positively and should highlight the importance of the apprenticeship and the employment of refugees!!! Germany is a country of skilled labor, which is extremely important to maintain.
- You must invest some money on advertisement: e.g., posters, signs, car advertisements.

f) Others

- Investment in new models, termination of old structures, gentle transition into a new model, to avoid resistance, because pressure always causes counterpressure.
- An argument starts where knowledge ends.

Discussion

Open-ended questions had been added to the follow-up survey to provide space for the respondents to comment subjectively on the different evaluation levels (four levels based on Kirkpatrick (Kirkpatrick, 1979), fifth level based on Phillip's ROI (Phillips & Phillips, 2005), plus the societal good level (Watkins et al., 1998). After analyzing the qualitative data, partly surprising insights were obtained.

First of all, the questions on whether participants had liked the training, the presentation style, and the facilitator, made the ITC seem very positive. The female and male journeymen appreciated its playful, jovial and relaxing nature. One person, however, found it to be too childish in parts.

One of the most important findings of this section was that the journeymen had liked the freedom in applying the methods. It poses the question of why that was remarkable to the female and male journeymen. Is it because it was different from how they are usually trained in their master programs? In any case, granting more freedom when applying methods and having participants create their own learning experience might be a way to proceed in training innovation and creativity in the crafts sector.

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Since respondents were well aware that it would be me who was going to analyze the feedback, the answers towards how they had liked the style of facilitation might have been especially positive, rendering these answers less valid.

Secondly, half of respondents had obtained knowledge from the ITC that they could recall one year after training, the other half of respondents did not remember anything.

Furthermore, the journeymen commented on how their attitude towards others had changed since participating in the ITC: towards colleagues from the same craft, they stated “to be different than others but not to be arrogant”. They had liked the possibility to work across crafts in the ITC. Note, that these answers only applied to those who had taken part in a heterogeneous group composition. Regarding academia, some people stated that they had extremely changed their attitude towards research and scientists, one person stating that she/he wanted to proceed in that direction.

Another behavior-related category – creativity – comprised of comments on how they see things differently now, to go ways that they have not yet gone before, to be interested in intuition and arts thinking.

On the results level, before analyzing the qualitative data, I had kept reporting that none of the participants in my ITC had implemented any idea, yet. However, results indicate that there were indeed ideas (especially advertisement related) that have been realized. For example, cost savings were attained through self-developed advertisements, little campaigns or changes of online representations. It adds to the value of the ITC as it seems as if ideas that were developed there have – in part – been applied in practice. Furthermore, journeymen listed ideas that they would implement if possible, such as a bathroom idea, or a family friendly show house park. Concerning the reasons why ideas have not been implemented, yet, participants’ answers paint a rather clear picture: lacking time, lacking money, lacking support were the three most often stated answers to that question.

Thirdly, because ROI was suggested as a fifth level of evaluation (Phillips & Phillips, 2005), I had planned on calculating the ROI. However, it was impossible to genuinely estimate all the savings or profits that resulted from the ITC in a lifelong timespan (highly dispersed estimations). Therefore, I chose not to calculate ROI.

Finally, the answers to the societal good questions were quite remarkable. I had asked participants if they had heard of the idea to train people who had fled from their home country in craft professions and how they liked that idea.

The negative comments about refugees grabbed my attention. Taking a closer look at their answers showed that people who were negative about the idea were mostly not speaking of their own experiences. Rather they were speaking of their experience with other migrants (not refugees) or simply had not had any experience with refugees before. On the other hand, those people who reported on their own firsthand experience with refugees, were entirely positive about the idea. Thus, it seems as if the female and male journeymen are cautious about integrating refugees when they have not yet worked with them. That poses the question of how such experiences with refugees can be created to lower prejudiced, stereotypical thinking or anxiety.

Concerning what needs to be done in order to implement that idea, the journeymen called for a change of the German society rather than an adaption of the refugees to the German society. That was remarkable. In fact, there were more comments on how the German people should improve its attitude towards refugees than the other way around.

4.5 General Discussion

To evaluate the ITC, a mixed methods approach was applied. A quantitative and a qualitative study complemented each other.

All data were treated as if stemming from one group, where in fact, respondents came from 16 different groups, participating in a 2-by-2 factorial quasi-experimental research design. Due to the major mistake of not creating a biunique identification code, the four experimental conditions under which respondents had partaken in the ITC are not considered in the analyses. Hence, the results obtained from the follow-up questionnaire are only of limited validity.

Respondents' quantitative data were subjected to a factor analysis with maximum likelihood estimation. Scree plots suggested the extraction of two factors to be sufficient, although all four levels from Kirkpatrick's evaluation framework had been considered during development of the questionnaire (Kirkpatrick, 1979). However, no four factors were extracted, but only two – comprising the question items related to level 1 and those related to level 4. It seems that level 2 (learning) is not distinguishable from level 1 (reactions) or level 4 (results) in my dataset. The same applies to level 3 (behavior) – it cannot be clearly discriminated from Level 4 (results). Instead, in this

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dataset, the questions related to the behavior level are part of the same factor comprising the result items.

The qualitative data were coded and categorized. They reflected Kirkpatrick's four levels (Kirkpatrick, 1979). Most important insight stemming from the analysis is the fact, that people have implemented ideas – mostly advertisement ideas – that had resulted from the ITC. So, the ITC has taken effect during the one year between the ITC and the follow-up.

All data reported in this chapter stemmed from a self-developed follow-up questionnaire resulting in self-reported feedback data. This rather subjective source of data was to be complemented by a more objective evaluation of the ideas that were developed during the ITC and of videos that were recorded during the trainings. This more objective study is reported in the next chapter.

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V. CHAPTER 5

MAXIMIZING CREATIVITY PERFORMANCE: HOW SEMANTIC-COGNITIVE JUMPING ENHANCES IDEA ORIGINALITY⁴

5.1 Introduction

Innovation—the generation, acceptance, and implementation of ideas, products, processes, or services (Thompson, 1965)—is at the core of today’s business world. Innovation comprises the development of ideas (known as ideation, sometimes referred to as creativity) and their implementation (Anderson et al., 2004; Anderson et al., 2014; Nijstad, 2015). Creativity and innovation yield competitive advantages (Anderson et al., 2004; Hender et al., 2002). Finding lucrative market opportunities requires looking for and generating creative ideas and solutions (Carmeli & Paulus, 2015).

Creativity is a construct not easily defined. Personality traits, abilities, and individual genius are influencing factors on what is coined the “person” level. External factors like situational, and process factors like social interaction, affect creativity at the “press” level—and lay the groundwork for the social psychology of creativity (Amabile, 1983). On the “product” level, the output of creativity is examined; on the “process” level, the development of creative output is studied. Person, press, product, and process go back to Rhodes’s alliteration of different creativity categories (Rhodes, 1961; Runco, 2004).

The standard definition of creativity is the development of ideas that are original and effective (Runco & Jaeger, 2012). Effectiveness takes various forms. It may be labeled as usefulness, fit, or appropriateness (Runco & Jaeger, 2012). The result of creative thinking—ideas—should be (1) novel and unusual (Runco & Jaeger, 2012), (2) useful and appropriate (Runco & Jaeger, 2012), should apply to the problem at hand (Dean, Hender, Rodgers, & Santanen, 2006), and be implementable (Diehl & Stroebe, 1987). High quality ideas are both, original and feasible (Rietzschel, 2005). Since these two dimensions of idea quality are negatively correlated (Nijstad et al., 2010; Rietzschel, 2005)—the more feasible an idea, the less original—innovation frameworks like Design Thinking (DT) must balance between the two. That is why innovation frameworks comprise two stages: a divergent and a convergent thinking stage, the divergent thinking

⁴ This paper has been co-authored by Margarete Boos and was submitted.

stage to create as many novel and unusual ideas to a given ideation task and the convergent stage to select and further enhance ideas towards effective solutions (Gumula, submitted). Both originality and feasibility are enhanced by utilizing the heterogeneity of teams and their diverse perspectives, thinking styles, and knowledge (Lewrick et al., 2017).

The DT framework serves the purpose of identifying novel market needs and developing relevant products that satisfy them (Zampollo & Peacock, 2016). DT is an iterative process: (1) understand task/market, (2) observe consumer behavior, (3) define the point of view—which client has which need based on which insights, (4) ideate, (5) prototype, and (6) test (Lewrick et al., 2017). The focus on customer feedback and iteration between generating, prototyping, and testing assure high usefulness, serving the feasibility dimension of ideas. The originality dimension—the most important creativity metric (Runco & Jaeger, 2012)—is established during the DT ideation stage. A large variety of ideation techniques exists: Osborn’s classical rules for brainstorming (Osborn, 1979)—still recommended for DT (Lewrick et al., 2017) over brainwriting, to newer approaches like electronical brainstorming (Rietzschel, Nijstad, & Stroebe, 2010) or collaborative sketching (Shah et al., 2001).

This study focuses on a new category of ideation methods: Semantic-Cognitive Jumping (S-CJ). S-CJ comprises known ideation techniques—design-by-analogy (Mak & Shu, 2008), adapt-a-role, reverse-technique, and exaggeration-technique (Gautam, 2001)—that have one aspect in common: they enable innovators to activate knowledge that is semantically unrelated to the ideation task. S-CJ provides a conscious stimulation of unrelated knowledge that would not be automatically activated by the ideation task.

In order to answer our research question—whether S-CJ can yield better ideas in DT ideation as compared to traditional brainwriting—we applied two known models of creative cognition, namely spreading-activation (Collins & Loftus, 1975) and the cognitive network model of creativity (Santanen et al., 2014). Based on both models, we derived that S-CJ would lead to ideas of higher originality in group ideation and tested our hypotheses in a quasi-experimental research design. How S-CJ compared to brainwriting affected creativity performance was tested under differing practitioner group composition conditions (homogeneous versus heterogeneous).

The paper is structured as follows: an introduction into innovation frameworks is followed by a summary of research on techniques for idea generation. The theoretical models and S-CJ are introduced before hypotheses are derived. The results of the 2-by-2

quasi-experiments are displayed and discussed afterwards. A conclusion and implications for practical application are provided at the end.

5.1.1 Innovation and Design Thinking

Innovation comprises the creation and application of ideas for services or products new to the organization (Wong, Tjosvold, & Liu, 2009) and is strongly linked to change, either due to changing environments or to change the environment (Damanpour, 1991). Baregheh, Rowley and Sambrook (2009) reviewed how organizational innovation was defined within various academic disciplines by means of content analysis. They concluded that innovation is the multi-stage process of generating and transforming ideas into new/improved products, services, or processes, in order to advance, compete and differentiate themselves successfully in their marketplace (Baregheh et al., 2009).

Processes leading to these innovations have been modeled as either (1) linear stage-gate sequences, or as (2) cyclical, disjunctive iterations (Anderson et al., 2004); back-tracking and overlapping of stages are likely to confirm the norm not the exception (King, 1992). The DT framework matches the second—the cyclical, iterative concept. In DT, creation and testing alternate between exploring the problem space, focusing on the customer, visualization, ideation, and rapid prototyping in preferably diverse groups (Carlgren, Rauth, & Elmquist, 2016). Given the vast amount of ideation techniques, deciding which technique to apply in the ideation-stage is a major challenge for DT-facilitators and innovation managers. If they knew which techniques best increase creativity performance, they could make more informed choices.

5.1.2 Research Gaps

This study is unique in terms of the ideation tasks that participants were to solve. Usually scholars present fixed problem tasks like “Improve the university” (Baruah & Paulus, 2008; Coskun, 2005; Goldenberg et al., 2013; Kohn, Paulus, & Choi, 2011; Kohn & Smith, 2011; Larey & Paulus, 1999; Paulus et al., 2013; Paulus & Dzindolet, 1993; Putman & Paulus, 2009) or “Improve the university’s parking problem” (Aiken, Rebman, & Vanjani, 2007; Barki & Pinsonneault, 2001; Connolly, Jessup, & Valacich, 1990; Jung et al., 2007; Satzinger, Garfield, & Nagasundaram, 1999). Other researchers have their participants design products, such as a Swiss Army Knife (Jaco et al., 2014; Schmitt, Buisine, Chaboissier, Aoussat, & Vernier, 2012).

A more standardized ideation task is the Alternative Uses Task (AUT) in which participants come up with alternative uses of common objects like tires (Acar & Runco, 2014, 2015; Opezzo & Schwartz, 2014) or paper clips (Paulus & Yang, 2000).

As our research was conducted with professionals, we chose two ideation tasks that benefited the participants and their future businesses. We asked them to create advertising for their business (Goldenberg et al., 1999b), and in a second task, to identify problems that they themselves or their future clients might have. These self-identified problems they subsequently solved.

The second research gap evolved from a systematic literature review on ideation techniques affecting creativity performance of individuals or groups (Gumula, in preparation). From 405 papers identified, 132 were experimental or quasi-experimental, 118 of them had been conducted with university students, undergraduate and graduate, from psychology (N=36), engineering (N = 12), business (N = 16) or other disciplines. There was only one study that explicitly avoided psychology students because of their knowledge on group processes (Sassenberg, Moskowitz, Fetterman, & Kessler, 2017).

If conducted with professionals, these participants were mostly from a design background (N=9) or worked in lower through upper middle management (N=3). No study of ideation techniques was done with small and medium-sized enterprises (SMEs). There was one study conducted by Gielnik and his colleagues (2012) who had interviewed small business owners in Uganda but had not manipulated the ideation technique for the business model ideation task but had only manipulated the amount of information that was accessible to the interviewees (Gielnik, Frese, Graf, & Kampschulte, 2012).

In conclusion, to the best of our knowledge, no study of ideation techniques has yet been conducted with a sample of non-academically trained future entrepreneurs such as the master craftswomen and master craftsmen. We consider this a critical research gap, as SMEs have comparatively far less resources for innovation than larger firms yet face ever increasing challenges due to globalized business chains, worldwide competition, and consequent pressure to innovate. We fill this research gap by explicitly cooperating with German trade guilds and by conducting innovation trainings for female and male journeymen in Germany.

5.2 Theoretical Framework

Because ideation techniques are replicable, they allow for standardization and expansion throughout and between organizations. Each technique claims to be an effective tool for creating original and useful ideas, such as brainstorming (Osborn, 1979), C-Sketch (Shah et al., 2001), and TRIZ—a Russian acronym for theory of inventive problem solving (Altshuller & Shapiro, 1956), to name a few.

Brainstorming remains the most widely used group ideation technique and most classical creative problem solving method (Jaco et al., 2014), although a large body of research has shown its weaknesses when conducted in interactive groups as compared to nominal groups (Diehl & Stroebe, 1987; Lamm & Trommsdorff, 1973; Mullen et al., 1991; Paulus & Yang, 2000; Rietzschel, 2005; Stroebe, Nijstad, & Rietzschel, 2010). Exceptions to this general finding are interactive groups moderated by highly trained facilitators (Oxley, Dzindolet, & Paulus, 1996).

To overcome brainstorming deficiencies, such as production blocking, evaluation apprehension, and social loafing/free riding (Diehl & Stroebe, 1987; Herrmann & Felfe, 2014; Nijstad, Diehl et al., 2003; Nijstad & Stroebe, 2006; Santanen et al., 2014; Shih, 2011), brainwriting was introduced as a form of brainstorming based on written communication (Coskun, 2011; Heslin, 2009; Paulus & Yang, 2000). Production blocking is reduced, and when done using “635”-technique, social loafing is also reduced due to forced turn-taking.

5.2.1 S-CJ as Ideation Technique

In humans, knowledge is organized as a network of interrelated concepts stored in long-term-memory. The result is a rich and highly interconnected network that encompasses the totality of our knowledge and experience (Santanen et al., 2014). The strength of interrelations varies; some concepts are strongly interlinked, like window, glass, and house, or football, soccer field, and referee.

As an ideation technique, S-CJ activates such concepts that are semantically unrelated to the ideation task. Whereas associative chaining, as done in brainwriting, progresses directly from the ideation task to solutions, S-CJ performs memory retrieval from concepts that have no or only little associations with the task. Participants are asked to skip ideas that come to their minds directly. Since innovators come up with these poorly related concepts themselves, S-CJ is a way of self-stimulating the cognitive

ideation process. For example, imagine an innovator applying the design-by-analogy technique. He/she deliberately interrupts his/her retrieval of possible solutions from his/her memory and searches for analogies instead, which causes a semantic-cognitive jump from the ideation task to an analogous situation. For example, instead of searching for a new machine that can handle multiple forms of objects at the same time, one could ask: what kind of animal handles all different kinds of object forms? Possible answer: an elephant. This S-CJ transfers the principle of an elephant's trunk to a machine construction task, leading to a biomimetic design of an elephant's trunk machine.

5.2.2 Cognitive Network Model of Creativity and Spreading-Activation Network Theory

There are two cognitive models of the creative process that support the hypothesis of higher potential effectivity of the S-CJ technique: The Spreading-Activation Theory of Semantic Processing by Collins and Loftus (1975) and the Cognitive Network Model of Creativity (CNM) by Santanen and colleagues (2014). How knowledge is organized in the human mind is illustrated as a network of interrelated bundles. Santanen (2014, p. 175) refers to these bundles which form nodes of the semantic network as frames, whereas Collins and Loftus (1975) call them concepts. For example, the items outdoors, eating, cloth, basket, and sunshine can be bundled into a frame (or concept) called picnic (Santanen et al., 2014, p. 175).

According to the Collins and Loftus theory, a conceptual semantic network is organized along the lines of semantic similarity. Semantically similar concepts are strongly related. The strength of the link depends on how often this connection is traversed in thinking (Collins & Loftus, 1975). The more properties two concepts have in common, the more links exist between the two via these properties and the more related the concepts. Different vehicles (bus, car, truck) are highly interlinked through their common properties; the same applies for sunsets, sunrises and clouds, although both networks are only weakly, i.e., singularly related through the color red (Collins & Loftus, 1975, p. 412). This also implies that red things (e.g., fire, engines, cherries, sunsets, and roses) are not closely interlinked, despite the one property—their color—they have in common. In these terms, semantic relatedness is based on an aggregate of the interconnections between two concepts (Collins & Loftus, 1975, pp. 411–413). Semantic distance is the distance along the shortest path, semantic relatedness (or similarity) is an aggregate of all the paths (Collins & Loftus, 1975, p. 412).

The CNM assumes that creative solutions result from the activation of two or more knowledge frames newly associated with one another in the context of some new problem (Santanen et al., 2014, p. 176). It is partly based on Mednick's (1962) associative theory of creativity; however, the creative process is not simply driven by random combinations of frames (Santanen et al., 2014, p. 176). According to Mednick's model of associative hierarchy, individuals differ regarding the steepness of their associative hierarchy: people with a flat slope can access less probable kinds of associations to the stimulus, whereas people with a steep slope of associative hierarchy stick to the obvious knowledge frames. "It would be predicted that the greater the concentration of associative strength in a small number of stereotyped associative responses (steep hierarchy), the less probable it is that the individual will attain the creative solution" (Mednick, 1962).

Mednick's theory is a theory of personal creative ability, according to which people have a certain higher or lower probability of being creative. CNM on the other hand, posits that regardless of the personal creative ability the possibility of producing creative solutions increases when new associations among previously unrelated frames are formed (Santanen et al., 2014, p. 178).

Empirical Evidence for Cognitive Stimuli in Ideation

Santanen and colleagues (2014) showed that cognitive stimuli operationalized as directed brainstorming as opposed to free brainstorming lead to a higher average creativity per person and to a higher concentration of creative solutions (Santanen et al., 2014). It appears cognitive stimuli breed creativity and novelty: People with a higher tendency of creative attitudes and values are more likely to make remote associations rather than close associations (Acar & Runco, 2014). Similarly, seeing provocative, novel examples at any stage of the design process leads to novelty increase, whereas typical examples decrease novelty (Smith, Kohn, & Shah, 2008).

Making unusual connections in the field of scientific ideation also leads to better ideation performance. Schilling and Green (2011) showed how atypical connections between Dewey Decimal Codes in social science papers increased the impact of these papers. The Dewey system organizes scientific literature by discipline, e.g., 000 is Computer science, 100 are philosophy and psychology, 600 is technology. Those papers that linked the least probable five percent connections of Dewey Decimals increased

likelihood of articles being high impact by a factor of 15.17 ($p < 0.1$), controlling for the experience and prior publishing success of the author(s) (Schilling & Green, 2011).

Brainstorming has seen a recent drop in its idea-generation fan base. Cognitive stimuli such as assumption reversal and analogies lead to significantly less ideas (quantity dimension) but analogy-based ideas were more creative than those produced by brainstorming (Hender, Rodgers, Dean, & Nunamaker, 2001). Assumption reversal, however, yielded ideas of lowest creativity.

It was also found that semantic similarity of shared ideas diminished brainstorming performance; semantic diversity raised performance (Nijstad & Stroebe, 2006; Nijstad, Stroebe, & Lodewijckx, 2003; Paulus & Brown, 2007; Wang, Fussell, & Cosley, 2011).

Knoll and Horton (2011) introduced *jumping* as one of three external cognitive stimuli. The other two were *pumping* as the focusing on specific concepts within the image of the creative task and leading to the activation of knowledge areas overlapping with this image and *dumping* as the challenging of assumptions contained in the creative task. According to them, jumping is a stimulus that activates “distant knowledge areas that have no or only a weak association to the image of the creative task” (Knoll & Horton, 2011) mentioned before, the semantic distance and semantic relatedness are two different concepts, but Knoll and Horton (2011) do not distinguish between the two but rather mix both constructs. We explicitly focus on semantic relatedness as the theoretical basis for S-CJ.

Theoretical Superiority of S-CJ to traditional brainstorming and brainwriting

S-CJ comprises ideation techniques long used in design, now gaining new theoretical foundation in ideation and the science of creativity performance. From the studies cited above, we now know that ideation based on mere associations and on spreading-activation from the ideation task directly to ideas A to B to C is likely to result in less original ideas and thus less creativity performance than if the spreading-activation is stimulated by semantically unrelated concepts. The studies show this is due to the way human knowledge is organized in semantic networks. There is high probability that an idea resulting from association chains, as in brainwriting, has already been developed by someone else. If unrelated concepts are activated, chances are higher that the resulting idea is unique. The less association there is between the ideation task-related

concept and the resulting idea, the higher probability of its originality. Therefore, since there is evidence for an optimal strength of semantic relatedness, the S-CJ techniques target a range of unrelated semantically related concepts. That said, these unrelated concepts are not entirely dependent on coincidence. An example of entirely random stimuli might be found via bisociation technique (Koestler, 1964), in which the creative thinker randomly opens a magazine and uses the picture as stimulus for the ideation task. The S-CJ does not rely on randomness but applies instructions on how to activate unrelated concepts. S-CJ comprises adapt-a-role-, design-by-analogy, ideal final result, reverse-, and exaggeration-technique (Gautam, 2001), briefly described below.

Table 20: S-CJ techniques used in this study.

	Activating analogue personas or natural entities, then applying their solution principles to the design task Five steps:
Design-by-Analogy	(1) Analyze the problem (2) Identify principles—what is unique about the problem? (3) Abstract from this principle, find analogies (persons, biomimetic entities, technical systems, etc.) (4) Find solutions to the analogous problem (5) Transfer the analogy solution to your problem
	Analogic reasoning applied, part of the TRIZ method
Ideal-Final-Result	(1) What is the ideal final result? (2) Search for analogies of persons, technology, biomimetic entities, which have already accomplished the ideal final result. (3) Apply the analogous solution to the design problem.
	A persona is chosen, his/her role adapted. Two variants of this technique exist:
Adapt-a-Role	(a) Think of how a known persona—celebrities, politicians, heroes—would solve the problem. (b) Imagine the person to be the customer: e.g., what kind of car would the company build if Superman were to buy it?
Reverse / Provocation	(1) List all assumptions about the problem, “things we take for granted” (2) Reverse assumptions (3) Use the reversed assumptions as stimuli to the task
	Overdoing the assumptions of the problem
Exaggeration	(1) Take features of a product or problem to their unnatural extreme (2) Activate frames/concepts as stimuli applied to the problem

5.2.3 Group Composition—Diversity in Idea Generation

DT literature stretches the importance of a diverse group composition (Lewrick et al., 2017). The variety of perspectives on an ideation task can increase the quality of ideas produced, as confirmed by empirical studies (Bechtoldt, Dreu, & Nijstad, 2007). Diversity increased group creativity of people when instructed to take their team members’ perspectives (Hoever, van Knippenberg, van Ginkel, & Barkema, 2012). Quality

of ideas from diverse (e.g., ethnicity) groups were rated higher in terms of effectiveness and feasibility than those developed by homogeneous groups (McLeod & Lobel, 1992). In a meta-analysis, Hülshager and colleagues (2009) found a small correlation between job-relevant diversity and innovation (Hülshager, Anderson, & Salgado, 2009). Team diversity affected individual creativity via creative self-efficacy and transformational leadership (Shin, Kim, Lee, & Bian, 2012); gender diversity as well as functional diversity positively affected self-assessed creative behavior (Choi, 2007)(Choi, 2007). The attitudes towards diversity moderated the impact of diversity on anticipated group outcomes (van Oudenhoven-van der Zee, Paulus, Vos, & Parthasarathy, 2009).

However, there have been studies in which diversity had no effect on creativity performance. In one study, diversity positively affected creativity performance only in nominal groups but not in interactive groups (Thornburg, 1991). In another study, cultural diversity did not affect creativity performance in dyads, but did affect idea quantity when pictures stimulated ideation (Wang et al., 2011).

5.2.4 Hypotheses

Based on our theoretical assumptions, we expected participants to produce less original ideas in the brainwriting condition because associations are strongly linked to the task. The S-CJ instructs participants to think of semantically unrelated stimuli, so we expected S-CJ to foster ideas of higher originality.

H1a: Participants create ideas of higher average originality when performing S-CJ than participants applying brainwriting.

H1b: Participants create ideas of higher average originality *and* feasibility when performing S-CJ than participants applying brainwriting.

H1c: Participants in the S-CJ condition create a higher percentage of ideas above a certain threshold in originality than participants in the brainwriting condition.

H1d: Participants in the S-CJ condition create a higher percentage of ideas with high originality *and* high feasibility than participants in the brainwriting condition.

When people create ideas high in originality the feasibility of these unusual ideas is likely low. It was therefore hypothesized that

H2: Participants' originality and feasibility scores are negatively correlated.

The DT literature calls for heterogeneous group compositions to facilitate the mutual stimulation of idea generation by inspiring innovators to come up with new

ideas through the utilization of different knowledge expertise and different perspectives (Lewrick et al, 2017). Thus, we assumed that:

H3a: Participants in the heterogeneous condition produce ideas of higher average originality than participants in the homogeneous condition.

H3b: Participants in the heterogeneous condition develop ideas of both, higher average originality *and* higher average feasibility than participants in the homogeneous condition.

H3c: Participants in the heterogeneous condition create a greater percentage of highly original ideas than participants in the homogeneous condition.

H3d: Participants in the heterogeneous condition create a higher percentage of ideas that are both, highly original *and* feasible in their individual idea sets than participants in the homogeneous condition.

Summarizing the hypotheses above, a positive interaction effect of S-CJ and group heterogeneity on participants’ average originality and feasibility scores as well as participants’ percentage of highly original ideas and percentage of good ideas was assumed.

H4: The positive effect of S-CJ on the creativity performance of participants (participants’ average originality and feasibility (H4a) and participants’ individual percentage of highly original and highly feasible ideas (H4b)) is expected to be even greater in heterogeneous than in homogeneous groups.

5.2.5 Operationalization of Variables

Independent Variable: Continuous Diversity Metric

Table 21: Four Layers of Diversity (Gardenswartz & Rowe, 2003, p. 33), adapted from the circular 4-layer model.

Internal dimensions	External dimensions	Organizational dimensions
Age	Geographic Location	Functional Level/Classification
Gender	Income	Work Content Field
Sexual Orientation	Personal Habits	Division/ Department/
Physical Ability	Recreational Habits	Unit/Group
Ethnicity	Religion	Seniority
Race	Educational Background	Work Location
	Work Experience	Union Affiliation
	Appearance	Management Status
	Parental Status	
	Marital Status	

According to the diversity layers in Table 21 and in line with scholars calling for consideration of multiple dimensions of individual differences (Lau & Murnighan, 2005; Mohammed & Angell, 2004; Molleman, 2005), we considered the diversity of participating groups relative to the extent their diversity dimensions (age, gender, ethnicity, religion, and work experience) varied. If age difference exceeded 15 years within a group, the group scored “1” in that category. To calculate our continuous diversity-measure, we counted and centered the varying dimensions of the groups so that each group received a diversity score based on multiple diversity dimensions.

Dependent variables: Originality, Feasibility, Share of Highly Original Ideas and Share of Good Ideas (Highly Original and Highly Feasible Ideas)

Amabile (1983) defined creativity as the production of novel and appropriate solutions (Amabile, 1983). We consider high-quality ideas are ideas that are both original and feasible (Rietzschel et al., 2010). As all existing creativity measures can be mapped to novelty, workability, relevance, and specificity (Dean et al., 2006), creativity performance within this study was measured according to two variables: (1) the ideas’ originality (Agogu , Kazakci, Weil, & Cassotti, 2011; Bretschneider, Rajagopalan, & Leimeister, 2012; Dahl & Moreau, 2002; Hender et al., 2001; Scott et al., 2004; Wang & Horng, 2002) and (2) their feasibility (Bretschneider et al., 2012; Levine et al., 2017; Rietzschel, 2005).

Originality (variable 1) refers to the novelty of ideas. Since without originality, there is no creativity (Runco, Illies, & Eisenman, 2005), it is considered the most important creativity indicator.

Feasibility (variable 2) refers to the usefulness and practicability of ideas. Feasible ideas are those that are implementable and workable (Bretschneider et al., 2012).

A third and a fourth variable— (3) share of highly original ideas within an individual’s idea set and (4) share of good ideas (above median originality and above median feasibility within an individual’s idea set—were also considered. Basing participants’ creativity performance only on their average originality and average feasibility has flaws. The more non-original or non-feasible ideas there are, the lower the participant’s average score, although she/he produced many ideas resulting in a high fluency-score even when a few highly original or highly feasible ideas are present (Reinig, Briggs, & Nunamaker, 2007). Therefore, we applied Reinig and his colleagues’ (2007) good-idea count in addition to the quality mean to assess creativity performance. We

calculated both the participants' individual percentage of highly original ideas within this subject's idea set (variable 3) and the participant's individual percentage of good ideas within an individual's set of ideas. Good ideas are ideas above median in originality and feasibility (variable 4).

5.3 Method

To test our hypotheses, we applied a quasi-experimental 2 (ideation techniques)-by-2 (group composition) factor design with experienced female/male journeymen. The treatment (S-CJ) and the control condition (brainwriting) were randomly assigned to natural groups (therefore with varying degrees of diversity) of future German master craftswomen or master craftsmen.

5.3.1 Participants

Two hundred seventeen (217) female/male journeymen ages 20 to 48—participated in one of 16 innovation trainings. Participants were recruited from five German trade guilds in five German cities. All participants were enrolled in training to become master craftswomen or master craftsmen.

5.3.2 Procedure

The 16 innovation trainings were developed by the first author for female/male journeymen. Training concept and a thorough description of the procedure have recently been published (Gumula, submitted). Trainings were conducted at five different training centers for trade guilds in Germany. Each group was trained for about six hours. Trainings and associated data collection were initiated with a pretest in November 2014, the majority of trainings was conducted throughout 2015, and one last training was conducted in March 2016.

Participants were welcomed and asked for informed consent. The training provided an overview of innovation processes, then introduced ideation techniques and the underlying cognitive model of spreading activation theory (Collins & Loftus, 1975) to which all groups were introduced. In the eight experimental groups (S-CJ) ideation techniques design-by-analogy, ideal final result, adapt-a-role, reverse-, and exaggeration-technique were introduced. In the control groups, the spreading-activation theory was followed by brainwriting instructions stressing the importance of paying attention

to the other participants' ideas. In both conditions, Brainstorming rules were presented during the introduction, and repeated shortly before as well as during ideation. Participants performed two ideation tasks: (1) a given problem to create advertisements for their own businesses, and (2) a problem to be found and solved, in which participants identified problems that they or their customers might have. After the ideation stage, participants in both conditions selected ideas based on identical selection criteria. For the advertisement task, criteria included implementation costs under 250 euros and ads that were surprising and novel. For the problem-finding-and-solving task, ideas had to match the customer needs and be novel and economical. Finally, participants pitched their favorite ideas, were thanked and asked to participate in the follow-up measurement.

Idea Rating Study

Resulting ideas were transcribed and, for standardization purposes, sketches were verbally described. All ideas were rated in an online survey, programmed for this study's purposes. Per contemporary rating standards, the quality of ideas was assessed by multiple raters (Friedman, Fishbach, Förster, & Werth, 2003). External raters (N=89)—acquired through an online snowball recruiting initiated from Facebook—rated the ideas on two 5-point Likert scales for their originality and feasibility, using coding schemes provided by Eric Rietzschel (Rietzschel et al., 2010). Ideas were randomly displayed to raters.

Because participants were nested into groups, a general linear mixed model was calculated, with originality and feasibility scores at the participant level nested in their respective groups. The ideation technique was manipulated at the group level. Group composition also varied at the group level.

Video Rating Study

Mainly for controlling the fact that the first author was also the experimenter, an observation study was conducted. Five raters—blind to hypotheses and acquired from an undergraduate psychology student's test person pool—observed participants and facilitator at 30 sec. video sequences randomly selected from all 16 groups, five videos per group. The randomization was done by gathering randomized four-digit numbers and transforming them into minutes and seconds of the video. After each sequence, observers answered an observation questionnaire consisting of 21 group cohesion items provided by Hung and her colleague (Hung & Gatica-Perez, 2010) (see Appendix V),

which also included a self-formulated facilitator enthusiasm item—all rated on 7-point Likert scales. With these data we first conducted a factor analysis and identified two major factors: group climate and group communication. Group climate comprised variables relating to atmosphere and bond between the group members, whereas group communication consisted of variables such as giving each other feedback or demonstrating good rapport. These two factors and the facilitator enthusiasm variable served as control variables.

5.4 Results

Of the 217 participants, 199 (92%) produced 1,266 ideas. The remaining 18 left early or did not generate ideas. Ideas were then rated in the online rating study. The 89 online raters evaluated the ideas; each idea was rated two to six times on the two scales (originality and feasibility). The raters were not clearly identifiable because they only had to provide their age and educational backgrounds; for about a third of the rater codes we identified two different raters with same age, gender, and study field. So, we analyzed whether the rater codes or the idea identification numbers were better suited for explaining the variance in the dependent variables.

Table 22: Variance of rater identification number on originality compared to idea identification number.

Tests of between-subject effects							
Independent variable: Originality							
Source		Sums of squares type III	df	Means of squares	F	Sig.	Partial eta squared
Constant term	Hypothesis	3,435.022	1	3,435.022	2,130.042	.000	.879
	Error	474.383	394.163	1.613 ^a			
Idea ID	Hypothesis	2,269.954	1,372	1.654	1.973	.000	.395
	Error	3,476.662	4,147	.838 ^b			
Rater ID	Hypothesis	638.348	88	7.254	8.652	.000	.155
	Error	3,476.662	4,147	.838 ^b			

a. .121 MS(rater:id) + .879 MS(error)
b. MS(error)

We found that the idea identification number explained the variance in the data much better than the rater codes (see Tables 22 and 23: Partial eta-square of idea id was

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higher (39% for originality; 47% for feasibility) than for rater id (15% for originality; 30% for feasibility).

Table 23: Variance of rater identification number on feasibility compared to idea identification number.

Tests of between-subject effects							
Independent variable: Feasibility							
Source		Sums of squares III	df	Means of squares	F	Sig.	Partial eta squared
Constant term	Hypothesis	7,677.175	1	7,766.175	3,568.350	.000	.956
	Error	350.684	162.998	2.151 ^a			
Idea_ID	Hypothesis	2,332.085	1,372	1.700	2.600	.000	.473
	Error	2,594.133	3,968	.654 ^b			
Rater_ID	Hypothesis	1,123.613	88	12.768	19.531	.000	.302
	Error	2,594.133	3,968	.654 ^b			

a. .124 MS(rater:id) + .876 MS(error)
b. MS(error)

5.4.1 Idea Quantity

Homogeneous groups produced 364 ideas with brainwriting, 294 ideas with S-CJ, whereas diverse groups developed 179 ideas in the brainwriting condition and 608 ideas in the S-CJ condition (see Table 24). However, since S-CJ requires more steps than brainwriting, we did not consider idea quantity as a dependent variable.

Table 24: Idea quantity under differing experimental conditions.

S-CJ * group composition Cross tabulation					
Count					
		Diverse_group			
		Without	Homogeneous	Heterogeneous	Total
S-CJ	With	294	429	723	
Total		658	608	1,266	

5.4.2 Average Originality and Average Feasibility

The results of the GLMM are reported in Table 25 The effect of S-CJ was tested in model M1, displaying a small ($r = .114$) but significant effect of the S-CJ ($p = .0225$) on the participants' average originality. Thus, it is reasonable to say that participants did create ideas of higher originality when performing S-CJ as compared to those

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applying brainwriting, supporting H1a. In model M2 we investigated the effect of S-CJ on one dependent variable while controlling for the other.

Table 25: Results of the GLMM, M0 – null hypothesis, M1 average originality and average feasibility, M2 average originality controlled for feasibility performance and average feasibility controlled for originality performance.

Models	Originality mean per person			Feasibility mean per person		
	M0	M1	M2	M0	M1	M2
Constant	2.79	2.75	2.75	3.78	3.82	3.82
Feasibility M / Originality M			-0.216 p2t = .002 p1t = .001			-0.218 p2t = .003 p1t = .0015
S-CJ		.114 p2t = .045 p1t = .0225	.095 p2t = .068 p1t = .034		-.088 p2t = .244	-.062 p2t = .379
Continuous diversity centered		-.034 p2t = .500	-.023 p2t = .603		.052 p2t = .438	.044 p2t = .481
S-CJ * diversity Interaction		.044 p2t = .374	.034 p2t = .448		-.055 p2t = .416	-.045 p2t = .474
Var(Gr)	.017	.014	.010	.029	.035	.020
Var(P Gr)	.138	.137	.132	.142	.142	.139
ICC Gr	11%			17%		
AICc	191,1	199,9	193.8	201.9	212.6	207.2
BIC	197,7	206.4	200.3	208.4	219.1	213.7

The results indicate a small (.095) but significant (p1t = .034) effect of S-CJ on the participants’ average originality controlled for feasibility performance. So even when feasibility was kept constant in all groups, the S-CJ still significantly affected the participants’ average originality, supporting H1a.

H1b stating that participants would yield higher average originality *and* higher average feasibility in the S-CJ condition is rejected because S-CJ did not affect the participants’ feasibility means (r = -.088, p2t = .244) and feasibility was also not affected by S-CJ when controlling for originality performance (r = -.062, p2t = .38). This is due to the significant negative correlation between participants’ average feasibility and average originality (r = -.216, p1t = .001; r = -.218, p1t = .0015). Hence, H2 is supported.

How the group composition—operationalized as the continuous diversity measure—affected participants’ originality and feasibility means is shown in line six of Table 25. Diversity did not significantly affect the participants’ originality mean ($r = -.034$, $p_{2t} = .5$); therefore, no significant effect was seen when controlling for feasibility performance ($r = -.023$, $p_{2t} = .6$). Respectively, diversity did not significantly affect the participants’ average feasibility, neither with nor without controlling for originality performance (without controlling: $r = .052$, $p_{2t} = .438$; with controlling: $r = .044$, $p_{2t} = .481$). Thus, H3a, hypothesizing participants to have higher average originality in the heterogeneous than in the homogeneous condition, as well as H3b (higher average originality *and* average feasibility) are rejected.

Table 26: Results of the GLMM, M0—null hypothesis, M1—percentage of ideas above median in originality per participant, M2—percentage of feasibility above median per participant, M3—percentage of ideas with above median-originality and above median-feasibility per participant.

	IV Percentage of originality above median per person			IV Percentage of feasibility above median per person			IV Percentage above median	
Models	M0	M1	M2	M0	M1	M2	M0	M1
Constant	.45	.41	.41	.51	.53	.53	.21	.20
<i>p_Feas_aM_c</i>								
<i>p_Inno_aM_c</i>			-.09			-.09		
S-CJ		.08 p2t= .04 p1t= .02	.08 p2t= .04 p1t= .02		-.02 p2t= .66	-.01 p2t= .66		.05 p2t=.12
Continuous diversity measure		-.03 p2t= .44	-.03 p2t= .44		.03 p2t= .44	.03 p2t= .44		-.01 p2t= .9
S-CJ * diversity Interaction		.04 p2t= .25	.04 p2t= .25		-.03 p2t= .46	-.03 p2t= .46		.01 p2t= .9
Var(Gr)	0,008	.007	.007	0,006	.009	.009	0,003	
Var(P Gr)	0,073	.073	.073	0,072	.072	.071	0,050	
ICC Gr	10%			8%			6%	
AICc	66,4	76,9	78,7	59,9	75,0	76,8	-12,6	.8
BIC	72,9	83,4	85,2	66,5	81,5	83,3	-6,1	7,3

5.4.1 Ideas Above Median

S-CJ positively affected the percentage of ideas above originality median ($r = .08$, $p1t = .02$) (see Table 26).

This very small effect remained, even when we controlled for feasibility performance ($r = .08$, $p1t = .022$), tested in M2. Participants in the S-CJ-condition had a greater percentage of ideas above originality median in their individual idea set than participants in the brainwriting condition, even when controlling for feasibility performance, supporting H1c. H1d, which stated that participants of the S-CJ-condition would have a greater percentage of good ideas in their resulting idea sets (above median in both originality and feasibility), is rejected, the percentage of good ideas of the individuals' idea set was not affected by S-CJ.

Group composition, measured as the continuous degree of diversity, did not affect the participants' individual percentage of ideas above median in originality and did also not affect the percentage of good ideas (percentage of ideas above median in both, originality and feasibility); H3c and H3d are thus rejected. There were no interactions of S-CJ and diversity on participants' average originality and average feasibility, or on participants' percentage of good ideas. H4a and H4b are both rejected.

5.4.2 Control Variables

Facilitator Enthusiasm

Because the trainings were facilitated by the first author of this paper, we controlled for the facilitator's enthusiasm as well as for group communication and group climate gathered from video data in an observation survey (see Methods section). Results for the facilitator enthusiasm variable are displayed in Table 27, showing that first of all, the enthusiasm of the facilitator was rated even higher in the control group condition ($M=5.0897$) than in the experimental condition ($M=5.0748$) and did not differ significantly between conditions.

Table 27: Comparing facilitator enthusiasm between the two experimental conditions.

	Ideation Technique	N	Mean	Std. Devia- tion	Std. Error Mean
Facilitator	S-CJ	107	5.07	1.09	.106
enthusiasm	brainwriting	78	5.09	.90	.102

However, referring to how the groups were composed, the facilitator enthusiasm did differ significantly, being higher ($M=5.23$) in the diverse groups and lower ($M=4.9$) in homogeneous groups.

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Table 28: Comparing facilitator enthusiasm between homogeneous and heterogeneous groups.

	Group composition	N	Mean	Std. Deviation	Std. Error Mean
Facilitator enthusiasm	diverse	98	5.23	1.15	.116
	homogeneous	87	4.91	.82	.087

Table 29: Levene’s test and t-test for facilitator enthusiasm between heterogeneous and homogeneous conditions.

		Independent Samples Test								
		Levene’s test for Equality of Variances			t-test for Equality of Means					
		F	Sig.	t	df	Sig. 2-tailed	MD	SED	95 % Confidence Interval of the Difference	
									lower	upper
Facilitator Enthusiasm	equal variances assumed	6.61	.011	2.2	183	.029	.33	.15	.035	.619
	equal variances not assumed			2.25	175	.026	.327	.15	.040	.613

Group Communication

Group communication comprised factors such as whether participants gave each other feedback, had a good pace of conversation, and listened attentively to each other. The means in both experimental conditions are displayed in Table 30. Group communication was slightly higher in the S-CJ condition but means did not differ significantly ($p=.81$).

Group Climate

Group climate was comprised of factors such as the atmosphere of the group, how cohesive the group appears, if there is a sense of belonging in the group, etc. Group climate was slightly higher in the S-CJ condition, but again, the means did not differ significantly ($p=.74$). Regarding the group composition, group climate did not significantly differ in homogeneous compared to heterogeneous groups (for group communication $p = .47$, for group climate $p = .52$). Results for both variables, group climate and group communication, regarding the ideation technique used and the group composition are displayed in Tables 30-33.

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Table 30: Comparing group communication and group climate between the two experimental conditions (S-CJ and brainwriting).

	Ideation technique	N	Mean	Std. Deviation	Std. Error Mean
Group Communication	S-CJ	120	4.33	.011	.083
	Brainwriting	109	4.31	.88	.085
Group Climate	S-CJ	120	4.28	1.09	.1
	Brainwriting	109	4.23	1.09	.1

Table 31: Levene’s test and t-test for group communication and group climate between experimental conditions.

		Independent Samples Test								
		Levene’s test for Equality of Variances			t-test for Equality of Means					
		F	Sig.	t	df	Sig. 2-tailed	MD	SED	95 % Confidence Interval of the Difference lower upper	
Group Communication	equal variances assumed	.003	.058	.245	227	.807	.03	.12	-.2	.26
	equal variances not assumed			.245	226	.806	.03	.12	-.2	.26
Group Climate	equal variances assumed	.006	.94	.33	227	.742	.05	.14	-.23	.33
	equal variances not assumed			.33	225	.743	.05	.14	-.23	.33

As for the group composition, group communication and group climate did not significantly differ from each other in the heterogeneous groups as compared to the homogeneous groups.

Table 32: Comparing group communication and group climate between homogeneous and heterogeneous groups.

	Group composition	N	Mean	Std. Deviation	Std. Error Mean
Group Communication	diverse	115	4.36	.95	.089
	homogeneous	114	4.28	.83	.078
Group Climate	diverse	115	4.3	1.12	.105
	homogeneous	114	4.2	1.06	.098

Table 33: Levene’s test and t-test for group communication and group climate between homogeneous and heterogeneous groups.

		Independent Samples Test								
		Levene’s test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. 2- tailed	MD	SED	95 % Confidence Interval of the Difference	
									lower	upper
Group Commu- nication	equal vari- ances as- sumed	1.683	.196	.72	227	.472	.085	.12	-.148	.319
	equal vari- ances not assumed			.72	225	.472	.085	.12	-.148	.319
Group Climate	equal vari- ances as- sumed	1.89	.664	.648	227	.518	.09	.144	-.19	.378
	equal vari- ances not assumed			.648	226	.518	.093	.144	-.19	.378

5.5 Discussion

S-CJ emphasizes the creative advantage of initially coming up with concepts/frames that are semantically unrelated to the ideation task, then using the resulting concepts/frames as stimuli to inspire solutions to the ideation task.

As we predicted, participants in our study scored higher on originality when they performed the ideation task using S-CJ as compared to brainwriting. S-CJ also led participants to create higher percentages of above median originality ideas as compared to brainwriting.

These results are in line with recent studies, in which originality was enhanced, for example, by teaching cognitive problem-solving techniques such as SCAMPER, brainstorming or Attribute Listing (Kashani-Vahid et al., 2017). However, this study was conducted with elementary school children, not adults. As for S-CJ, a 2017 study using analogy-technique demonstrated that participants using biocards instead of brainstorming created concepts of higher novelty (Keshwani et al., 2017); and exposing designers to a wide range of remote analogies proved to be a successful strategy to enhance a designer’s creativity and to overcome design fixation (Goldschmidt, 2001; Linsley, Markman, & Wood, 2012; Nguyen & Zeng, 2017).

Contrary to our expectations, group heterogeneity did not affect originality and feasibility of ideas in our study. Wang et al. (2011) showed that multi-culturally diverse groups needed additional stimuli (pictures) to positively affect ideation outcomes (Wang et al., 2011). Türkmen (2013) described a U-shaped curvilinear relation between cognitive diversity and quality of innovation, revealing that workgroups tend to increase innovation performance when either higher levels of homogeneity or heterogeneity exist (Türkmen, 2013). Perhaps in our groups, diversity did not reach the high threshold needed for a positive effect on creativity performance. Also, the homogeneous groups were comprised of female/male journeymen of the same profession, meaning they be future competitors. This competition anticipation might have neutralized the beneficial effect that group diversity can have. A possible explanation might be that in our study, competition positively affected the ideation outcome of participants in the homogeneous groups, whereas diversity positively affected it in the heterogeneous groups and thus neutralizing the effect.

Regarding facilitator enthusiasm, we found no significant difference between the experimental conditions concerning the techniques but did find a significant difference for facilitator enthusiasm in the diverse and homogeneous groups. This is problematic as it lowers the internal validity of the experiments. At the same time, since diversity as a dependent variable did not significantly affect participants' creative outcome, the results of the experiments are not entirely invalid. In fact, the control variable of facilitator enthusiasm was nearly constant across 185 observations in both experimental conditions ($M_{\text{facilitator enthusiasm in S-CJ}}=5.07$, $SD=1.09$ versus $M_{\text{facilitator enthusiasm in brainwriting}}=5.09$, $SD=.90$).

Team communication was slightly but not significantly higher in the S-CJ condition, but this can be explained by the nature of the brainwriting technique used in the control groups: brainwriting comprises writing down instead of telling each other his/her ideas, thus intentionally limiting talking among group members.

5.6 Limitations

Some shortcomings are to be noted: Although two different card colors were to be used for distinguishing complete ideas from comments or semantically unrelated stimuli leading to ideas, it is possible that participants had accidentally switched the

card colors. If so, it was up to the first author to decide whether written items were ideas or merely notes or unrelated stimuli (in experimental conditions).

For standardization purposes, sketched ideas were verbalized, and only written words were presented to the independent raters. We assume that verbalizing these sketches might have affected the rating outcomes, since research from Choo and colleagues (2014) as well as Linsey and colleagues (2011) both have demonstrated that collaborative sketching as an ideation technique had outperformed non-visual ideation techniques like brainstorming (Choo et al., 2014; Linsey et al., 2012). Collaborative sketching had yielded the highest means in quality, novelty, variety, and quantity of ideas than any other ideation technique (individual brainstorming, group brainstorming, individual and group mind mapping) (Choo et al., 2014). Thus, by verbalizing sketches we might have lowered the ideas' inherent quality.

For avoiding rating bias, false spelling was corrected. Further issues were related to ideas that had no exact id. To link them correctly, the first author compared handwritings—a potential source of mismatching.

Another issue lies in the scoring method for our independent variable: continuous diversity measure. Although in line with scholars calling for considering multiple diversity dimensions simultaneously (Mohammed & Angell, 2004; Molleman, 2005), some diversity dimensions are not easily observed. Some were straightforwardly obtained because participants self-reported them, like age and gender. However, ethnicity was judged by the first author based on skin color, name of the participant, and whether she or he spoke German with or without an accent. The same issue applied for religion as a diversity dimension. Here, the first author had gained knowledge about different religions only in some of the groups, whereas in other especially homogeneous groups, religion did not seem to vary. Herein lies high risk of bias, and future research should apply self-reporting methods to obtain the actual variation in diversity dimensions.

All shortcomings mentioned above occurred in all groups equally.

5.7 Conclusions and Implications

This study was conducted to test the effects of S-CJ as compared to brainwriting and varying group composition on the quality of ideas, filling a gap in the research literature, which has entirely relied on student-samples tested under laboratory conditions or—if applied in organizations—only academically trained participants from middle to

upper management levels had partaken. No study manipulating idea generation techniques had been done with small- and medium-sized enterprises (SMEs), yet SMEs face ever increasing challenges due to globalized business chains, worldwide competition, and consequent pressure to innovate.

The results of our statistical analyses show a small effect of the S-CJ on the participants' originality scores, but no effect of group composition on the originality or interaction of both dependent variables. These results are in line with other creativity training evaluations, in which originality was raised by, for example, cognitive problem-solving training covering SCAMPER, brainstorming and attribute listing (Kashani-Vahid et al. 2017), and novelty was raised using analogy-technique (Keshwani et al., 2017).

Our findings are important for organizational practice because, as demonstrated by Dahl and Moreau (2002), small changes in originality may have some meaningful influence on an innovation's value to a firm (Dahl & Moreau, 2002).

For DT facilitators or innovation managers, the results of this study support the choice of applying S-CJ out of more than 100 different ideation techniques (Van Gundy, 2005). Results suggest that S-CJ yields highly original yet feasible ideas.

Our study also showed that creativity, including the underlying processes of cognitive creativity, can be taught and thus replicate the general finding of e.g. Scott and her colleagues that creativity trainings are effective (Scott et al., 2004). Even though today's business world calls for creative skills, teaching that skill has remained absent, particularly in the German journeyman education curriculum—an SME sector in Germany facing extraordinary challenges like shortage of skilled labor and global competition. Our study makes a small contribution to this sector regarding (1) a result-oriented approach to creating ideas and (2) an approach to teaching the idea creation skill (Gumula, submitted).

However, the generation of ideas is only one half of the process. Since innovation comprises the generation and implementation of ideas, implementing the ideas is just as important. The implementation step has been widely neglected by creativity research and thus calls for new research of idea implementation especially in SMEs.

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VI. CHAPTER 6 SUMMARY, IMPLICATIONS, AND CONCLUSION

6.1 Summary of Results

In this chapter, the most important results obtained from this dissertation thesis are summarized.

In the first chapter, the general topics of this thesis – innovation and creativity – were introduced and the research question of this thesis – how ideation techniques affect creativity performance – was stated.

The systematic literature review (Chapter 2) served the purpose of reviewing all experimental or quasi experimental evidence from ideation research on how techniques affect the idea quality. Here, the superiority of the nominal group technique over brainstorming became evident (Dunnette et al., 1963; Haley, 2014; Manning, 1998; Putman & Paulus, 2009; Rietzschel, 2005; Taylor et al., 1958) with some null hypothesis results, lately (Baruah & Paulus, 2008; Haats, 2012; Jung et al., 2007; Morgan, 1996).

Secondly, analogy technique has been widely investigated and was shown to be more effective in enhancing creativity performance than any other technique (Burgers et al., 2015; Casakin & Goldschmidt, 1999; Chan et al., 2011; Dahl & Moreau, 2002; Goldenberg et al., 1999a; Hender et al., 2002; Karni & Shalev, 2004; Keshwani et al., 2017; Wilson, 2008). Only Wilson (2008) who had shown his participants a human engineered example or a bio-inspired analogy example obtained no statistical differences of the techniques' effectiveness (Wilson, 2008).

Some empirical evidence shows how priming for unrelated categories (Baughman & Mumford, 1995; Kohn, Paulus, & Korde, 2011) but also priming for related categories can (Rietzschel, 2005) enhance creativity performance. Research on priming for goals has produced results indicating a positive effect on idea quality (Dennis et al., 2013; Potter & Balthazard, 2004; Selart & Johansen, 2011; Shalley, 1991; Škerlavaj et al., 2014). Only Litchfield (2011) did not reject the null hypothesis as brainstorming rules vs. creativity goals vs. both, rules and goals, did not differ (Litchfield et al., 2011).

However, priming for examples should be avoided as it seems to diminish creativity performance (Dahl & Moreau, 2002; Eppler & Hoffmann, 2012; Potter & Balthazard, 2004). On the other hand, visualization by means of mind maps seems to enhance originality (Malycha & Maier, 2017a, 2017b). Provocation technique has led

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participants to produced ideas of better quality than brainwriting (Herrmann & Felfe, 2014), but was outperformed by EBS and analogy technique in terms of idea creativity (Hender et al., 2002).

Figure 7 (displayed in Chapter 2 as well) again, serves as a graphic summary, the primary results from the literature review are displayed.

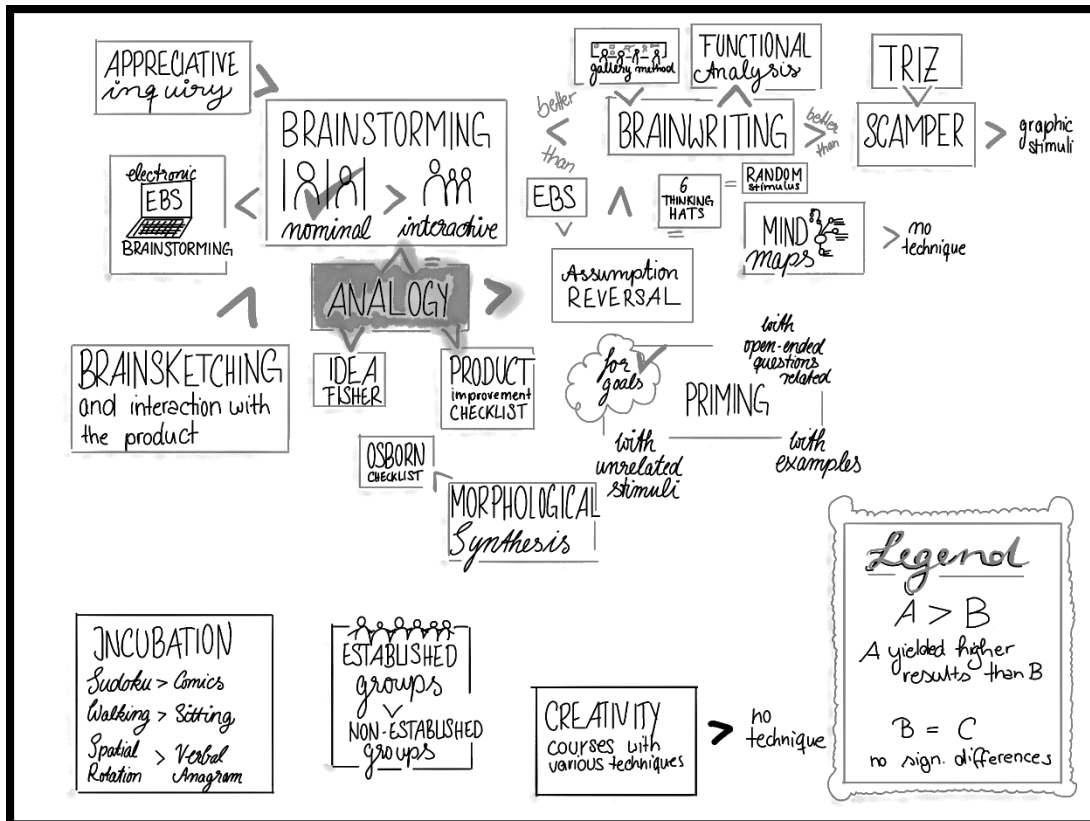


Figure 7: Sketchnote from the most important findings resulting from the literature review, "A < B" means A is less effective than B, "A > B" means A is more effective than B and "A = B" means there were no significant differences between the ideation techniques. Analogy is highlighted because in the studies reviewed it was the only technique that was not outperformed by any other technique.

Based on the findings from the systematic literature review and with empathy towards organizational practice, a one-day long ITC was designed aiming at enhancing participants' knowledge on innovation and their creativity performance. The step-by-step instructions of the ITC (Chapter 3) were to serve its immediate application in practice hoping to render additional innovation facilitators obsolete.

The proposed ITC had been applied with 217 female and male journeymen from five different German cities. Overall, 16 ITCs had taken place.

One year after participating in the ITC, the female and male journeymen were asked to respond to an online follow up questionnaire. It had been designed according to Kirkpatrick's model on evaluating trainings (Kirkpatrick, 1979) and comprised items for collecting quantitative data but also open-ended questions. The quantitative data

were only of limited value because biunique identifiers had not been assigned to respondents. Therefore, it was not clear whether they had taken part in the brainwriting or S-CJ version of the ITC, and whether they had been in heterogeneous or homogeneous groups. Hence, only a confirmatory factor analysis was run. It had been hypothesized that there would be four factors corresponding with the Kirkpatrick framework. However, factor analysis produced two factors. The first was related to Kirkpatrick's fourth level (results), the second to the first level (reactions). Participants had clearly liked the training, whereas they had not obtained tangible results from it.

Qualitative feedback complemented the quantitative data. After coding and categorizing the journeymen's answers to the open-ended questions, it became clear that the data reflected the evaluation framework with its six levels (liking, learning, behavior, results, ROI and societal good).

People had liked the ITC, had gained some knowledge on ideation techniques and have somewhat applied them. Participants had liked the freedom to apply the methods in their own manner. However, ROI was not calculated due to highly scattered savings and profits data. Concerning the societal good level, many female and male journeymen had commented on the idea to integrate refugees in the crafts sector. Participants even suggested ways to realize the idea. Note, however, that their attitude towards this idea prior to the ITC was not assessed. So, no relation between the ITC and their liking the idea and suggesting steps to implement it can be assumed.

These self-reported data were complemented by an objective observation study presented in Chapter 5. The empirical evaluation results of a 2-by-2 factor quasi experimental research design with 217 female and male journeymen were presented. Participants had worked in groups – either homogeneous or heterogeneous – and had been randomly assigned either the S-CJ techniques or brainwriting to create ideas for advertisement and for self-identified problems.

As predicted, participants had scored higher on originality when they had performed the ideation task using S-CJ as compared to brainwriting. S-CJ also led participants to create higher percentages of above median originality ideas as compared to brainwriting. Contrary to what was expected, group diversity had not affected originality and feasibility of ideas in this study.

6.2 Implications for Future Research

Ideation research dates back to 1958 (Taylor et al., 1958) and has expanded since. As a result from the Cochrane review on experimental or quasi experimental research investigating how ideation techniques affect idea quality, various research gaps become evident.

First of all, there are multiple ideation techniques of which there was only one study in the data set, e.g. appreciative inquiry, gallery method, TRIZ, Idea Fisher, Product Improvement Checklist, Osborn's checklists, and Six Thinking Hats. Based on the model displayed in Figure 7, there are techniques that have been under investigated, calling for experimental research comparing these with each other.

Secondly, psychological innovation research has strongly focused on the creation phase of the process and has neglected the implementation of ideas. Here, two main aspects evolved that call for additional scientific investigation: the why and how of successfully implemented ideas and the flipside of that topic – why ideas that, despite meeting the feasibility and originality requirements, have not been successfully implemented.

6.3 Implications for Practice

In past experimental and quasi experimental research that has investigated how different ideation techniques affect the quality of ideas, analogy technique has been shown to be the best ideation technique when it comes to creating ideas of high quality. Not outperformed by any other technique, yet it was superior to brainstorming, IdeaFisher, Product Improvement Checklist, and Assumption Reversal. Only one experiment produced no statistical difference between analogy and interactive brainstorming, although ranked higher (Hender et al., 2002).

Other than that, interactive brainstorming has been outperformed by nominal brainstorming, by appreciative inquiry, by brainwriting, and brainsketching. If brainstorming must be done in practice, the nominal technique is to be preferred.

Brainwriting is a moderately good method to create ideas of high quality. It was shown to be more effective than SCAMPER and Functional Analysis but performed poorer than the Gallery Method and Assumption Reversal.

SCAMPER – as just mentioned – is rather ineffective in producing creative ideas. It was outperformed by brainwriting but also by TRIZ and was only superior to graphic stimuli.

Assumption Reversal, although better than brainwriting, was found to be as effective as the Six Thinking Hats and these are as effective as Random Stimuli. Checklists seem to produce ideas of less quality than, for example Morphological Analysis or Analogy.

In conclusion, as a result from the literature review and from the quasi experiments, it became evident that S-CJ techniques such as Analogy technique, Ideal Final Result, Mr. X technique, Reverse technique and Exaggeration, enable participants to produce ideas of significantly higher originality than brainwriting, controlled for feasibility. Although the effect size was rather small, small changes in originality may have some meaningful influence on an innovation's value to a firm as demonstrated by Dahl and Moreau (Dahl & Moreau, 2002).

So, in today's economies – in which people work in groups when developing ideas – it is advisable to use ideation techniques that raise creativity performance of interactive groups as opposed to nominal groups. The S-CJ is such adequate tool which better suits the way that ideation is done in daily organizational practice – face to face.

Regarding the group composition, DT handbooks or other practitioner's guides (Lewrick et al., 2017) keep stressing the importance of group diversity in innovation. However, from the results of the quasi experimental research design with two differing group composition conditions, this claim cannot be restated. Diversity – operationalized as a continuous metric depending on the amount of diversity dimensions that varied within a group – had not significantly affected the idea quality. As discussed in Chapter 5, the competition between female or male journeymen from the same crafts might have increased their motivation to be productive and therefore homogeneous groups might have been as good as the diverse groups.

Either way, this study's findings do not allow for continuously demanding only diverse teams. Rather this study stresses the call for more research on the question whether heterogeneous group composition enhances the creativity performance.

6.4 Conclusion

Since 1958, psychologists have demonstrated the ineffectiveness of brainstorming and a large body of research has emerged that empirically tested ideation techniques and their effectiveness towards mostly quantity but also quality results.

Contrary to the findings which experimental research has produced, brainstorming is still the most widely used idea generation technique, it is popular and with increasing pressure to innovate, brainstorming gets applied quite often.

Apparently, there is still potential for improving the knowledge transfer between academia (psychological creativity research) and practice (innovating firms). The reason for that suboptimal transfer might be the way that information is prepared and provided does not match with the other side of the transfer process. This match might mean structurally: information packages do not get delivered, referring to paywalls protecting scientific findings. It might also mean logically: concepts, syntax and meaning do not fit because both sides have developed their own language. It might also mean temporal, referring to the asynchronous need and offer of information. Maybe psychological creativity research came a bit early for organizations which only recently have increasing need for professional ideation facilitation and for techniques that grant competitive advantage because they enable people to create ideas of significantly higher quality. This thesis' research question of how ideation techniques can enhance creativity performance can be answered now: four S-CJ techniques were presented that activate knowledge concepts in the human semantic network which would not be activated by the ideation task and which have been proven to cause better creativity performance in quasi experiments. Participants achieved significantly higher originality – controlled for feasibility – when choosing from the S-CJ category as compared to applying the brainwriting technique.

In sum, to create ideas that no one has thought of before activate knowledge that no one has activated before in the light of this particular ideation task or problem.

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APPENDIX I REASONS FOR EXCLUDING STUDIES

Table 34: Reasons for excluding studies that had resulted from the systematic literature search.

(Abraham, 2014)	Conceptual Paper, no quantitative data provided
(Abraham, Windmann, Siefen, Daum, & Güntürkün, 2006)	Disease related
(Abraham, Windmann, McKenna, & Güntürkün, 2007)	Disease related
(Abraham, Thybusch, Pieritz, & Hermann, 2013)	no treatment - no ideation technique, only gender differences and fMRI scans
(Acar & Runco, 2014)	no manipulation of ideation technique
(Acar & Runco, 2015)	no manipulation of ideation technique
(Aflalo & Offir, 2010)	children-sample
(Agina, 2012)	children-sample
(Agogué et al., 2011)	originality was measured by statistical infrequency, not rated
(Aiken et al., 2007)	no creative outcome, only satisfaction, evaluation apprehension, production blocking
(Akar & Sengil-Akar, 2013)	children-sample
(Almeida, Prieto, Ferrando, Oliveira, & Ferrándiz, 2008)	no treatment - no ideation technique, testing construct validity of TTCT
(Al-Zahrani, 2015)	"flipped classroom" is not an ideation technique
(Aslan & Puccio, 2006)	no treatment - no ideation technique, TTCT translation into Turkish, and identification of cultural differences in Turkish and USA sample
(Ball, Ormerod, & Morley, 2004)	no creativity-related outcome
(Ball & Christensen, 2009)	no manipulation of ideation technique
(Barak & Doppelt, 2006)	qualitative study
(Barbot & Lubart, 2012)	no treatment - no ideation technique, Creativity in Music assessment through Musical Expression Test MET)
(Bart, Hokanson, Sahin, & Abdelsamea, 2015)	no treatment - no ideation technique, TTCT for gender differences in a sample of 8th and 11th grade students
(Bart, Hokanson, & Can, 2017)	no treatment - no ideation technique, TTCT for construct validation, factorial analysis: two-factor model fits the innovation-adaption construct
(Basadur & Thompson, 1986)	no manipulation of ideation technique, rather exploratory, all had the same treatment, dv: most valued idea and when it occurred if during the first, second or third third of creative process)
(Basadur & Hausdorf, 1996)	no manipulation of ideation technique, survey
(Basadur, Runco, & Vega, 2000)	statistical infrequency
(Basadur, Graen, & Green, 1982)	no creative output - ideation output was measured by judging "wishes"
(Beaty & Silvia, 2012)	no ideation technique
(Witell, Ben Rejeb, Boly, & Morel-Guimaraes, 2011)	not experimentally tested
Bingwen 2010	Case Study
(Birdi, 2007)	not experimental, survey
(Bocken, Allwood, Willey, & King, 2011)	no statistical data provided
(Boddy, 2012)	qualitative study, and review about Nominal Group Technique
(Bull, Montgomery, & Baloch, 1995)	Questionnaire, Survey, no manipulation of ideation technique

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(Butler, 2010)Butler 2010	no creativity-related outcome
(Calvo, Elorriaga, Arruarte, Larrañaga, & Gutiérrez, 2017)	concept maps were taught, output however, is not creativity or innovation related
(Canesi et al., 2016)	Disease-related, Parkinson's Disease
(Canesi, Rusconi, Isaias, & Pezzoli, 2012)	Disease-related, Parkinson's Disease
(Canning, 2013)	No treatment, rather observation of children in woodlands while making a den
(Cannon, Carrol, & Seamons, 1993)	idea fisher technique, but no quantitative results provided
(Caroli & Sagone, 2009)	children-sample
(Casakin, 2004)	no creative idea quality
(Casakin, Davidovitch, & Milgram, 2010)	No treatment, no ideation tools
(Cavallera, Boari, Labbrozzi, & Bello, 2011)	no treatment, rather morning/evening type disposition and hours of sports per week and creativity TTCT)
(Cerne, Nerstad, Dysvik, & Skerlavaj, 2014)	knowledge hiding not a real ideation technique
(Chan & Schunn, 2015)	not experimental
(Chang, Li, Chen, & Chiu, 2013)	children-sample
(Chen et al., 2015)	correlation, no manipulation of ideation technique
(Cheng, Wang, Liu, & Chen, 2010)	children-sample
(Cheng et al., 2010)	children sample
(Chermahini & Hommel, 2012)	no ideation technique
(Cheung, Chau, & Au, 2008)	knowledge reuse from Intranet is not an ideation technique
(Chryssikou, Motyka, Nigro, Yang, & Thompson-Schill, 2016)	no idea quality
(Clapham, 2016)	no treatment, no ideation techniques, correlation between different creativity tests
(Clapper, McLean, & Watson, 2009)	no ideation technique, GSS group support system, no creativity-related outcome
(Collins, 2016)	case study of a musical composer, no treatment, no ideation technique
(Connolly et al., 1990)	no real ideation technique manipulation, rather feedback Evaluative tone=
(Cooper & Dilek, 2007)	No treatment, cross-cultural comparison of children's history lessons
(Coskun, 2005)	no idea quality
(Coskun, 2011)	no idea quality
(Cramond, Matthews-Morgan, Bandalos, & Zuo, 2016)	TTCT Validity Testing after 40 years of usage
(Cropley, 2006)	qualitative, conceptual paper
(Damian & Robins, 2012)	correlational
(Daskolia, Dimos, & Kampylis, 2012)	qualitative
(Davidovitch & Milgram, 2006)	Correlational
(Dennis & Valacich, 1993)	no idea quality
(Dennis & Valacich, 1994)	the task was to discuss all "people, groups and organizations" that would be affected by a proposal requiring business students to have individual access to a microcomputer - I do not consider this a creative or innovative idea generation task
(Dennis & Williams, 2005)	meta-analysis
(Dennis & Reinicke, 2004)	correlational, survey
(Dennis et al., 2005)	no idea quality

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(Diehl & Stroebe, 1987)Diehl & Stroebe 1987	no idea quality
(Doumas et al., 2008)	not creativity- or innovation related outcome
(Duff, Kureczek, Rubin, Cohen, & Tranel, 2013)	disease-related
(Dugosh et al., 2000)	no idea quality
(Dumas & Schmidt, 2015)	statistical infrequency as novelty measure
(Duran-Novoa, Leon-Rovira, Aguayo-Tellez, & Said, 2011)	qualitative, not experimental
(Eberle, 1972)	no experimental, no results provided
(Ebrahim, 2006)	Deaf vs. hearing children - no ideation technique
(Eisele, 2007)	no idea quality
(Erdoğan & Durmuş, 2009)	no creativity-related outcome variables
(Ezzat et al., 2017)	no idea quality
(Fan, Chen, Wang, & Chen, 2014)	no ideation technique
(Faraci, Hell, & Schuler, 2016)	no ideation technique
(Faust-Socher, Kenett, Cohen, Hassin-Baer, & Inzelberg, 2014)	disease-related
(Fernández-Abascal & Díaz, 2013)	no idea generation technique
(Ferreira, Antunes, & Herskovic, 2011)	no idea quality
(Fink, Graif, & Neubauer, 2009)	EEG while dance improvisation, no ideation technique
(Fisher & Amabile, 2009)	case study
(Forgeard, 2011)	no ideation technique
(Fornell & Menko, 1981)	conceptual, no manipulation of ideation technique
(Franklin & Cornell, 1997)	Disease related
(Friedman & Förster, 2005)	no ideation technique, motivational cues
(Friedman et al., 2003)	no ideation technique
(Froehlich & Hoegl, 2012)	survey
(Fuji, 2016)	case study
(Garfield, Taylor, Dennis, & Satzinger, 2001)	statistical infrequency as novelty measure
(Gentner & Kurtz, 2006)	no manipulation of ideation technique. no results provided
(Gentner & Smith, 2012)	analogy, but no manipulation of ideation technique, no results provided
(Giampietro & Cavallera, 2007)	correlational, no ideation technique
(Gibson, 2015)	Master's thesis, not peer-reviewed
(Gielnik et al., 2012)	no manipulation of ideation technique but manipulation of information amount
(Gist, 1989)	no idea quality
(Goldenberg & Wiley, 2011)	Review
(Goldschmidt, 2001)	provide no new data, but report data from Casakin & Goldschmidt 1997, 1999, and 2000
(Goldstein, Revivo, Kreitler, & Metuki, 2010)	no ideation technique, but hand contractions
(Gomes et al., 2006)	no ideation technique, a computation retrieval of analogies
(González, Campos, & Pérez, 2010)	correlational, no manipulation of ideation technique
(Green et al., 2012)	no manipulation of ideation technique, no creative outcome
(Guegan, Buisine, Mantelet, Maranzana, & Segonds, 2016)	statistical infrequency, no rating
(Hamlen, 2014)	children sample

IDEAS ARE CRAFTWORK

(Hao, Yuan, Hu, & Grabner, 2014)	no ideation technique, but arm extension and contraction and body posture
(Harvey, 2013)	no ideation technique (brainstorming), diversity was manipulated
(He & Wong, 2011)	school children, gender differences
(Hechter & Guy, 2010)	no manipulation of ideation technique, no control group, qualitative, no quantitative results provided
(Hee Kim, 2006)	children sample, no ideation technique, correlation, factor analysis of TTCT
(Heilman et al., 2003)	no quantitative results, no ideation technique, review
(Herring, 2011)	no treatment, interviews with designers
(Heslin, 2009)	no manipulation of ideation technique, conceptual paper on benefits of brainwriting over brainstorming, no quantitative results
(Hipple, 2012)	no manipulation of ideation technique, TRIZ technique and principles described, no data
(Hofstadter, 2001)	no data, no manipulation of ideation technique, description of analogy technique
(Hong & Milgram, 1995)	Children Sample
(Hong & Milgram, 2010)	no manipulation of ideation technique, surveys and tests
(Hong, Peng, O'Neil, & Wu, 2013)	children sample, no manipulation of ideation technique
(Howard, Dekoninck, & Culley, 2010)	case study, no manipulation of ideation technique
(Hsiao & Chou, 2004)	case study
(Hu, Ridong, Wu, Yi-Yong & Shieh, 2016)	no idea quality
(Huang et al., 2013)	no ideation technique, fmri scans of brain during creative and uncreative tasks
(Ilevbare, Probert, & Phaal, 2013)	no manipulation of ideation technique: a survey on TRIZ usage
(Jalil, 2007)	review, no quantitative data, no ideation technique
(Jin & Chusilp, 2006)	no manipulation of ideation technique but additional or no constraints on the design problem
(Kao, 2014)	no treatment, but survey with analogical thinking
(Kao, 2016)	no experimental treatment, survey, analogical thinking
(Karimi, Biemans, Lans, Aazami, & Mulder, 2016)	a whole creative thinking course - ideation techniques not specified
(Karni & Shalev, 2004)	not experimental, review
(Karpova, Marcketti, & Barker, 2011)	no manipulation of ideation technique, no control group
(Kashani-Vahid et al., 2017)	children sample
(Kavadias & Sommer, 2009)	meta-analysis, no manipulation of ideation technique
(Kenett, Anaki, & Faust, 2014)	no manipulation of ideation technique
(Kershaw & Peterson, Rebecca L., Bhowmick, Sankha, 2016)	no manipulation of ideation technique as iv.
(Lai Keun & Hunt, 2007)	one-group, dancing
(Khandwalla, 2006)	no data provided, conceptual paper
(Kim & Jeong, 2008)	plagiarism?
(Kim, 2011, 2011)	no treatment, no ideation, comparison of many years of TTCT -
(Hee Kim, 2006)	no treatment, no ideation, TTCT, creativity = two dimensional
(Kirk & Lewis, 2017)	children sample
(Kleibeuker et al., 2017)	children-sample
(Klimas-Kuchtowa, 1993)	no treatment, correlation between creativity and musical talent

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(Knoll & Horton, 2011)	no statistical results provided
(Kohn & Smith, 2011)	no ratings of novelty, but statistical infrequency
(Kokotovich, 2008)	no manipulation of ideation technique - all students used non-hierarchical mind-maps
(Koutsoupidou & Hargreaves, 2009)	children-sample
(Kowaltowski, Bianchi, & Paiva, 2010)	not experimental
(Kratzer & Lettl, 2008)	children, no control group, no ideation technique
(Krumm, Arán Filippetti, Lemos, Koval, & Balabanian, 2016)	no treatment, correlation of TTCT scores
(Krumm, Aranguren, Arán Filippetti, & Lemos, 2016)	no treatment, validation of TTCT
(Ku & Kuo, 2015)	no control group, qualitative/quantitative, case study, no manipulation of ideation technique
(Kudrowitz & Wallace, 2013)	no manipulation of ideation techniques, rather idea evaluation
(Kuo, Chen, & Hwang, 2014)	no idea quality
(Kurtzberg, 1998)	correlation of TTCT subtest and negotiation joint gain, creativity and negotiation gain are correlated
(Lai Keun & Hunt, 2007)	children sample
(Lamm & Trommsdorff, 1973)	Review
(Larey & Paulus, 1999)	no idea quality
(Lavery, 1974)	Circumrelator - concept. no data provided
(Lee & Therriault, 2013)	no treatment, correlation study
(Lee, 2002)	no treatment, no ideation technique
(Lee, Therriault, & Linderholm, 2012)	no treatment, correlation
(Leung et al., 2014)	no manipulation of ideation technique but manipulation of mood
(Lilien, Morrison, Searls, Sonnack, & Hippel, 2002)	qualitative, field experiment, grounded theory, no control group
(Linsey et al., 2012)	no idea quality
(Litchfield, 2009)	no idea quality
(Liu, 1998)	children sample
(Liu, He, & Li, 2015)	no treatment, no ideation technique, but correlation
(Liu et al., 2013)	no treatment, no ideation technique, but correlation
(Loewenstein & Mueller, 2016)	no ideation technique manipulated
(Lopes & Pinto-Gouveia, 2013)	hallucination-predisposition, disease-related
(Lu et al., 2017)	no idea generation technique, manipulation of intercultural dating
(Lunke & Meier, 2016)	introduction of a new test for artistic creativity
(Madore, Jing, & Schacter, 2016)	no ideation technique
(Madura Ward-Steinman, 2008)	no treatment, no ideation technique, correlation of different questionnaires
(Mak & Shu, 2008)	no quantitative data
(Mann & Cadman, 2014)	boring task: copying telephone numbers - is not ideation technique
(Matud, Rodríguez, & Grande, 2007)	Gender Differences on Creativity Scores TTCT-subset)
(Mayer & Greeno, 1972)	no creativity-related output
(McGrath, Bresciani, & Eppler, 2016)	no ideation technique - but the finishedness of visual icons was tested
(Medeiros, Steele, Watts, & Mumford, 2017)	no ideation technique, manipulated the constraints on the problem finding, on ideation and on evaluation.
(Meinel & Voigt, 2016)	Telephone Interviews on Usage of Ideation Techniques
(Memmert, 2006)	sports program

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(Metcalf, Hess, Danes, & Singh, 2012)	no ideation technique
(Metzl, 2009)	Hurricane Katrina-survivors responded to questionnaires on creativity and resilience and others, no treatment, no ideation technique
(Michaelis & Markham, 2017)	Interviews
(Michinov, 2012)	no quality ratings, non-redundant ideas
(Möller, Marshall, Wolf, Fehm, & Born, 1999)	EEG comparison in creative tasks, no treatment, no ideation techniques
(Müller et al., 2013)Müller et al. 2013	Modafinil test, no ideation technique
(Mumford et al., 2003)	conceptual paper, Review
(Nagasundaram & Dennis, 2016)	no quantitative results provided
(Navarrese, Yauch, Goff, & Fonseca, 2014)	no manipulation of ideation technique
(Navarrete, 2013)	game-design, one group, qualitative, case study, children sample
(Nelson, Wilson, Rosen, & Yen, 2009)	conceptual paper, proposal for new ideation effectiveness measures
(Nemeth & Kwan, 1985)	word association task, not primarily creativity performance
(Nemeth, Brown, & Rogers, 2001)	not primarily creative output, but decision making
(Nemeth & Nemeth-Brown, 2003)	no quantitative data provided
(Nemeth, Personnaz, Personnaz, & Goncalo, 2004)	no idea quality
(Noble, 1982)	no data provided, conceptual paper
(Nogueira, Almeida, & Lima, 2017)	no treatment, no ideation technique, factor analysis of Test for Creative Thinking-Drawing Production TCT-DP)
(O'Connor, Nemeth, & Akutsu, 2013)	no ideation technique, but primed for "malleability of creativity" - the believe that creativity can be enhanced
(Offner et al., 1996)	no idea quality
(Oxman, 2004)	no quantitative data provided
(Ozkan & Dogan, 2013)	no idea quality
(Pahl et al., 2007)	handbook on engineering design
(Pang, 2015)	no results provided, conceptual paper
(Park, Kim, Park, Goh, & Pedro, 2017)	survey, not experimental
(Park, Kirk, & Waldie, 2015)	no treatment, no ideation technique, fMRi study and correlation between creativity task and schizotypy questionnaire scores
(Passig & Cohen, 2013)	no treatment, no ideation technique, questionnaire validity testing
(Paulus & Brown, 2003)	no data provided
(Paulus & Dzindolet, 1993)	no idea quality
(Paulus & Nijstad, 2003)	no quantitative results provided
(Paulus & Yang, 2000)	no idea quality
(Perkins, 1983)	conceptual paper, no quantitative data provided
(Perry & Karpova, 2017)	no control group, creative outcome: TTCT scores, no ideation scores
(Pinsonneault, Barki, Gallupe, & Hoppen, 1999)	Number of unique ideas was number of non-redundant ideas no quality-rating)
(Pringle & Sowden, 2017a)	no treatment, no ideation technique
(Pringle & Sowden, 2017b)	no treatment, think aloud study of professional garden designers
(Proudfoot, Kay, & Koval, 2015)	no ideation technique, gender-bias related experiments
(Proudlove, 1998)	no quantitative results provided, no manipulation of ideation technique

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(Proudlove, 1998)	No manipulation of ideation technique, correlation: survey
(Rabanos & Torres, 2012)	children sample
(Raghavan, 1990)	no innovation or creativity related outcome
(Randles, 2009)	semi-structured interviews, n=2, no treatment, no ideation technique, phenomenological qualitative research
(Rasidi et al., 2015)	survey, not experimental
(Rasoli & Jenaabadi, 2015)	children sample
(Reinig et al., 2007)	no manipulation of ideation technique - showed a line indicating the performance of an imaginative other group
(Reinig & Briggs, 2008)	no manipulation of ideation technique
(Riga & Chronopoulou, 2014)	children sample
(Ritchey, 2011)	no data provided, no manipulation of ideation technique
(Robson & Rowe, 2012)	no treatment, no ideation technique, one-group, kindergarten children observation
(Robson, 2014)	no treatment, no ideation technique, development of an observation led approach of children's creative thinking
(Rook, 2014)	color red is no ideation technique, appetite-aversion paradigm Maze-mouse-owl) is not an ideation technique either
(Roskos-Ewoldsen, Black, & McCown, 2008)	no ideation technique, no treatment, correlation
(Rudowicz, 2016)	no treatment, no ideation technique, explored the applicability of the Test of Creative Thinking–Drawing Production TCT-DP)
(Ruiz, Bermejo, Ferrando, Prieto, & Sainz, 2014)	no treatment, no ideation technique, one-group, correlation of creativity, scientific and critical thinking on academic performance
(Runco & Mraz, 1992)	no manipulation of ideation techniques, but research focusing on different scoring methods
(Runco, Millar, Acar, & Cramond, 2010)	50-year follow-up of a longitudinal study E. Paul Torrance Initiated
(Saeki, Fan, & Dusen, 2001)	cross-cultural correlational study, no treatment, no ideation technique
(Sajjadi-Bafghi, 2007)	children sample
(Sak & Oz, 2010)	children
(Santos, Uitdewilligen, & Passos, 2015)	correlational, no treatment, no ideation technique
(Sassenberg et al., 2017)	no idea quality
(Satzinger et al., 1999)	no idea quality
(Sauder & Jin, 2013)	not experimental, but protocol analysis, no creative outcome measures, but BICB test scores and collaboration activity
(Sauder & Jin, 2014)	no ideation technique, protocol analysis, no statistical differences
(Sauder & Jin, 2016)	qualitative, case study
(Saulais & Lecante, 2016)	no quantitative data provided, theoretical paper
(Sawyer, 2011)	Review
(Sayed & Mohamed, 2013)	Gender Differences, TCTT-Drawing Production, Survey, children sample, correlational study, no ideation technique, no treatment
(Schmajuk, Aziz, & Bates, 2009)	no primary study, computer simulations
(Schmitt et al., 2012)	statistical infrequency as uniqueness criterion
(Scholer, Lemétayer, & Schiltz, 2015)	disease-related, psychopathologic
(Schreiner, 2016)	no experimental data, cross sectional survey data, no idea generation but focus on idea implementation and different leadership roles and Team property factors in that phase
(Schulthess, 2014)	no idea quality

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(Scibinetti, Tocci, & Pesce, 2011)	no treatment, no ideation technique, correlation between moving and creativity
(Scopelliti, Cillo, Busacca, & Mazursky, 2014)	no manipulation of ideation technique, rather financial constraints on the task
(Scott et al., 2004)	Review on Creativity Training Effectiveness
(Segura, Vidal, & Rostami, 2016)	treatment: bodystorming, no control group, qualitative
(Shah et al., 2001)	no primary data reporting, collection of previous studies on C-sketch and other techniques, survey-data
(Shamay-Tsoory, Adler, Aharon-Peretz, Perry, & Maysseless, 2011)	correlational, neuro imaging study, lesions in right or left hemisphere affecting creativity
(Shahrin, Toh, Ho, & Wong, 2002)	no treatment, no ideation techniques, children sample
(Shawareb, 2011)	children
(Shi, Dai, & Lu, 2016)	correlational study, no treatment, no ideation technique, children
(Shigenobu, Yoshino, & Munemori, 2007)	no idea quality
(Shih, 2011)	survey
(Sierra-Pérez, López-Forniés, Boschmonart-Rives, & Gabarrell, 2016)	no manipulation of ideation technique against other... no control group, case study
(Silvia et al., 2008)	no manipulation of ideation technique
(Sitorus & Masrayati, 2016)	qualitative, grounded theory
(Smith, 1998)	Review on Active Ingredients of Ideation Techniques, no quantitative data
(Smith, 2008)	no manipulation of ideation technique
(Smith, Ward, & Schumacher, 1993)	no manipulation of ideation technique, but constraining effects of examples design fixation)
(Sosik, Avolio, & Kahai, 1998)	statistical infrequency as originality measure
(Starchenko, Bekhtereva, Pakhomov, & Medvedev, 2003)	positron-emission tomography, dependent variable is not creativity
(Storm & Patel, 2014)	No idea generation technique
(Studente, Seppala, & Sadowska, 2016)	plants - no ideation technique
(Szobiova, 2006)	no manipulation of idea generation technique, a correlational study between Big Five and Creativity
(Tasaki et al., 2016)	no quantitative data provided, qualitative
(Taylor, 1969)	no data provided
(Thoma & Huebner, 2013)	suicidal ideation
(Thompson, 1965)	no manipulation of ideation technique
(Thornhill-Miller & Dupont, 2016)	no quantitative data provided, more a questionnaire among professional innovation consultants
(Timbadia & Khavekar, 2017)	Review, no manipulation of ideation technique
(Tseng, Moss, Cagan, & Kotovsky, 2008)	statistical infrequency: novelty
(Tu, Kuan, Li, & Su, 2017)	disease-related
(Ulger, 2015)	no treatment, no ideation technique
(Valacich, Dennis, & Nunamaker, 1992)	task was to identify all people, groups, and organizations affected by a proposal requiring all business students to have individual access to a personal computer not really creative task)
(van de Ven, A. H. & Delbecq, 1974)	not truly a creative task: defining the job description of part-time student dormitory counselors who reside in and supervise student living units of university owned or approved housing.
(van der Lugt, 2002)	no idea quality

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(Verhaegen, D'hondt, Vandevenne, Dewulf, & Duflou, 2011)	no manipulation of ideation technique, rather a computer based way of finding candidates for design-by-analogy, no experimental design
(Vernon et al., 2016)	review
(Vernon & Hocking, 2016)	problem construction task, not creative ideation
(Vissers & Dankbaar, 2000)	no manipulation of ideation technique, review
(Vissers & Dankbaar, 2008)	no manipulation of ideation technique, review
(Wang, 2012)	correlation between hours spent on writing and reading WITH creativity, no treatment, no ideation technique
(Wang et al., 2017)	disease-related
(Wechsler, 2006)	validity testing of TTCT
(White & Shah, 2016)	no technique, comparing ADHD and healthy subjects, disease related
(White, Wood, & Jensen, 2012)	lacking scientific rigor
(Wierenga & van Bruggen, 1998)	no quantitative data provided
(Wodehouse & Ion, 2012)	no statistical results provided
(Xu & Brucks, 2011)	neuroticism and mortality salience
(Yang & Hung, 2015)	emotion induction, but not ideation technique, no creative output measure
(Yarbrough, 2016)	TTCT assessment, validity testing
(Yin, Vanides, Ruiz-Primo, Ayala, & Shavelson, 2005)	no creativity-related outcome
(Yuan, 2015; Zabelina, D. L., Colzato, L., Beeman, M., & Hommel, B., 2016)	correlation, no treatment, no ideation technique
(Zabelina, D. L. et al., 2016)	no ideation technique
(Zabelina, D., Saporta, A., & Beeman, M., 2016)	no manipulation of ideation technique
(Zitek & Vincent, 2015)	no ideation technique
(Zmigrod, Zmigrod, & Hommel, 2015)	correlation, no treatment, no ideation technique

APPENDIX II LITERATURE REVIEW SUMMARY

Table 35: Included studies overview - samples, sample sizes, tasks, raters and idea quality metrics.

Study	Sample	N	Tasks	Raters	Idea Quality
(Barki & Pinsonneault, 2001)	undergraduate business students	192	Improve tourism to Montreal	12 expert judges	<ul style="list-style-type: none"> • feasibility • effectiveness • average idea quality • number of good ideas above average quality)
(Baruah & Paulus, 2008)	undergraduate psychology students	165	Improve university	2	<ul style="list-style-type: none"> • originality
(Baughman & Mumford, 1995)	undergraduate psychology students	155	Combine categories defined by the exemplar lists to generate a new category that would account for all presented exemplars, write a label and list additional exemplars	5 psychologists	<ul style="list-style-type: none"> • originality • quality
(Burgers et al., 2015)	online community participants	152	Rate advertisements		<ul style="list-style-type: none"> • perceived complexity • brand attitude • perceived creativity • ad appreciation • purchase intent
(Bushe & Paranjpey, 2014)	employees from a Midwest urban transit organization	76	Ideas for an employee recognition program	5	<ul style="list-style-type: none"> • Novelty / Innovative • Implementation/Interestig • Practicability
(Casakin & Goldschmidt, 1999)	architectural designers / advanced architecture students / beginning architecture students	61 / 23 / 21	Architecture design problems: 'The Prison'; 'The Viewing-Terrace' and 'The Dwellings.'	3	<ul style="list-style-type: none"> • Quality of design ideas
(Chan et al., 2011)	predominantly mechanical engineering undergraduate students	153	low cost, easy to manufacture, and portable device to collect energy from human motion	2	<ul style="list-style-type: none"> • the extent to which solution features were transferred from examples, • quantity of ideation, • breadth of search through the space of possible solutions, • quality of solution concepts

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					<ul style="list-style-type: none"> novelty of solution concepts
(Chulvi et al., 2013)	designers and engineers enrolled on a PhD design program or experienced professional designers	48	design a new office table for alternating a standing and sitting position	6 experts	<ul style="list-style-type: none"> creativity novelty and utility)
			design a drawing table occupying as little space when not in use		
(Chulvi et al., 2012)	designers and engineers in a design PhD program, or working as professional designers	12	design a system to bring together and to hide the wires in a table	17 experts	<ul style="list-style-type: none"> creativity novelty x usefulness)
			design a tubular map case for only by one extraction and introduction of maps		
			design a table for alternating stand up and sit down position		
(Colombo et al., 2015)	young adults	45	AU alternative uses task		<ul style="list-style-type: none"> originality
(Culvenor & Else, 1997)	engineering undergraduate students	42	design risk control options		<ul style="list-style-type: none"> quality originality)
	Study 1: professional product developer	1			
(Dahl & Moreau, 2002)	Study 2: undergraduate engineering students	106	design a new product that will meet the needs/solve the problems of the commuting diner	2	<ul style="list-style-type: none"> originality perceived customer value willingness to pay)
	Study 3: engineering students	119			
(Davis & Roweton, 1968)	undergraduate educational psychology	16	List changes for a thumbtack / kitchen sink	2	<ul style="list-style-type: none"> above median creativity percent of ideas above median creativity
(Dennis et al., 2013)	undergraduate business students	175	increase tourism within the state.		<ul style="list-style-type: none"> novelty, workability relevance
			ideas to reduce pollution		
(Dumas & Schmidt, 2015)	graduate students, mechanical engineering	44	Freezing LED traffic lights		<ul style="list-style-type: none"> originality

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(Dunnette et al., 1963)	research personnel from one of the larger laboratories of Minnesota Mining and Manufacturing Co. (3M)	48	advantages and disadvantages of an additional thumb		
	persons employed with 3M's central staff Advertising Department	48	teacher decline – education problem	2	<ul style="list-style-type: none"> mean idea quality
(Eppler & Hoffmann, 2012)	experienced managers enrolled in a part-time executive MBA program (graduate students)	45	create a business model		<ul style="list-style-type: none"> creativity willingness to adopt the developed model
(Fink et al., 2010)	adult students	39	original, unusual uses of conventional everyday objects		<ul style="list-style-type: none"> originality fluency
(Gilhooly et al., 2013)	100 students undergraduates and graduates 20 from general population	120	AUT Brick	2	<ul style="list-style-type: none"> creativity of ideas
(Goldenberg et al., 2013)	undergraduate psychology students	572	improving their university	6	<ul style="list-style-type: none"> practicality - number of highly practical ideas
(Goldenberg et al., 1999a)			produce ideas for baby ointment, produce ideas for mattresses	3 professionals	<ul style="list-style-type: none"> originality value
(Goldenberg et al., 1999b)	undergraduate students	Study3: 60 Study 4: 54	advertisement for dandruff shampoo, diet products, sneakers	1 judge	ranked 5 best ideas in each product category
(Haats, 2012)	Industrial Design & Psychology	24	How to raise awareness of modern-day slavery around the Carleton University Campus? How to enhance the dine-in experience of this new restaurant venture?	CAT ⁵	<ul style="list-style-type: none"> above mean-quality number of good ideas
(Haley, 2014)	employees from an automotive supplier	62			<ul style="list-style-type: none"> idea quality (feasibility, only)

⁵ CAT – Consensual Assessment Technique (Amabile (1983))

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(Hender et al., 2002)	undergraduate students, business computer-systems	135	restaurant wants to retain customers	2	<ul style="list-style-type: none"> creativity (originality & paradigm relatedness)
(Herrmann & Felfe, 2014)	undergraduate students teaching & educational science	186		7	<ul style="list-style-type: none"> creativity average qualitative creativity highest qualitative creativity per subject
(Huber, 2014)	online community participants (students also)				<ul style="list-style-type: none"> novelty feasibility relevance comprehensiveness Average Idea Quality
(Hung et al., 2012)	undergraduate students	113	design a “creative invention”	4	<ul style="list-style-type: none"> originality appropriateness feasibility elaboration
(Jaco et al., 2014)	students or staff members	48	swiss army knife of the future		<ul style="list-style-type: none"> originality
(Jung et al., 2007)	business students	411	university’s parking problem	3 expert judges	number of high quality ideas quality score of these ideas
(Karni & Shalev, 2004)	engineers, doctors, architects, teachers and students	24	Velcro-Problem - new uses for adhesive strips African woman problem providing water without injury flashlight problem - developing new uses for specialty flashlights cocktail problem - enjoying the food and handshaking		<ul style="list-style-type: none"> quality: average quality number of “very creative” ideas proportion of “very creative” ideas quality of the best idea
(Keshwani et al., 2017)	undergraduate studies in engineering Study 1: 15 first year Master in Design students Study 2: 23 first and second year Master in Design students Study 3: 8 (1 professor, 7 Master in Industrial Design Engineering) Study 4: Master in Design and Innovation, a PhD		reduce the consequences of a car collision window shades that protect from sun but allow the view	decision tree	<ul style="list-style-type: none"> novelty

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			student in Architecture, two students form Mechanical Engineering		
(Kilgour & Koslow, 2009)	49 advertising creatives & 65 account executives, 44 students		three creative campaigns for a hypothetical brand (insecticide advertisement)	4	<ul style="list-style-type: none"> • Appropriateness (how on strategy an idea)
(Kohn, Paulus, & Choi, 2011)	Exp 1: 120 undergraduate psychology students Exp 2: 130 undergraduate students from an introductory psychology course		ideas to improve the university	2	<ul style="list-style-type: none"> • number of categories • relatedness of categories • novelty • utility • novelty of combination • feasibility • impact
(Kohn, Paulus, & Korde, 2011)	Exp. 1: 56 undergraduate students participated in this experiment Exp. 2 83 undergraduate students		additional thumb	2	<ul style="list-style-type: none"> • originality • fit
(Kristensson & Norlander, 2003)	students	96		8	<ul style="list-style-type: none"> • originality (the newness of an idea) and • elaboration (the amount of detail in ideational responses).
(Levine et al., 2017)	students	126	friendlier atmosphere for student and faculty healthier life style		<ul style="list-style-type: none"> • idea quality (number of high-quality ideas)
(Lin & Wu, 2016)	university and college students	186	no task specified		<ul style="list-style-type: none"> • elaboration • uniqueness
(Litchfield et al., 2011)	college freshmen	147	transition from high school to college	2 students	<ul style="list-style-type: none"> • creativity • novelty • effectiveness • practicality
(López-Mesa et al., 2009)	Engineering Design PhD students or doctors	17	tubular map case for maps		<ul style="list-style-type: none"> • novelty • quality • variety
(Malycha & Maier, 2017a)	undergraduate students, from psychology, law, educational science, history, business	121	elephant-toy baby-stroller		<ul style="list-style-type: none"> • originality
(Malycha & Maier, 2017b)	undergraduate students, psychology, educational science, law, sports, sociology	80	product improvement task		<ul style="list-style-type: none"> • originality

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(Manning, 1998)	Exp. 1 182 students from Texas Tech University, psychology or business management, Exp. 2 24 additional psychology students		ideas for a recreation or medical center	2	<ul style="list-style-type: none"> • quality (creativity and feasibility) • number of 7 or above scoring - top ten list
(Masseti, 1996)	MBA students	44	devise solutions to the homeless problem faced by cities and society		<ul style="list-style-type: none"> • novelty • value • creative performance
(Mathew, 2013)	Exp. 1: 12 engineering students (grad. level) Exp. 2: 12 engineering grad. level students		Design a car seating mechanism that will place the occupant in the desired travel window Design a mechanism to accept used aluminum drink cans and store the crushed ones	2	<ul style="list-style-type: none"> • Novelty • Variety • Quality
(McGrath, 2015)	middle or upper managers	72	How could we use social media for the implementation of a business strategy?		<ul style="list-style-type: none"> • originality • feasibility
(Michinov, 2012)	undergraduate psychology students	41	AUT shoe box		<ul style="list-style-type: none"> • quality of ideas (originality)
(Moon & Han, 2016)	engineering students	40	generate as many creative ideas for IoT products or services for wellness as possible		<ul style="list-style-type: none"> • variety • novelty • relevance • feasibility
(Morgan, 1996)	undergraduates	90	help ease the transition to college in terms of social issues	3	<ul style="list-style-type: none"> • idea quality • usability (feasibility & outcome of implementation)
(Nijstad et al., 2002)	students	63	help preserve the environment	2	<ul style="list-style-type: none"> • diversity of ideas
(Oppezzo & Schwartz, 2014)	Exp. 1: 48 undergraduate psychology students Exp. 2: 48 psychology students Exp. 3: 40 students Exp. 4: 40 students		AUT		<ul style="list-style-type: none"> • appropriateness • appropriate novelty - final operationalization of creativity
(Parnes & Meadow, 1959)	undergraduate students	52	AUT		<ul style="list-style-type: none"> • uniqueness • value • number of good responses

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(Paulus et al., 2013)	undergraduate students psychology	162	improve their university	2	<ul style="list-style-type: none"> quality (originality & utility)
(Paulus et al., 2015)	Exp. 1: 57 of the employees of a high-technology company in Israel Exp. 2: same as in study 1		excellent efficient team mobile device	2	<ul style="list-style-type: none"> originality utility number of good ideas
(Pissarra & Jesuino, 2005)	students	150	increase the number of foreign tourists in Portugal		<ul style="list-style-type: none"> quality diversity
(Polman & Emich, 2011)	Exp. 1: 262 undergraduates Exp. 2a: 65 undergraduates Exp. 2b: 516 undergraduates Exp. 3: 137 undergraduates		ideas for a gift	2	<ul style="list-style-type: none"> number of creative gift ideas
(Potter & Balhazard, 2004)	senior undergraduate students from a business	82	reduce the number of traffic accidents involving bicycles and motor vehicles	bicycle-patrol officer	<ul style="list-style-type: none"> number of high quality ideas per minute and for the complete session (comprised creativity effectiveness, feasibility
(Putman & Paulus, 2009)	undergraduate psychology students	120	improve the university		<ul style="list-style-type: none"> feasibility of the top 5 ideas originality combined measure of feasibility and originality
(Rietzschel, Nijstad, & Stroebe, 2007)	Study 1: 93 undergraduate students of psychology Study 2: 148 undergraduate students		improve or maintain one's health	2	<ul style="list-style-type: none"> originality feasibility
(Rietzschel, 2005)	Study 1: 138 undergraduate students Study 2: 30 psychology students Study 3.1: 93 psychology students Study 3.2: 94 undergraduate students Study 3.3: 148 undergraduate students Study 4.1: 55 psychology students Study 4.2: 90 students Study 4.3: 105 students		improve or maintain health	2	<ul style="list-style-type: none"> originality feasibility high-quality ideas (above mean in both O and F)
(Schütmaat, 2014)	Exp. 1: 120 undergraduate students Exp. 2: 80 stud.		AUT Paperclip & Creation of an Advertisement for a Paperclip		<ul style="list-style-type: none"> originality (novelty) seldom

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Exp. 3: 120 undergraduate stud.						
(Selart & Johansen, 2011)	HR professionals	70	make suggestions about how a minor amount of money (20,000 Swedish Crowns) could be saved			<ul style="list-style-type: none"> • innovativeness of ideas
(Shalley, 1991)	undergraduates business administration	270	problems presented to the personnel director of a steel manufacturing company	3		<ul style="list-style-type: none"> • creativity
(Škerlavaj et al., 2014)	undergraduates in an HRM course	123	printed newspaper job advertisement	2		<ul style="list-style-type: none"> • innovativeness
(Sun et al., 2013)	students	10	designing a chair	3		<ul style="list-style-type: none"> • quality
(Sun et al., 2014)	students, industrial design	41	facilities that enhance communication in a park			<ul style="list-style-type: none"> • idea differentiation
(Sun et al., 2016)	Exp. 1: 40 participants from Southwest University, China		Product improvement task	3		<ul style="list-style-type: none"> • originality of ideas
	Exp. 2: 15 new participants		AUT			
(Taylor et al., 1958)	psychology undergraduates	96	additional thumb-problem	3		<ul style="list-style-type: none"> • effectiveness, • probability, • generality, • feasibility • significance
			increase tourism from Europeans to the city			
(Toh & Miller, 2013)	undergraduate engineering design course	59	ensure quality of education in case of decline in teachers (education problem)	2		<ul style="list-style-type: none"> • novelty, • quality, • variety
			innovative, product that can froth milk in a short amount of time			
(Toh, 2014)	Study 1: 76 students Study 2: 76 students engineering		redesigning an electric toothbrush for increased portability	2		<ul style="list-style-type: none"> • feature novelty • design novelty • participants novelty
(Tyl et al., 2015)	industrial designers specialized in eco-design	24	Reduce the environmental impact of an outdoor lam	3		<ul style="list-style-type: none"> • originality • environmental relevance
(van Eijs, 2016)	students	252	How can we engage more customers?	1		<ul style="list-style-type: none"> • originality • feasibility
(Wang et al., 2009)	EMBA students	50	New recruiting ways for insurance	2		<ul style="list-style-type: none"> • originality • feasibility • elaboration

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(Warren & Davis, 1969)	psychology undergraduate	30	Changes for a door knob	2	<ul style="list-style-type: none"> • number of good ideas • above mean originality • above mean practicality • above mean both, o and p
(Wilson, 2008)	Study 1: 26 mechanical engineering students Study 2: 21 mechanical engineering students		portability and effectiveness for a leg immobilization device designed for use in the wilderness	experimenter	<ul style="list-style-type: none"> • novelty • variety
(Wu et al., 2013)	students undergraduate Business Planning	137	develop a business plan	3	<ul style="list-style-type: none"> • innovation • completeness
(Yilmaz et al., 2010)	psychology undergraduate students	120	Redesign of a pair of salt and pepper shaker	3	<ul style="list-style-type: none"> • creativity • highly creative ideas (above 5 on a 7-point scale) • practicality
(Yu et al., 2014)	Exp. 1: 209 M-Turk Exp. 2: 145 M-Turk Exp. 3: 121 M-Turk		Design a product	2	<ul style="list-style-type: none"> • novelty • practicality • usefulness
(Ziegler et al., 2000)	psychology students	60	additional thumb	2	<ul style="list-style-type: none"> • originality • feasibility • effectiveness

APPENDIX III FOLLOW-UP QUESTIONNAIRE (IN GERMAN)

Fragebogen Innovationstraining "Ideen sind Handwerk"
Fragebogen von Julia Gumula, Universität Göttingen

In welcher Stadt haben Sie am Innovationstraining teilgenommen? _____

Aus welchem Gewerk sind Sie? _____

1. Wie fanden Sie das Innovationstraining?

- Ich fand das Innovationstraining gut.
- Ich fand das Innovationstraining schlecht.
- Ich fand das Innovationstraining weder gut noch schlecht.

2. Wie fanden Sie die Art und Weise der Präsentation, die Frau Gumula für Sie gehalten hat?

- Gefiel mir nicht.
- Weder gut noch schlecht.
- Gute Präsentationsweise.

3. Sie erinnern sich ja sicher noch an die Inhalte des Innovationstrainings. Frau Gumula stellte Ihnen den Innovationsprozess vor und zeigte Ihnen Ideenproduktionstechniken. Wie nützlich fanden Sie diese Inhalte?

- Das Wissen war nützlich.
- Das Wissen war nicht nützlich.
- Die Inhalten waren weder nützlich noch unnütz.

4. Was waren die drei größten Schwächen des Innovationstrainings aus Ihrer Sicht?

5. Was waren die drei größten Stärken des Innovationstrainings aus Ihrer Sicht?

6. Bitte vervollständigen Sie den Satz: Die Teilnahme am Innovationstraining war...

- Zeitverschwendung.
- weder gut noch schlecht.
- eine sinnvolle Investition meiner Zeit.

7. Würden Sie das Innovationstraining Ihren Kollegen und Kolleginnen empfehlen?

- Ja
- Nein

8. Inwiefern unterschied sich das Innovationstraining von Frau Gumula von solchen Trainings, an denen Sie normalerweise teilgenommen haben?

9. Was sind die drei wichtigsten Dinge, die Sie in dem Innovationstraining gelernt haben?

10. Wie schätzen Sie Ihr Wissen über Innovationsprozesse ein?

- Ich weiß, was Innovationsprozesse sind und wie man sie in Gang bringt.
- Ich weiß ein bisschen was über Innovationsprozesse.
- Ich weiß nichts über Innovationsprozesse.

11. Wie schätzen Sie Ihr Wissen über Ideenproduktionstechniken ein?

- Ich weiß nicht, wie man Ideen produziert.
- Ich weiß ein bisschen was über Ideenproduktionstechniken.
- Ich kenne Ideenproduktionstechniken und weiß, wie man sie anwendet.

12. Von dem, was Sie im Innovationstraining gelernt haben, was davon wenden Sie im Job tatsächlich an?

13. Nutzen Sie eine der Ideenproduktionstechniken, die Sie gelernt haben?

- Ich wende sie nie an.
- Ich hatte keine Zeit, keine Möglichkeit oder keine Notwendigkeit, sie anzuwenden.
- Ich habe sie schon angewendet.

13. a) und zwar hierfür: _____

14. Wenn Sie irgendwann einmal Ideen für eine Problemlösung oder für eine neue Dienstleistung oder ein Produkt oder Werbung bräuchten, was würden Sie tun? Bitte seien Sie ehrlich und antworten nicht damit, was Frau Gumula hören will.)

- Ich würde es so tun, wie ich es sonst auch immer getan habe, ohne Ideenproduktionstechniken.
- Ich würde jemand Anderen fragen oder mit der Ideensuche beauftragen.
- Ich würde eine der Ideenproduktionstechniken anwenden.

15. Denken Sie einmal darüber nach, wie Sie andere Vertreter Ihres Gewerks normalerweise wahrgenommen haben, bevor Sie am Innovationstraining teilgenommen haben. Wie hat sich Ihre Einstellung bezüglich Wettbewerb und Konkurrenz aber auch Kooperation und Netzwerken mit Ihren Kolleginnen und Kollegen durch das Training verändert?

16. Welche Ideen aus dem Workshop haben Sie umgesetzt?

17. Was hat Ihnen und Ihrer Firma das eingebracht?

18. Schätzen Sie einmal, wie viel Geld Sie oder Ihre Firma dadurch sparen konnten, bzw. wie viel Gewinn Sie dadurch erzielen konnten?

19. Welche Ideen hätten Sie gerne umgesetzt, konnten Sie aber nicht umsetzen?

20. Was waren die Gründe dafür, dass die Ideen nicht umgesetzt werden konnten?

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21. Gab es noch etwas Anderes, das Sie aus dem Innovationstraining für sich mitgenommen haben?

22. Was hat Ihnen und Ihrer Firma das eingebracht?

23. Schätzen Sie wieder, wie viel Geld Sie sparen, bzw. wie viel Gewinn Sie dadurch erzielen konnten?

24. Es folgen nun einige Aspekte, auf die das Innovationstraining möglicherweise einen Einfluss hatte. Sie dürfen diese Aufzählung bitte ergänzen. Zu jedem Aspekt markieren Sie, inwieweit Sie zustimmen oder nicht zustimmen. 1. Das Training hatte einen Einfluss auf die Qualität der Arbeit.

1	2	3	4	5
Stimme überhaupt nicht zu				Stimme voll und ganz zu

24. 2. Das Training hatte Einfluss auf die Produktivität.

1	2	3	4	5
Stimme überhaupt nicht zu				Stimme voll und ganz zu

24. 3. Auf die Qualität meines Arbeitslebens.

1	2	3	4	5
Stimme überhaupt nicht zu				Stimme voll und ganz zu

24. 4. Auf die zwischenmenschlichen Beziehungen

1	2	3	4	5
Stimme überhaupt nicht zu				Stimme voll und ganz zu

24. 5. Auf die Verkaufszahlen

1	2	3	4	5
Stimme überhaupt nicht zu				Stimme voll und ganz zu

24. 6. Auf die Arbeitsmoral

1	2	3	4	5
Stimme überhaupt nicht zu				Stimme voll und ganz zu

24. 7. Auf die Zufriedenheit mit meinem Beruf

1	2	3	4	5
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Stimme überhaupt nicht zu	Stimme voll und ganz zu
------------------------------	----------------------------

24. 8. Auf die Zuversicht mit Blick auf die Zukunft

1	2	3	4	5
Stimme überhaupt nicht zu				Stimme voll und ganz zu

24. 9. Wenn Sie weitere Aspekte kennen, auf die das Innovationstraining außerdem Einfluss hatte, können Sie hier einen Aspekt ergänzen:

24.9. Einfluss des Trainings auf den von Ihnen in der vorigen Frage ergänzten Aspekt:

1	2	3	4	5
Stimme überhaupt nicht zu				Stimme voll und ganz zu

24. 10. Ein zweiter Aspekt, den Sie ergänzen möchten?

24. 10. Einfluss des Trainings auf den von Ihnen in der vorigen Frage ergänzten Aspekt:

1	2	3	4	5
Stimme überhaupt nicht zu				Stimme voll und ganz zu

25. Jetzt kommt eine Herausforderung. Es gibt keine falschen Antworten! Sie sollen einfach mal schätzen. Und zwar: Schätzen Sie bitte einmal den Wert des Innovationstrainings für Ihre gesamte Laufbahn als Handwerksmeister_in ein. Wie viel Geld können Sie in der gesamten Zeit sparen? Wie viel Geld können sie mit dem Wissen, das Frau Gumula Ihnen vermittelt hat, verdienen? Schätzen Sie den Nutzen des Innovationstrainings in Euro:

26. Wie hoch waren Ihre Kosten für das Innovationstraining? Denken Sie an Ihren normalen Stundenlohn oder Tagessatz, den Sie in den 6 Stunden bekommen würden und an die Kosten für die Meisterschule. Schätzen Sie bitte Ihre Kosten für das Innovationstraining in Euro:

27. Welchen direkten Einfluss, glauben Sie, hatte das Innovationstraining auf Sie als Unternehmerin oder Unternehmer?

28. Hat sich Ihre Einstellung zu Forschung und Wissenschaft nach dem Innovationstraining verändert? Wenn ja, in welche Richtung?

29. Es gibt die Idee, Menschen, die vor Krieg geflohen und nach Deutschland gekommen sind, als Handwerker einzustellen bzw. im Handwerk auszubilden. Damit will man dem Fachkräftemangel entgegenwirken. Haben Sie von dieser Idee schon einmal gehört? Wie finden Sie diese Idee?

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30. Was muss passieren, damit diese Idee umgesetzt werden kann?

APPENDIX IV CODING SYSTEM OF THE QUALITATIVE FOLLOW-UP SURVEY DATA

<u>Level 1 Reactions</u>				
ITC related				
Something Different	Freedom in applying a method	Interesting Presentation	Structure of ITC	Atmosphere
War das erste Innovationstraining, im Bezug auf "normalerweise" sollte ein Ideenfindung nicht der norm Normal) sein. wenn etwas normal ist gibt es keine Ideen. Das normale ist kontraproduktiv	relativ spezielle Methodik, sondern immer allgemein, du musst so und so, Methodik beigebracht, wie man an die Sache geht	Dabei wurden wir mit in ihrer Präsentation hineingezogen sodass und nicht langweilig wurde.	Kleinere Teilnehmerzahl wäre besser gewesen	Teilweise etwas zu kindisch
Das Training ist nicht technisch	Man wird sonst in eine bestimmte Richtung gelenkt was bei Frau Gumula nicht so war da sie nicht vom Fach war. Das war aus meiner Sicht ein großer Vorteil.	Es wurde nicht langweilig	zu wenig Teilnehmer,	Entspannte Atmosphäre!!!
Abwechslung,	Wie wende ich es an und wo	Interessante Sichtweisen gelernt	War besser aufgebaut und sie ist auf die Personen eingegangen	Empfand es als eine recht lockere Freundschaftlich Grundstimmung. Kann aber auch daran gelegen haben das wir Probanden uns kannten.
	Wie setze ich was um	Präsentationsweise	Schnelle kreative Ideenfindung	Es war eine entspanntere Atmosphäre.
	Das Training bestärkt mich freier Individueller zu arbeiten!!!	Wurde nicht langweilig	Es lief ruhig und gezielt	Spaß
		Sehr tolle Präsentation	Gut erklärt	Lockerer Umgang miteinander!!!
		gute präsentation	strukturiert	kommunikatives Zusammenarbeiten,
		Gute Präsentation, nicht langatmig	Normale Trainings sind zu durchstrukturiert, anstatt dass man irgendwie folgen kann, Innovationstraining von Frau Gumula bot mehr Platz, um mehr Fragen nachzugehen	stärkt die Gruppendynamik
Legend		Besserer Gestaltung und Beispielgebung	und klar und deutlich	Improvisation
Question addressed Level 1			zeit für die bewältigung der Fragen	offen
Question addressed Level 2			Mehr Mitarbeit	lockere Atmosphäre

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Question addressed Level 3			Die Ideen vorzustellen und in der Gruppe zu vervollständigen!!!	Spielerisch
Question addressed Level 4			Gutes Feedback, Lösungsorientiert	Team Arbeit ist wichtig
Question addressed Societal Good			nicht so stumpf, vernünftig dargestellt	Spass und Wertschätzung

<u>Level 1 – Reactions towards the facilitator</u>
Facilitator Person
Frau Gumula hat eine besondere Art die Themen sehr gut und interessant rüber zu bringen!
sie ist auf die Personen eingegangen
Spontanität, Humor
sie ist auf uns eingegangen
persönlich auf die Teilnehmer eingegangen
Kompetenz,
Freundlichkeit
Ausdauer der Frau Gumula
, das sichere Auftreten von Frau gumula
Gut auf die Teilnehmer eingegangen
Sie ist sehr auf uns eingegangen
hat mich persönlich von Minute zu Minute neugieriger gemacht

<u>Level 1: Critique</u>			
Video recording	Activating Games	Target group	More time
Die Aufnahme auf Video / Ton	Die Mitmachaktion, wo sich jeder um einen anderen kreisen sollte hatte ich nicht mitgemacht).	Nicht für jeden geeignet	Unsere Gruppe hat sich mehr Zeit gewünscht!!!
	Gruppenspiele	Kaum Informationen im Vorfeld,	Es hätte mehr Zeit eingeplant werden müssen,
	Gruppenarbeit hat nicht so funktioniert	Zielgruppe hat wenig Erfahrung mit der Art und Weise des Trainings sollte viel öfters gemacht werden)	Zu wenig Zeit
		Was ich schwach fand, war, dass die Gruppe nicht gleichmäßig interessiert gewesen ist.	Ich fand es zu komprimiert, man hätte es zeitlich weiter ausbauen können, um die einzelnen Dinge intensiver bearbeiten zu können. Räumlichkeiten sind nicht schön gewesen.

<u>Level 2 Learning</u>	
Knowledge and Skills	
Development of skills	Knowledge
persönliche Entfaltung	Nein
Chancen Verbesserung	leider nein
den eigen Beruf zu reflektieren	Nein
Einfacher denken	nein
Horizontenerweiterung	Keine antwort
Interesse an Kunst ,Naturwissenschaften generell und Philosophie	Nein
Feedback das ich kreativ bin	Leider nicht
naja, dass alles immer ein Lernprozess, dass man sich nie zufrieden geben darf	Fakten
ja, unbewusst so, dass man Dinge anders betrachtet, schon ein anderer Blickwinkel als die Leute, die hier schon lange arbeiten. aber auch als Person eher innovativ, nicht so festgefahren	Informativ
Das man alles aufschreibt und dann sortiert	neues Input, wie man sich an Probleme, die technisch entstehen, wie man sich daran wagt, wie man da rangeht, die Methodik dazu
Man muss offen für Neues sein	Neue Ansetzte zur ideenfindung
	Es war alles wichtig
	positive Erfahrung
	Viele neue Eindrücke
	Leidenschaft und neue Erkenntnisse , Entsprechung

<u>Level 3 – Behavior and Change of Attitudes</u>			
Attitude towards others			
Attitude towards Academia	Within crafts	Across crafts	Towards others
Positive, würde wieder in dieser Form teilnehmen	also ich sag mal, der Konkurrenzdruck ist härter, als ich vorher angenommen, Kollegialität ist bei uns in unserer Ecke so gut wie nicht vorhanden. Da kocht jeder sein eigenes Süppchen. Leider	An einem Training, gewerkeübergreifend war neu	Unmotivierte andere Teilnehmer
schon auf jeden Fall, Wissenschaft generell ist ein wichtiger Aspekt, an der ich in Zukunft weiterarbeiten möchte	gar nicht	Sich mit anderen Gewerken Austauschen zu können!!!	Teilweise die probanten ;)

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Ja, positiv	Nicht sonderlich spürbar	na mit anderen Gewerken und anderen Firmen mal Sachen zusammen, sich mal zusammensetzt, ohne dass der andere den einen neidet	Gemeinschaft, Respektives Verhalten!
Immens	Unverändert	Verschiedenste Sichtweisen des Handwerks betreffend	Offenheit und Ideenfindung mit gleichgesinnten weckt Begeisterung.
Das Menschliche Herz funktioniert wie ein elektronischer Sender .	Unverändert		Das die Gruppe nur gemeinsam stark ist,
Wenn sie sich wie in meinem Fall durch grosses Leid gehen und es bewusst transzendieren und durchleben ohne die Verantwortung und Schuld in der äußeren Welt zu suchen und in der Liebe bleiben , löschen Sie ihr Ego und befreien sich aus alten Konditionierten Verhaltensmustern.	Nicht selbstständig	Keine Veränderung	Team Gespräche /
Sie erreichen dadurch eine höhere Bewusstseinsstufe und das erlaubt Ihnen ein tieferen Einblick. INNE-Haltung	Hat sich nichts geändert	Gar nicht!	Wenn man merkt, dass die Ideen nie umgesetzt werden, neuen Arbeitgeber suchen mit dem man besser kooperieren kann
Deutsche Sprache , Klare Sprache deutlich)	keine Veränderung	Nein	Meine Persönliche Einstellung, auch anderen gegenüber!
schon im Vorfeld aus Wissbegierde ,als Gesamtheit aus Naturwissenschaften ,Biologie , Geschichte , Kunst , Philosophie und aus Spirit immens .	Kann ich schlecht beurteilen ob sich etwas verändert hat	Nicht das ich wüsste	
Ich fände es einfach Interessant wie man Ideen Entwickeln kann.	ja, es hat sich nicht durch das Training geändert sondern durch meine jetzige Position, ständig neue Sachen und daher auch ständig im Austausch mit Monteuren, aber es liegt nicht an dem I-Training	garnicht,da mein gewerk kaum mit anderen gewerken zusammenarbeitet	
	Nicht gravierend	Habe schon verschiedene Vorstellungen , leider mangelt es mir noch an Zeit und Liquidität und durch meine Extrovertiertheit an Konzentration.	
	Hat sich nicht geändert.	Sehr verändert ins Positive vom Zusammenhalt!	
	Ideen verbessern immer wenn ein System obsolet ist	Das Miteinander Gefühl ist deutlich gestiegen	
	Wenn ich an Wettbewerb und Konkurrenz Denken)- MUß) brauch ich auch nicht über Kooperation reden. Paradox.	Ich muss mich von der Masse abheben aber darf doch nicht überheblich wirken .	
	Zu hoher Wettbewerb verfolgt nur ein Ziel. Billiglöhne	Ich gehe jetzt offener dran und versuche sie zu überzeugen	

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	, Verarmung und Verblödung der Bevölkerung!		
	Kollektives Bewusstsein , Konsum im Überfluss macht nicht glücklich sondern hemmt den Geist sich weiter Zu-ent-wickeln.	Jeder ist individuell und ich wünsche mir das alle die Möglichkeit nutzen sich frei entfalten zu können!!!	
	Das Problem ist das sich unsere materieller Vorschrift sich schneller entwickelt hat wie unser Geist und daraus Intuitives Handeln unterdrückt wird, die für die Weiterentwicklung der Evo-lution für neue In-no-va-tion-en NOT-wendig ist!	Mit Partner Stärker zusammenhalten, Mitbewerber akzeptieren	
	Ist gibt in der Materie bzw. im Universum nur eine Konstante Veränderung)	also es persönliche Empfindung, anhand der Kenntnisse weiß ich, diese Dinge sachlich jetzt auch zu betrachten	
	Liniäres Wachstum funktioniert nur bis zu ein gewissen Grad und dann entsteht ein Ausgleich. das Polaritätsprinzip . ein natürlicher Ausgleich .	Ich schaue mir meine Mitbewerber genauer an.	
	Das es nicht ausreicht den Kunden das selbe anzubieten was alle tun und ich aus großen Interesse Leidenschaft zur Kunst entwickelt habe, möchte ich in Zukunft eine Tugend für mein Handwerksunternehmen entwickeln.	Konkurrenz denken gibt es nicht.	

Level 3 – Behavior and Change of Attitudes		
Creativity and Free Wheeling, Different Perspectives		
Creativity	Different Perspectives	Freewheeling
Kreativität fördern	Dass man Dinge mit anderen Sichtweisen betrachten kann, man hat andere Sichtweisen aufgezeigt bekommen. Das fand ich gut.	Die Möglichkeit seinen Gedanken freien Lauf zu lassen!!!
Eigene Ideen konnte man gut umsetzen	Blickwinkel ändern, eigene Ideen entwickeln	Alles ist möglich
wo Ideen und Lösungen gesucht bzw. entwickelt werden, gibt es keine Schwächen	Aus keinen Ideen eines einzelnen kann eine große Idee zusammenwachsen	Den Kopf frei zu bekommen!!!
Neue Ansetzte zur ideenfindung	Dinge aus anderen Blickwinkeln zu sehen, Gedanken mal völlig freien Lauf zu lassen, dass man sich durchaus mit Leuten aus anderen GEwerken zusammenarbeiten lässt etwas Neues entstehen	Grenzenlos denken zu dürfen!!!
Andere Wege versuchen, nicht ausgeben, durchhalten		Das es kein falsch gibt
Kreativer denken		Eigenen Ideen Raum zu geben!!!

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Ideen sind Kreativtechniken vom Herzen .		dass man sich einen Kopf macht, auch andere Wege geht, nicht nur die, die man bisher kennt, sich intensiver auseinandersetzt mit dem anstehenden Problemen, alles ist nicht so schwer, wie man es am Anfang denkt
Intuition , künstlerisches denken, etwas neues schöpfen		Eigene Ideen produzieren und verbessern bis sie perfekt in das Bild passen
Für mich habe ich gelernt und mitgenommen wie ich alleine oder in der Gruppe Ideen entwickeln und weiter entwickeln kann.		Neue Wege der Ideenfindung,
Semantischer Sprung		man jede Idee berücksichtigen sollte, das man sowas auch öfters mal in den Alltag der firma einbringen sollte um produktiver zu werden
Höhere Kreativität		Um Ecken denken auch bei der Werbung
Effizientere Ideenfindung		es gibt keine falsche Antwort
Um das Universum zu verstehen müssen Sie in Frequenz, Schwingung, Energie denken bzw .Fühlen .Das menschliche Herz eine Quelle von Inspiration, Kreativität, Entwicklungen, Weisheit.		Nichts ist unmöglich
Kreativität, hat durch das Training, verstärkt im Arbeitsprozess Anwendung erhalten!!!		Man sieht Ideen von anderen Mitarbeitern mit anderen Augen
Kreativität und Ideen		geht nicht, gibt's nicht. dass man sich intensiv damit auseinandersetzen muss, um Lösungen zu finden, Ansätze
Kreativität		geht nicht, gibt's nicht. dass man sich intensiv damit auseinandersetzen muss, um Lösungen zu finden, Ansätze
		Vorschläge, auch wenn sie komisch klingen einfach auszusprechen

Level 4 Results

Application of Knowledge and Implementing Ideas

Advertising ideas	Application into Practice	Implementation	Would implement ideas	Reasons for not implementing
Es waren gute Ideen dabei, wie man für sein Werbung machen könnte	Praxisbezug fehlte	Eigene Ideen gut umzusetzen	Keine Ahnung	bin nicht erwerbstätig
gutes Leitbild, solvents Auftreten in der Öffentlichkeit, die richtige Repräsentation und Darstellung des eigenen Betriebs	erst mal Gedanken fassen muss, dass das nicht immer so einfach ist. Umsetzbarkeit kann immer erst hinterher geprüft, nicht durch irgendwelche anderen Einflüssen fehlgeleitet sein, nicht auf dem Holzweg sein mit seinen Innovationen.	Eigene Ideen verwirklichen, von anderen deutlich unterscheiden	Nicht zutreffend	Keine Zeit und keine Teilnahme o.g. Beispiele
Marketing, Repräsentation	man kann es leider nicht gleich umsetzen, da man nicht selbstständig ist.	Ein positives, aber für mich persönlich kam es etwas zu früh,	Bis jetzt noch keine.	Zeitmangel

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Um Ecken denken auch bei der Werbung	Für meinen Berufszweig fand ich keine Anwendung [Anmerkung: Straßenbau]	In jeglicher Hinsicht setzte ich Ideen um und verwirkliche Sie.	Ist zu lange her	In meinem Umfeld nicht anwendbar
Durchsetzung, sich richtig verkaufen, was wirklich wichtig ist an Werbung und was man machen muss	Finden in meinem Job kaum Anwendung	Ideen Umsetzung	nichts	Geld hat gefehlt
Ich sollte genau wissen wer mein Kunde ist, was er von mir erwartet und wie ich ihn erreiche	Mit Herz arbeiten	keine	keine	Kein Interesse, bringt nichts, Desinteresse
Kosten zu sparen dich selbst entwickelte Werbung	konzentrierteres und fundierteres Arbeiten an der Selbstständigkeit und an der Umsetzung	Keine, da ich keine Gelegenheit habe	Fällt mir keine ein	KFZ Vermarktung noch nicht, weil eine Prüfung aussteht
Hinsichtlich Erregen von Aufmerksamkeit anderer Kollegen bzw. Kunden	Positive	Noch keine	Keine	Nicht zutreffend
Werbung richtig nutzen und anwenden fand ich sehr gut..	Ideen aufzuschreiben	Keine	zb "bewärte Prinzipien übernehmen"	Der Umstand!
eigentlich alles, muss ich ganz ehrlich sagen: Repräsentation von dem Betrieb, wie trete ich nach außen auf, wie erreiche meine Verwirklichung, Ideen, Controlling	Man sieht die firma nun mit anderen Augen da man jetzt anders denkt	Leider alles vergessen	Ausmaß Vereinfachung	Zeit und Geld
so viel wemöglich, um Kunden zu werben, von dem bisschen was, das hängen geblieben ist, eigentlich alles	Man schaut schon weiter wie die Idee sich entwickeln kann	Keine Anwendung	Familienfreundlicher Musterhauspark	Liquidität
Vieles konnte ich schon umsetze was man mit einfachen Mitteln an Werbung machen kann	Ideen bekommen freien Raum, Weden besprochen ohne sie gleich im Ansatz zu ersticken!!!	leider keine	Familienfreundlicher Musterhauspark	Liquidität , Ansprechpartner , Zeit
Werbung und die Gestaltung der Werbung wie ich sie am besten rüber bringen kann so das sich der Kunde angesprochen fühlt.	konzentrierteres und fundierteres Arbeiten an der Selbstständigkeit und an der Umsetzung	umgesetzt noch nicht	Musterhauspark mit großen Spielplatz , Lichtbetonböden oder 3D-böden	Zusammenhalt funktioniert nicht, das ist nicht angekommen, dass man zusammenhält und dass das dann besser funktioniert
Werbung im laden	Es hat potenzial geweckt	Hatte bis jetzt noch nicht die finanzielle Möglichkeit.		Bin leider noch nicht wieder im Betrieb

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für mein Nebengewerbe - für Werbezwecke als Musiker, wie trete ich auf, wie erstelle ich eine online-profilseite solche sachen	Man versucht nun alles zu tun damit die Mitarbeiter zufrieden und zugleich produktiv sind.	Noch keine		War nicht in der Position etwas zu verändern oder anzustoßen
für Werbezwecke	Ja , ich mache mir jetzt sehr oft Gedanken darüber wie man alles verbessern kann und es den Leuten besser geht und die sich in der firma wohler fühlen	Leider noch keine		Noch keine eigene Firma
Werbung	Ich hab mir das "Schubladen Denken" abgewöhnt!!!	keine		Der Chef ist dagegen
Generelles Auftreten in der Öffentlichkeit, z.B. bei Messen oder Tag der offenen Tür	Lösungsorientiert	keine		Keine Möglichkeit ergeben
Leitbild erschaffen, Auftreten und Vermarktung von sich selbst	Ich agiere mehr aus vertrauen ,als aus Kontrolle .	Noch garkeine		habe mich bis jetzt nicht darum gekümmert
Werbung und auftreten der Firma	damit erreiche ich ein ausgewogenes Maß zu mir selbst und zu meiner Umwelt. ohne zu große Erwartungen zu haben.	Keine		Keine antwort
eine kleine gezielte Werbekampagne	Zu Hohe Erwartungen haben meist un-bewusst schon die Ent-täuschung in sich.	Keine		Noch keine Möglichkeit gehabt
Mehr Werbung, gezielte Werbung für junge Leute Schule nebenan)	das Ergebnis ist somit immer solide und gesund.	Keine		kein bedarf da
Logo Entwicklung	Jeder Idee nachzugehen und zu schauen inwiefern sie dem Betrieb hilft	keine		Bürokratie
Bessere Werbung für die firma	Verbesserungen in der Arbeitsweise und-abläufe	Keine		
ja generell, die Informatione, mir war vorher nicht bewusst, wie ein Auftritt Eindruck bei potentiellen Kunden hinterlässt. das war mir vorher nicht bewusst	Vllt ein klein wenig	wie oben beschrieben		
	Um neue Angebote für unsere Kunden zu entwickeln!!!	Badidee, Funktionalität des ganzen Raumes		
	Bei dem Bau einer Werkstatt!	Krative Arbeit zusammen setzen und über neue Ideen nachzudenken		
	Hobby	Ich bereite gerade meine Selbstständigkeit vor und werde dann meine Ideen in die Tat umsetzen!!!		
	Überdachte Terrasse auf Betonsäulen	Den Weg der Ideen.....		

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	bestehendes mit neuem vermischt	ließ sich eigentlich alles umsetzen, außer KFZ, weil eine Prüfung aussteht		
	Badgestaltung beim Kunden	Produktivität und ergonomie		
	Produktion Optimierung	Stärken und schwächen sammeln		
	Zu Hause für die Kinder	Die Techniken auch in den privaten Alltag anzuwenden!!!		
	Familienleben, Freizeitgestaltung	Es hat mir Spaß gemacht, vielleicht verdiene ich irgendwann damit mein Geld		
	Entwicklung auf die Selbstständigkeit hin			
	Persönliche Einstellung!			
	Ich bin im Fluss			
	Hobbys			
	Chancen			

<u>Level 6 Societal Good</u>	
Idea: Refugees for Conquering the Shortage of skilled labour	
Refugees to conquer shortage of skilled labour	What does it take to implement this idea?
Unbrauchbar, da Qualifikationen UND Lebenseinstellungen zu unterschiedlich sind.	Der 30. Februar fällt auf einen Sonntag...
Ehrlich gesagt weniger gut da es den allgemeinen wert des deutschen Handwerks runterziehen würde und dieses auf alle Handwerker des Bereiches automatisch überträgt	Möchte ich mich nicht äußern dazu
Ja, finde nur die Idee zur Ausbildung gut. Erfahrungen mit nicht geflohenen ausländischen Mitarbeitern zeigen sehr hohe negative Qualitäts- und Kenntnisunterschiede, die den Bau-fortschritt oft zurückwerfen	oh, da m+ssen noch viele Innovationstrainings angeboten werden, die Leute, die gesetzlichen Voraussetzungen schaffen, dass das nicht nur ein Stück Papier gibt, wo was drauf ist, dass es um Menschen geht, nicht nur gesagt, getan.
Ja habe ich. Aber diese bevorzuge ich nicht. Wenn sie was für unsere Kinder und jugendliche tun würden. Und sie unterstützen hätten wir keinen Fachkräfte Mangel. Sondern unsere Jugend würde motivierter an die Sache ran gehen. Aber dadurch das die Flüchtlinge in den Himmel gehoben werden, hat unsere Jugend kein elan was zu machen weil sie es so wie so nicht bedankt bekommen wie die Flüchtlinge ...	Sie müssen sich dem wissen und Fertigkeiten des deutschen Standards im Handwerk anpassen
Die Flüchtlinge machen was und werden lobend in der Zeitung erwähnt und mache unsere was bekommen sie nicht gar nichts keine Anerkennung ... Deswegen bei diesem teama sehe ich rot.	Ein Einführungskurs zum Abgleich der Basisstandards, bzw. eine neue Ausbildung
Absolut Quatsch. Es bekommen viele Jugendliche keine Azs-bildungsstellen aufgrund schlechter Noten. Ich finde hier sollte das Handwerk und der Bund Hilfen schaffen. Denn wenn jemandem mit einem schlechten Schulabschluss keine Erfolgreiche Ausbildung vorhergesagt werden kann, wie soll es erst mit jemandem werden der nicht mal unsere Sprache spricht oder gar nach Deutschem Schulsystem ausgebildet wurde. Auf Grund eigener Erfahrung sei noch hinzuzufügen das diese Leute aufgrund Ihrer Mentalität und Einstellung	Die Einstellung vieler Menschen zu Flüchtlingen:

IDEAS ARE CRAFTWORK

zum Leben oft nicht die Qualität und Leistung erbringen die das Deutsche Handwerk bitter nötig hat.	
Ja. Aufgrund unterschiedlicher Ausbildungsstandards, anderer Produktionsmittel und -methoden und unterschiedlicher Herstellungs- und Montagestandards ist der Ausdruck "Fachkraft" schwer anwendbar. Ohne eine umfassende Anpassung/Aus-/Weiterbildung kann dem Fachkräftemangel auch so nicht entgegen gewirkt werden.	Deutschkurse für das jeweilige Handwerk anbieten, die sich parallel neben der Ausbildungen absolvieren lassen. Pädagogen / Mentoren als Vermittler beschäftigen, die beide Seiten über die Eigenarten des jeweils anderen Landes beraten und bei Missverständnissen und Konflikten zur Seite stehen und aufklären, dass viele Konflikte ihre Ursache in unerkannten Missverständnissen haben.
Es wird wenige Betriebe geben die diese Aufgabe aufgrund der oft anderen Mentalität und Einstellung übernehmen werden.	Zusammenarbeit zwischen den Ämtern sollte Vereinfacht werden!!!
also gehört hab ich davon, das Umsetzen stelle ich mir relativ schwer vor durch Sprachbarrieren und den unterschiedlichen Wissensstand, nicht so einfach, wie in Medien dargestellt, wird ein langer Integrationsprozess mit sich bringen	Die Presse sollte positiver Berichten!!!
Humanitär wäre das schön. Wird in der Praxis nur in Einzelfällen klappen. Ein Versuch wäre es wert.	Auf die Wichtigkeit der Ausbildung und Einsetzung von Flüchtlingen sollte hingewiesen werden!!! Deutschland ist ein Fachkräfte Land, dass zu erhalten ist extrem wichtig für alle!!!
nein	Etwas Geld für Werbung investieren, z.B. Schilder, Plakate, Auto Werbung
Nein leider nicht	erst mal müssen die Flüchtlinge akzeptiert werden von allen generell, und die Menschlichkeit muss verdeutlicht werden, dass es Menschen sind, die Geld verdienen wollen, nicht der Fall, dass die Flüchtlinge Steuergelder verschwenden. die Flüchtlinge flüchten aus einem bestimmten Grund, die können einfach nicht mehr nach Hause.
Von dieser Idee habe ich noch nicht gehört, jedoch sehe ich dies als große Chance für das Handwerk. Es gibt so große Probleme Auszubildende zu finden, da wäre es doch "dumm" diese Chance nicht zu nutzen!	Löhne bindend machen, auch wenn kleine Unternehmen sterben.
Gut, wenn sich Ausländer finden lassen, die das auch wollen. Schlecht, da ein Fachkräftemangel zu besseren Arbeitslöhnen führen würde, die insbesondere im Handwerk extrem gering sind.	Ein wenig mehr Verständnis und mehr Flexibilität! Zeit und Ruhe!
Da wir zukünftig immer weniger Fachkräfte haben, finde ich diese Idee sehr gut!!! Und wünschenswert für die Zukunft Deutschlands!!!	Es müssten Zentren geschaffen werden in denen die Fähigkeiten oder auch Talente unabhängig von Sprachbarrieren) der Flüchtlinge getestet werden können.
Ich finde diese Idee super. Momentan arbeite ich mit zwei Flüchtlingen zusammen die mir untergestellt sind. Beide super nett und sehr freundlich.	Investieren in neuen Modells, Auflösung alter Strukturen und sanfter Übergang in neue, um Widerstand zu vermeiden. Druck erzeugt immer Gegendruck
ich habe von der Idee gehört und finde das gut, Flüchtlinge in einem anderen Land zu integrieren	Auflösung von Urteilen über Religionen .
Ja gehört! Idee ist gut, habe selbst mit Flüchtlingen zusammen gearbeitet, sehr gute Menschen! Aber, die Löhne werden gedrückt, die Leute verdienen teilweise weniger als Auszubildende, die meisten Chefs ziehen aus den Flüchtlingen ihren Profit, man darf nicht vergessen, woher die geflohen sind ist ein Handwerker oft wichtiger als bei uns.	Wo Streit anfängt, hört Wissen auf .
Ja habe ich und ich befürworte dieses auch!	Integration, Sprachkurse, Investitionen in Bildung und Forschung/Kunst. Auflösung von starren Doktrinen. Bewusstseinscoachings/ Seminare. Naturheilkunde
Gut	Integration als erstes Sprachkurse, Praktikum, Aufklärung und Auflösung von Vorurteilen über Religionen.
Halte ich für kaum umsetzbar, zumindest was den Fachkräftebereich angeht. Dennoch halte ich es für richtig Flüchtlinge in den Arbeitsmarkt zu integrieren.	Motivationskurse, Bewusstseinscoachings,
ideen sind immer gut, wenn ein altes System nicht mehr funktioniert, darf es umgeschrieben werden. bzw entsteht ein natürlicher Ausgleich um wieder ausgewogen zu werden. Ein neues Modell überschreibt das alte (obsolet)	Absolut Quatsch. Es bekommen viele Jugendliche keine Ausbildungsstellen aufgrund schlechter Noten. Ich finde hier sollte das Handwerk und der Bund Hilfen schaffen. Denn wenn jemandem mit einem schlechten Schulabschluss keine

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	Erfolgreiche Ausbildung vorhergesagt werden kann, wie soll es erst mit jemandem werden der nicht mal unsere Sprache spricht oder gar nach Deutschem Schulsystem ausgebildet wurde. Auf Grund eigener Erfahrung sei noch hinzuzufügen das diese Leute aufgrund Ihrer Mentalität und Einstellung zum Leben oft nicht die Qualität und Leistung erbringen die das Deutsche Handwerk bitter nötig hat.
Die Idee ist gut , halt Veränderung. Das Mittel macht es, natürlich Menschen die auch wirklich wollen und bereit sind. Generell sollte den Mittelstand und den Image mehr Aufmerksamkeit geschenkt werden , dass auch Einheimische Jugendliche sich wieder den Handwerk zuwenden .	Der Deutsch Unterricht sollte nicht so oft ausfallen wie er es momentan tut
es gibt natürliche gesetzmässigkeiten die energetisch oder auch physikalisch die Wirkung und dessen Ursache ER-Klären.	Sprachlich muss viel gelehrt werden. Man sollte die Menschen an die hohen Qualität der Arbeit gewöhnen und dementsprechend Schulen.
eine gute Idee und auch aus wirtschaftlichen Interesse notwendig.	Menschen, die Lust haben und wollen, sollen kommen
Ja habe ich.	da müssen Praktika durchgeführt, wahrscheinlich müssen da Sprachkurse durchgeführt werden und dann kann man das herausfinden, die Eignung herausfinden, nicht jeder ist für jeden Job geeignet, Praktikant kann herausfinden, ob ihm das liegt, oder ob ihm das Spaß macht. genauso kann der Arbeitgeber herausfinden, ob der Kandidat geeignet ist und ob er ins Gefüge passt.
Ich bin ein großer Freund dieser Idee da mein Betrieb selbst davon betroffen ist und wir auch momentan im Gespräch mit welchen sind nur leider sind die Deutsch Kenntnisse noch nicht so gut wo die beiden aber dran Arbeiten um endlich mit der Ausbildung zu beginnen	siehe 31. Durch eine Aufwertung des heimischen Handwerks in der Politik und Bevölkerung sollten Schulabgänger motiviert werden, einen handwerklichen Beruf zu ergreifen.
teils gut, teils schlecht. Wer arbeiten möchte, darf gerne anfangen. Aber wer keine Lust hat, soll wegbleiben	Es muss mehr investiert werden um den Leuten die Sprache beizubringen und mehr Betriebe müssten diese Leute auch einstellen und sich trauen
da hab ich von gehört, und ich glaube, wenn man die einzelnen Kandidaten aus der Masse herausbekommt, dass das gut sein kann	Vernünftige Integration, deutsch Kurse für das Verständnis. Die Einstellung der Firmen. Viele sind rechts oder stark konservativ eingestellt und würden niemanden aufnehmen. Das dürfte das größte Problem darstellen
Die Idee ist gut aber erst nachdem sie die Sprache besser beherrschen damit es nicht zu Missverständnissen kommt	Sprachkenntnisse und Bereitschaft sich an das deutsche Arbeitsleben anzupassen
Ja ich habe davon schon gehört. Es ist eine gute Idee den Menschen hier die Möglichkeit zu geben etwas neues zu erlernen. Dies allerdings auf Grund des Fachkräftemangels möglich zu machen ist nicht so pralle. Für die meisten Berufe im Handwerk ist ein Hauptschulabschluss notwendig. Diese Voraussetzungen bringen sicherlich auch die Flüchtlinge mit die in dem Ausbildungsalter sind. Natürlich jeh nach Herkunft.	Die Flüchtlinge müssen unsere Sprache lehren und sich bemühen diese Stelle zu bekommen
Ich finde es eine gute Idee. Jedoch sollte man auch bedenken das Deutschland auch viele arbeitslose menschen hat, die gerne arbeiten würden.	Politische Veränderungen
Ja habe ich ich finde diese Idee gut	
Sicher, hört und liest man in allen Medien, ausgebildet werden gute lernwillige Leute, egal ob mit oder ohne Migrationshintergrund.	

APPENDIX V

VIDEO RATING STUDY – OBSERVATION QUESTIONNAIRE

Please read this carefully. You are going to answer this particular questionnaire multiple times. Please make sure to number the questionnaire exactly as the number of sequence that it applies to. For example, if you have just seen scene #1 from Video 1, then please tick 1 #1. If you have seen scene #5 from Video 9, then please tick 9 #5.

The groups that you observe:

The groups seen in these videos are participating in an innovation management workshop. A workshop lasts five hours. The sequences that you have seen or will see have randomly been extracted from these 5-hour-workshops.

About answering the questions:

Answer all of the following questions about how the team in these scenes appears to you. Tick a maximum of one box per question. If the question does not apply to the observed scene or the behavior is not observable, please tick "Does not apply".

Your annotations will be anonymous.

The survey was created by Hung and Gatica-Perez (Hung & Gatica-Perez, 2010) and adapted to this particular study by Julia Gumula, Georg-Elias-Müller-Institute of Psychology. julia.gumula@psych.uni-goettingen.de

Please create a rater code by writing down the first two letters of your last name and the date of your birthday. For example, Julia Gumula, born Feb. 12, rater code would be Gu12.

Please tick the number of scene that you have just watched and are now going to rate. Sequence Number: _____

1. Overall, do you feel that the work group operates spontaneously?

1	2	3	4	5	6	7
Very spontaneous						Not at all spontaneous

If the behavior is not observable, tick "DOES NOT APPLY"

2. Does the team seem to share the responsibility for the task?

1	2	3	4	5	6	7
Very much so						Not at all

If the behavior is not observable, tick "DOES NOT APPLY"

3. Do you feel that team members share the same purpose/goal/intentions?

1	2	3	4	5	6	7
Completely different						The same

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If the behavior is not observable, tick "DOES NOT APPLY"

4. Overall, how enthusiastic is the group?

1	2	3	4	5	6	7
Not at all						Very enthusiastic

If the behavior is not observable, tick "DOES NOT APPLY"

5. Overall, how involved/engaged in the discussion do the participants seem?

1	2	3	4	5	6	7
Not at all						Very

If the behavior is not observable, tick "DOES NOT APPLY"

6. Do the team members seem to enjoy each other's company?

1	2	3	4	5	6	7
Not at all						Very much

If the behavior is not observable, tick "DOES NOT APPLY"

7. How is the morale of the team?

1	2	3	4	5	6	7
Very high morale						No morale

If the behavior is not observable, tick "DOES NOT APPLY"

8. Overall, do the members give each other a lot of feedback?

1	2	3	4	5	6	7
Not at all						A lot of feedback

If the behavior is not observable, tick "DOES NOT APPLY"

9. Does the team seem to have a good rapport?

1	2	3	4	5	6	7
Very good rapport						Very bad rapport

If the behavior is not observable, tick "DOES NOT APPLY"

10. Is there a leader in the group?

1	2
Yes	No

If the behavior is not observable, tick "DOES NOT APPLY"

If you answered YES, does the leader bring the rest of the group together?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

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Very much so	Not at all
-----------------	------------

If the behavior is not observable, tick "DOES NOT APPLY"

11. Overall, does the atmosphere of the group seem more jovial or serious?

1	2	3	4	5	6	7
Very serious					Very jovial	

If the behavior is not observable, tick "DOES NOT APPLY"

12. Overall, does the work group appear to be in tune/in sync with each other?

1	2	3	4	5	6	7
Not at all in tune					Completely in sync	

If the behavior is not observable, tick "DOES NOT APPLY"

13. Overall, how cohesive does the group appear?

1	2	3	4	5	6	7
Very cohe- sive					Not at all	

If the behavior is not observable, tick "DOES NOT APPLY"

14. Overall, does there appear to be equal participation from the group?

1	2	3	4	5	6	7
Not at all					Very equal	

If the behavior is not observable, tick "DOES NOT APPLY"

15. Overall, do the group members listen attentively to each other?

1	2	3	4	5	6	7
Very atten- tive					Not at all at- tentive	

If the behavior is not observable, tick "DOES NOT APPLY"

16. Overall, does the team appear to be integrated?

1	2	3	4	5	6	7
Not at all in- tegrated					Very inte- grated	

If the behavior is not observable, tick "DOES NOT APPLY"

17. Do the team members appear to be receptive to each other?

1	2	3	4	5	6	7
Very recep- tive					Not at all re- ceptive	

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If the behavior is not observable, tick "DOES NOT APPLY"

18. Overall, do the team members appear to be collaborative?

1	2	3	4	5	6	7
Very collaborative						Not at all collaborative

If the behavior is not observable, tick "DOES NOT APPLY"

19. Do the participants appear comfortable or uncomfortable with each other?

1	2	3	4	5	6	7
Very uncomfortable						Very comfortable

If the behavior is not observable, tick "DOES NOT APPLY"

20. Is there a strong sense of belonging in the work group?

1	2	3	4	5	6	7
Very much						Not at all

If the behavior is not observable, tick "DOES NOT APPLY"

21. Overall, does the atmosphere seem tense or relaxed?

1	2	3	4	5	6	7
Very relaxed						Very tense

If the behavior is not observable, tick "DOES NOT APPLY"

22. Does the work group appear to have a strong bond?

1	2	3	4	5	6	7
Very strong bond						No bond

If the behavior is not observable, tick "DOES NOT APPLY"

23. How is the pace of the conversation?

1	2	3	4	5	6	7
Very slow						Very fast

If the behavior is not observable, tick "DOES NOT APPLY"

24. Overall, do the team members seem to be supportive towards each other?

1	2	3	4	5	6	7
Not at all						Very supportive

If the behavior is not observable, tick "DOES NOT APPLY"

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25. How well do you think the participants know each other?

1	2	3	4	5	6	7
Very well			Not at all			

If the behavior is not observable, tick "DOES NOT APPLY"

26. Does every team member seem to have sufficient time to make their contributions?

1	2	3	4	5	6	7
Not at all			Always			

If the behavior is not observable, tick "DOES NOT APPLY"

27. If the moderator was audible: How enthusiastic does the moderator appear to you?

1	2	3	4	5	6	7
Not at all			Very enthusiastic			

If the behavior is not observable, tick "DOES NOT APPLY"

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