# The Benefits of Creativity Support Systems for Entrepreneurs: An Exploratory Study

*Full Paper*

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## Abstract

Successful start-ups require a range of organizational and systematic activities. Not only the acquisition and the successful use of resources play a decisive role in the success of a start-up, but also the development of a business idea. In this context, creativity is an essential part, and both creativity techniques and creativity support systems prove to be fundamental to the success in the initial phase of the start-up, as well as in the entire entrepreneurial process. In this paper, we present the results of an exploratory study with 105 entrepreneurs, to deeper understand the impact of creativity techniques and creativity supporting information technology. With a literature review and the results of our study, we furthermore highlight the importance of knowledge and teaching about creativity enhancing methods and the right application of creativity supporting IT. Additionally, we show the influence and environmental factors of creativity within the different stages of entrepreneurship.

**Keywords**

Creativity, Entrepreneurship, Creativity Support Systems, Start-up

## Introduction

The founding of companies plays a decisive role in the economic and social progress of a country (Bridge and O'Neill 2012). With the founding, new market participants are created, which give the competition an impetus and thus promote economic dynamism (McMullen and Shepherd 2006). On the basis of a new, innovative and promising idea, start-ups try to enter into the value chain of the market in order to compete against the competition. This promotes the ongoing innovation process in the national economy (Baron and Shane 2007). Thus, the importance of entrepreneurship for the international competitiveness and the national economic situation is of high interest in economic and political discussions (Baumol and Strom 2007; Bridge and O'Neill 2012).

Especially through the global upswing of the economy and the changing social desires, there is a need for creative entrepreneurs who develop disruptive solutions (McMullen and Shepherd 2006). They face the particularly complex challenge of generating new and innovative ideas as quickly as possible to differentiate themselves from the competition (Gielnik et al. 2012). Although the globalization and the rise of information technology will create many new business opportunities for companies, the pressure to remain competitive and to produce new innovative products or services is increasing (Somech and Drach-Zahavy 2013). A decisive factor for the development of innovative products or services is creativity (Gassmann and Zeschky 2008). Many managers and founders recognize that the traditional methods no longer achieve the desired success (Gundry et al. 2014). Therefore, creativity must be given more attention for both, start-ups and established companies (Shalley et al. 2009). The link between entrepreneurship and creativity has already been recognized (Gielnik et al. 2012), as creativity enables entrepreneurs to discover and exploit opportunities (Gundry et al. 2014). Creativity is indispensable for

the idea-finding process and thus plays a central role for entrepreneurs (Gielnik et al. 2012; Ward 2004). The consistent and systematic use of creativity methods can make a beneficial contribution to the innovation process (Gassmann and Zeschky 2008). Particularly helpful are information technologies, which are designed to support the creative process and increase the creative abilities (Cherry and Latulipe 2014; Gabriel et al. 2016).

Much research deals with the question of how the support of creativity can lead to more successful entrepreneurship. Findings show that these two factors cannot be separated (Gilad 1984). Through creativity, entrepreneurs are able to generate valuable and useful products or services in order to create competitive advantages (Ames and Runco 2005). Therefore, creativity is crucial for the discovery of an innovative idea and thus particularly important for the first steps of a start-up. Additionally, entrepreneurs are often taking a risk by turning their idea into a business opportunity as they often invest their entire time and frequently their entire capital into their business idea (Naldi et al. 2007; Oosterbeek et al. 2010). It is therefore highly important to make the best use of all available resources in order to support the idea-finding process in an optimal manner.

Since the rise of information technology, research has focused on how the creative process can be supported with computer-tools (Gabriel et al. 2016; Massetti 1996). In addition to specific creativity techniques, so-called Creativity Support Systems (CSS) are increasingly being used in practice. CSS intend to support the creative process and improve the overall quality of the ideas (Shneiderman 2007). However, studies show that many companies have not yet recognized the relevance of these systems and often only use a few creativity methods (Amabile 1988; Hayen et al. 2007). Additionally, the use of CSS is more commonly spread within established companies, which follow a systematic innovation process and invest in systems to support creativity (Hayen et al. 2007). As shown in previous studies (Cherry and Latulipe 2014; Shneiderman 2007), the use of CSS can highly improve the quality of the generated idea and thus lead to competitive advantages. Because of that, we aim to point out the importance of CSS for start-ups, which often rely on only a single idea regarding their business model. The objective of our research is, to demonstrate the importance of CSS for entrepreneurs. To examine the importance of creativity support and the link between CSS and entrepreneurial activities, we conducted an exploratory study with 105 entrepreneurs, who are or were actively involved in entrepreneurial activities. At first, we point out the theoretical background of creativity, entrepreneurship and the link between both of them, followed by the design of the survey and the procedure of the study. Subsequently, we discuss the results of the study and highly important aspects, which contribute to the understanding of the relationship between CSS and entrepreneurship and give valuable insights for practice.

# Theoretical Background

Creativity can be described as the ability to break out of solidified patterns and structures (Amabile 1988; Csikszentmihalyi 2013). Creative people are able to develop new combinations from the experience and are able to discover new connections (Brophy 2001; Guilford 1968). Other definitions describe creativity as the generation of useful and novel ideas, products and problem solutions (Hennessey and Amabile 2010; Runco 2004). Furthermore, most definitions highlight the creative idea as the central element in a company's foundation (Gundry et al. 2014; Mayer 1999; Ward 2004).

Entrepreneurship describes the entire process of a company from the foundation to all management activities (Stevenson and Jarillo 2007). Entrepreneurship also stands for factors such as innovation, creativity and economic ventures (Naldi et al. 2007; Stevenson and Jarillo 2007). The entrepreneur is responsible for the setup, the organization and the handling of the start-up. The core element of entrepreneurship is the development and implementation of new business opportunities. A new business model, an innovative service or a product can be introduced on the market by means of an indispensable and novel idea of the entrepreneur (Gilad 1984; Stevenson and Jarillo 2007; Whiting 1988).

## *Creativity and Entrepreneurship*

The aspect of usefulness and novelty is reflected in both, the definition of creativity and the definition of entrepreneurship (Shane and Venkataraman 2000; Zhou 2008). For entrepreneurship and creativity the emergence of useful and novel ideas is essential (Dimov 2007). So is the implementation of the idea (Frese 2009; McMullen and Shepherd 2006). The effective implementation of the idea-finding phase

promises more success for the start-up, as business opportunities are recognized, analyzed and further developed in the early stages of the start-up process (Koen et al. 2001). However, these activities in the initial phase are often carried out with insufficient resources and, above all, are unstructured (Gielnik et al. 2012). The idea-finding process is described as the livelihood of entrepreneurship (Ward 2004). An awareness of the far-reaching consequences of the implementation qualities in the idea-finding phase, could support entrepreneurs to carry out the generation and evaluation of the idea more systematically and strategically (Ko and Butler 2007; Ward 2004).

The importance of creativity and creative thinking for entrepreneurship is a frequently discussed topic (Fillis 2007; Fillis and Rentschler 2010; Ko and Butler 2007). Entrepreneurs are proven to be more innovative and creative than others (Naldi et al. 2007; Shane 2003). Both Ward (2004) and Ko and Butler (2007) see creativity as a necessary prerequisite to generate useful ideas for a company. According to Bouncken (2004), the discovery and implementation of a business opportunity bears the founding of a company. Runco (2004) describes creativity as the key to economic life and organizations because of the enormous relevance to entrepreneurship and innovation. Gilbert (2007) and Glynn (2008) highlight this important role of creativity in entrepreneurship in their research. Gilbert (2008) points out, that not only dedication and hard work is important for successful start-ups, but creative skills and intuitive thinking in particular. Thus, creativity is an important ability of an entrepreneur, which he or she must release in order to generate a profit for the start-up (Burke et al. 2008; Tracy 2006). Gilbert (2008) sees the emergence of important innovations such as the car, the Internet or the sewing machine in the ability of entrepreneurs, who used their own creativity. In addition he asked himself, "why has virtually every breakthrough concept been the child of an innovative entrepreneur and not the industry leader?" (Gilbert 2007, p. 40).

A study by Ames and Runco (2005) also shows that successful companies can generate more ideas through divergent thinking (as a part of the creative process). Divergent thinking can be described as the ability to build up an assortment of unordinary and original ideas (Guilford 1950). Divergent thinking has a major impact on the creation of business opportunities. The more useful business opportunities are identified and elaborated, the higher the competitive advantages can be (Gielnik et al. 2012; Montag et al. 2012). Additionally, divergent thinking can increase business efficiency, increase product quality and enables the development of new market strategies (Basadur et al. 1992; Kilgour and Koslow 2009). It helps the company to solve problems more easily and thus permanently pursue the corporate objectives (Frese and Fay 2001; Markman et al. 2005; Zaccaro et al. 2000). Furthermore, divergent thinking is linked to successful change processes and leadership qualities (Matthew 2009; Vincent et al. 2002). The high motivation of the founders and the efficient use of their own dynamics are also of great importance (Amabile 1996; Shane 2003).

## *Creativity Support Systems*

Discussions about Creativity Support Systems have started in the early 1990s (Massetti 1996; VanGundy 1992). Since then, various research has focused on the question of how creativity can be supported with information technology (Gabriel et al. 2016; Nunamaker et al. 2014). The definition of CSS is imprecise. However, computer-tools that serve to support the creative process of an individual, a group or an organization can be regarded as CSS (Gabriel et al. 2016; Massetti 1996; Seidel et al. 2010). CSS aim to improve the creative skills and support the creative process in general (Nakakoji 2005; Shneiderman 2007). A variety of diverse types of CSS exist, which are used in different contexts and have to be selected according to the task. There are systems that facilitate collaboration, systems that serve as a guide to help implement and use creativity techniques, systems that support the monitoring of a progress, and systems that independently and actively contribute to the creative process (Lubart 2005). With the selection of the proper CSS, not only the idea generation can be considerably improved, but also the overall business process (Dewett 2003; Massetti 1996). This optimization is due to the fact that the skills of the employees are encouraged and routed in the right direction in order to facilitate communication across the entire range as well as to improve the acquisition of the entrepreneurial knowledge (Dewett 2003). CSS encourage the user to deviate from familiar patterns of thought and to broaden his or her horizon. Consequently, more ideas can be generated and ideas can be evaluated, improved and selected more effectively (Greene 2002; Nunamaker et al. 1996).

Start-ups have to recognize the relevance of CSS at an early stage and successfully integrate them. Important is the continuous use to permanently create a more creative working environment. This enhances the efficiency and competitive advantages and makes access to information resources more efficient. This could again be the basis for the discovery of new useful ideas, like new business opportunities or the improvement of the business process (Olszak and Kisielnicki 2016). In a study by Siemon et al. (2016), the influence of creativity support and entrepreneurship was examined by a selective exploratory study with 16 companies. The study shows that only six companies used creativity techniques. These companies were able to achieve a positive result through their use. The participants said that they would continue to use these techniques in the future. Reasons for non-use were, among other things, the lack of knowledge and skills or the high purchase costs (Siemon et al. 2016). To further substantiate the importance of creativity support for entrepreneurs, we build upon this study and aim to deeper understand, which benefits entrepreneurs can receive from using creativity techniques and creativity supporting information technology. To achieve this, we designed a survey and recruited a considerably high number of active entrepreneurs that answered various questions about their entrepreneurial activities.

# Method and Procedure

In order to get a better understanding of the influence of creativity in start-ups, we designed a survey with the aim to gain deeper insights of this relationship and, above all, to find a link between entrepreneurial activities and CSS. In addition, we aim to understand, whether the creative process is influenced by specific CSS and which other factors stimulate the idea finding process in start-ups. Furthermore, it is important to examine why CSS are not used. From the results, we expect to foster the understanding of the creative start-up process and the use of CSS. Subsequently, we deduce important aspects for entrepreneurs to improve this creative process in the future.

## *Survey Development*

We developed an online survey that can be carried out asynchronously, allowing the subject to select the date itself. In addition, no further persons are necessary to carry out the survey personally. Furthermore, a large number of participants can be reached within a short time period (Bandilla 2002). Moreover, there are no geographical limitations. The survey design was selected from the above-mentioned factors, as it is cost-effective and effective in the execution and evaluation, but nevertheless the adherence to the test quality criteria is ensured.

The questionnaire consists of seven topic blocks and 41 questions. The questionnaire contains both open and closed questions. Within this study it is necessary to assess the personal attitude and perception towards creativity techniques and systems. In this procedure, the participant is supposed to refer to a given statement by classifying his or her opinion on the basis of a multilevel scale. In the first part of the questionnaire, general items about the start-up are asked. Subsequently, questions about the generation of the ideas and influencing factors follow. As a result, questions on creativity techniques and CSS as well as the respective benefits follow. To measure the degree of creativity support, we used the Creativity Support Index (CSI) by Cherry and Latulipe (2014). This method is used for the measurement of six dimensions of any CSS and the evaluation of the effectiveness of the tool. The effectiveness of the CSS is disregarded in this work. However, the impact of CSS on entrepreneurial activities will be examined in more detail. The following three dimensions were used:

- the improvement of the overall idea (exploration)
- the worthiness of the tool (results worth effort)
- collaboration support (collaboration)

In addition, techniques and systems are being considered which are particularly suited to entrepreneurs (Cherry and Latulipe 2014). If the participant does not respond to the topic blocks above, he or she is forwarded to the last topic block, which aims to examine why creativity support and CSS were not used. The survey was available over period of 59 days. The full survey and the results can be found in the appendix.

## *Data Collection*

The participants in the study were exclusively entrepreneurs. This means that every participant is actively working in a start-up or is currently starting a company. The participation was based on the voluntary principle and the data was kept anonymous. In order to collect valid data, a high number of participants with at least 100 test persons were targeted. We identified start-up companies on various Internet platforms and start-up communities like The Fastlane Entrepreneur Forum[1]. The criterion for selection was that the companies started their business in the last two years or offered their services via a homepage during this time. The goal was to select entrepreneurs from different sectors and phases. In addition, only entrepreneurs who were involved in the idea-finding process were selected. Firstly, a personalized request was sent, which was accompanied by a brief explanation of the project and a reference to the survey. A total of 500 start-up companies were identified and addressed, of which 105 responded. This resulted in a data set with 103 completed questionnaires and two uncompleted questionnaires.

## *Results of the Survey*

The data set consists of a total of 103 participants, where 86% of the respondents are male and 13% are female (one person did not give an answer). 90% of the entrepreneurs are under 40 years and 53% are under the age of 30 years. The level of education of the participants shows that 79% have a university degree (Bachelor, Master or PhD). All respondents are either working full-time (69%) or part-time (28%) in a start-up. The remaining 3% are in the initial phase of their company and therefore have a different job. 50% of the entrepreneurs were in the pre-seed or seed phase. 35% were in the start-up phase, which means that these companies are already in the public eye with their business ideas. 10% are dealing with the growth of the company and 5% chose the option "other". Over 90% of respondents were directly involved in the founding process, or are holding a leading role within the company. This means, that they have partly built up the company or are involved in all entrepreneurial activities. Other participants were, for example, employees in marketing, product management or development. The companies are made up of eleven different industries, including technology (15%), marketing (5%), web services (23%), software development (15%), education (8%) and fashion (5%).

By means of a multiple selection, the participants were able to indicate how the business idea was generated. The majority of the business ideas, on which the business start-up was built, were either a question or a desire for a product/service or the need for an improvement. Also 19% stated that a creative inspiration was decisive in the search for the ideas. This shows that many ideas arise from the origin and discovery approach. On average, 2.56 people were involved in the generation of the idea, with a peak of ten (5%) (mean = 2.56, SD = 2.01). Alone, 33% entrepreneurs stated that only one person was involved in the search for ideas. However, 85% said that their ideas were positively influenced by external influences such as internet databases, magazines, printed articles, market research, contact with other people and creativity techniques. Of these, 83% were convinced that the idea was improved due to the external influence. Only 10% could not see any improvement. 7% said that they couldn't make any statement.

Creativity techniques were used by 54%, whereas 14% were uncertain about the use of creativity techniques. However, the results also show that the most used technique was Brainstorming and/or Brainwriting. Of these 54%, 24% used this technique. Others stated that they did not know the name of the technique(s), or applied a mixture of different techniques. The creativity techniques were used for the most part in the seed phase (73%). Only 21% used them in the start-up phase and 6% of the companies used creativity techniques in the later phases. As already mentioned, the need for creativity support is especially important in the beginnings of a start-up. The extent to which creativity techniques support the development of the ideas was predominantly classified as "high" (32%) or "very high" (20%) on a five-point Likert scale, with a mean value of mean = 3.5 (SD = 1.1). Of the 54% that used creativity techniques, 59% used IT during the idea generation phase and again, the majority (97%) of them specifically used CSS. This makes it clear that IT affine start-ups also have more access to CSS. The most popular CSS were digital whiteboards, mind mapping tools, electronic brainstorming systems, image and video editing programs, visualization software and many other systems. Of these 32 start-ups, 77% said they would continue to use CSS in the future. As a result, 77% of the start-ups are already using CSS and consider

[1] https://www.thefastlaneforum.com

them as very helpful. Only 3% stated that CSS are too expensive and 20% that they did not know any suitable systems.

For a deeper understanding of the benefits of CSS, seven items were selected and combined into one measure. These items include questions about the influence on the creative process, the qualitative and quantitative enhancement of the ideas, the support of the idea-finding process, the acceptance in the start-up, the improvement of the idea exchange as well as the importance of these systems for entrepreneurs in specific. All items were rated on a five-point Likert scale with 1 being the lowest score and 5 being the highest. From these seven items we constructed the measure, "Benefits of CSS for entrepreneurs and start-ups". With a value of $\alpha = 0.79$ for Cronbach's alpha, the reliability of the measure is good. Overall, the mean value of this measure is 3.58 (SD = 0.61), meaning that the use of CSS is considered as useful and helpful and that CSS support the idea-finding process.

However, in total, 46% of the entrepreneurs did not use any creativity techniques and 69% did not use CSS. The majority of the entrepreneurs did not know creativity techniques and CSS or do not know the benefits of creativity support and CSS. Furthermore, this shows the lack of knowledge and awareness of the advantages of these methods. This assumption is confirmed, since 52% of the entrepreneurs said, that they had never used creativity techniques before.

## Discussion and Outlook

The results of this study confirm the hypothesis that many start-ups fail to recognize creativity techniques and CSS as a successful factor of entrepreneurship. Although many start-ups use creativity methods, their knowledge in this area is not absolutely sufficient. Usually, only a few techniques and their fields of application are known. CSS have even less prominence in the world of entrepreneurship. The awareness of the numerous advantages in favor of the business process is missing and the motivation to create CSS competences in a company is usually not available. The entrepreneur exaggerates the cost factor to the detriment of the benefit. As entrepreneurial practice still prevails, the acquisition of such competencies devours more resources than it can generate profitably into the company. The study furthermore shows, that creativity techniques and CSS bring enormous advantages and are the basis for innovations and the business model. The use of CSS cannot only improve the idea generation phase, but also the overall business development. Even so, creativity support and CSS were mainly used in the beginning of the start-up, the majority of the entrepreneurs stated, that their initial idea developed over the time and was positively influenced by external resources. Therefore, the use of CSS should be adapted not only to the needs of the start-up, but also to the phase in which the start-up is. Especially in the early phase, CSS can be beneficial to support the essential identification of business opportunities (DeTienne and Chandler 2004; Siemon and Robra-Bissantz 2017). Entrepreneurs that did not use creativity techniques or CSS did not know the any specific creativity techniques, did not know how to apply them or did not know the benefits of them. The same applies to CSS. This is also reflected within the open questions, where entrepreneurs specifically stated that CSS or creativity techniques would not have been useful for their start-up or that the application is too complicated and not necessary. Even so, applying the right technique or systems is challenging and requires specific knowledge, the results show, that the benefits overweight and that a consideration of both, creativity techniques and CSS can improve entrepreneurial activities. This is especially possible if a creative working environment is created and the necessary IT structures are available. The decisive factor is the optimal selection and use of the appropriate techniques and systems.

On the basis of the study and the literature review, this work elaborated the outstanding importance of creativity support for entrepreneurs during the foundation of a company. Further research in this area is necessary in order to define the specific impact of CSS on entrepreneurial activities. Additionally, it has to be examined, which CSS and what creativity techniques are applicable for what start-up and situation.

## REFERENCES

Amabile, T. M. 1988. “A Model of Creativity and Innovation in Organizations”.

Amabile, T. M. 1996. Creativity in context: Update to “The Social Psychology of Creativity.,” (Vol. xviii), Boulder, CO, US: Westview Press.

Ames, M., and Runco, M. A. 2005. "Predicting Entrepreneurship From Ideation and Divergent Thinking," Creativity and Innovation Management, (14:3), pp. 311–315.
Bandilla, W. 2002. "Web surveys–an appropriate mode of data collection for the social sciences," Online social sciences, pp. 1–6.
Baron, R., and Shane, S. 2007. Entrepreneurship: A Process Perspective, Cengage Learning.
Basadur, M., Wakabayashi, M., and Takai, J. 1992. "Training effects on the divergent thinking attitudes of Japanese managers," International Journal of Intercultural Relations, (16:3), pp. 329–345.
Baumol, W. J., and Strom, R. J. 2007. "Entrepreneurship and economic growth," Strategic entrepreneurship journal, (1:3–4), pp. 233–237.
Bouncken, R. B. 2004. "Cultural diversity in entrepreneurial teams: findings of new ventures in Germany," Creativity and Innovation Management, (13:4), pp. 240–253.
Bridge, S., and O'Neill, K. 2012. Understanding Enterprise: Entrepreneurship and Small Business, Palgrave Macmillan.
Brophy, D. R. 2001. "Comparing the Attributes, Activities, and Performance of Divergent, Convergent, and Combination Thinkers," Creativity Research Journal, (13:3–4), pp. 439–455.
Burke, G., Clarke, L., Barrow, P., and Molian, D. 2008. Growing your business: A handbook for ambitious owner-managers, Routledge.
Cherry, E., and Latulipe, C. 2014. "Quantifying the Creativity Support of Digital Tools Through the Creativity Support Index," ACM Trans. Comput.-Hum. Interact., (21:4), p. 21:1–21:25.
Csikszentmihalyi, M. 2013. Creativity: The Psychology of Discovery and Invention, (Auflage: Reprint.), Harper Perennial.
DeTienne, D. R., and Chandler, G. N. 2004. "Opportunity Identification and Its Role in the Entrepreneurial Classroom: A Pedagogical Approach and Empirical Test," Academy of Management Learning & Education, (3:3), pp. 242–257
Dewett, T. 2003. "Understanding the Relationship Between Information Technology and Creativity in Organizations," Creativity Research Journal, (15:2–3), pp. 167–182.
Dimov, D. 2007. "Beyond the Single-Person, Single-Insight Attribution in Understanding Entrepreneurial Opportunities," Entrepreneurship Theory and Practice, (31:5), pp. 713–731.
Fillis, I. 2007. "A methodology for researching international entrepreneurship in SMEs: A challenge to the status quo," Journal of Small Business and Enterprise Development, (14:1), pp. 118–135.
Fillis, I., and Rentschler, R. 2010. "The Role of Creativity in Entrepreneurship," Journal of Enterprising Culture, (18:1), pp. 49–81.
Frese, M. 2009. "Towards a psychology of entrepreneurship—an action theory perspective," Foundations and Trends in Entrepreneurship, (5:6), pp. 437–496.
Frese, M., and Fay, D. 2001. "Personal initiative: An active performance concept for work in the 21st century," Research in Organizational Behavior, An Annual Series of Analytical Essays and Critical Reviews, (23), pp. 133–187.
Gabriel, A., Monticolo, D., Camargo, M., and Bourgault, M. 2016. "Creativity support systems: A systematic mapping study," Thinking Skills and Creativity, (21), pp. 109–122.
Gassmann, O., and Zeschky, M. 2008. "Opening up the Solution Space: The Role of Analogical Thinking for Breakthrough Product Innovation," Creativity and Innovation Management, (17:2), pp. 97–106.
Gielnik, M. M., Frese, M., Graf, J. M., and Kampschulte, A. 2012. "Creativity in the opportunity identification process and the moderating effect of diversity of information," Journal of Business Venturing, (27:5), pp. 559–576.
Gilad, B. 1984. "Entrepreneurship: The Issue of Creativity in the Market Place," The Journal of Creative Behavior, (18:3), pp. 151–161.
Gilbert, M. 2007. The Switch Effect, Richmond, VA: Palari Publishing.
Glynn, B. 2008. Left on Red: How to Ignite, Leverage and Build Visionary Organizations, (1 edition.), Hoboken, N.J: Wiley.
Greene, S. L. 2002. "Characteristics of Applications That Support Creativity," Commun. ACM, (45:10), pp. 100–104.
Guilford, J. P. 1950. "Creativity," American Psychologist, (5:9), pp. 444–454.
Guilford, J. P. 1968. Intelligence, Creativity and Their Educational Implications, Edits Pub.
Gundry, L. K., Ofstein, L. F., and Kickul, J. R. 2014. "Seeing around corners: How creativity skills in entrepreneurship education influence innovation in business," The International Journal of Management Education, (12:3), pp. 529–538.

Hayen, R. L., Swaby, S. A., and Huang, Z. 2007. "Use of group support systems in today's society," Issues in Information Systems, (8:2), pp. 120–126.
Hennessey, B. A., and Amabile, T. M. 2010. "Creativity," Annual Review of Psychology, (61:1), pp. 569–598.
Kilgour, M., and Koslow, S. 2009. "Why and how do creative thinking techniques work?: Trading off originality and appropriateness to make more creative advertising," Journal of the Academy of Marketing Science, (37:3), pp. 298–309.
Ko, S., and Butler, J. E. 2007. "Creativity: A key link to entrepreneurial behavior," Business Horizons, (50:5), pp. 365–372.
Koen, P., Ajamian, G., Burkart, R., Clamen, A., Davidson, J., D'Amore, R., Elkins, C., Herald, K., Incorvia, M., Johnson, A., and others. 2001. "Providing clarity and a common language to the 'fuzzy front end,'" Research-Technology Management, (44:2), pp. 46–55.
Lubart, T. 2005. "How Can Computers Be Partners in the Creative Process: Classification and Commentary on the Special Issue," Int. J. Hum.-Comput. Stud., (63:4–5), pp. 365–369.
Markman, G. D., Baron, R. A., and Balkin, D. B. 2005. "Are perseverance and self-efficacy costless? Assessing entrepreneurs' regretful thinking," Journal of Organizational Behavior, (26:1), pp. 1–19.
Massetti, B. 1996. "An Empirical Examination of the Value of Creativity Support Systems on Idea Generation," MIS Quarterly, (20:1), pp. 83–97.
Matthew, C. T. 2009. "Leader Creativity as a Predictor of Leading Change in Organizations," Journal of Applied Social Psychology, (39:1), pp. 1–41.
Mayer, R. E. 1999. "22 Fifty Years of Creativity Research," Handbook of creativity, (449).
McMullen, J. S., and Shepherd, D. A. 2006. "Entrepreneurial Action And The Role Of Uncertainty In The Theory Of The Entrepreneur," Academy of Management Review, (31:1), pp. 132–152.
Montag, T., Maertz, C. P., and Baer, M. 2012. "A Critical Analysis of the Workplace Creativity Criterion Space," Journal of Management, (38:4), pp. 1362–1386.
Nakakoji, K. 2005. "Seven issues for creativity support tool researchers," Workshop on Creativity Support Tools.
Naldi, L., Nordqvist, M., Sjöberg, K., and Wiklund, J. 2007. "Entrepreneurial Orientation, Risk Taking, and Performance in Family Firms," Family Business Review, (20:1), pp. 33–47.
Nunamaker, J. F., Jr., Briggs, R. O., Mittleman, D. D., Vogel, D. R., and Balthazard, P. A. 1996. "Lessons from a Dozen Years of Group Support Systems Research: A Discussion of Lab and Field Findings," Journal of Management Information Systems, (13:3), pp. 163–207.
Nunamaker, J. F., Romano, N. C., and Briggs, R. O. 2014. Collaboration Systems: Concept, Value, and Use, M.E.Sharpe.
Olszak, C. M., and Kisielnicki, J. A. 2016. "Organizational Creativity and IT-based Support," Informing Science: the International Journal of an Emerging Transdiscipline, (19).
Oosterbeek, H., van Praag, M., and Ijsselstein, A. 2010. "The impact of entrepreneurship education on entrepreneurship skills and motivation," European Economic Review, (54:3), pp. 442–454.
Runco, M. A. 2004. "Creativity," Annual Review of Psychology, (55:1), pp. 657–687.
Seidel, S., Müller-Wienbergen, F., and Becker, J. 2010. "The Concept of Creativity in the Information Systems Discipline: Past, Present, and Prospects," Communications of the Association for Information Systems, (27:1).
Shalley, C. E., Gilson, L. L., and Blum, T. C. 2009. "Interactive Effects of Growth Need Strength, Work Context, and Job Complexity on Self-Reported Creative Performance," The Academy of Management Journal, (52:3), pp. 489–505.
Shane, S. A. 2003. A General Theory of Entrepreneurship: The Individual-opportunity Nexus, Edward Elgar Publishing.
Shane, S., and Venkataraman, S. 2000. "The Promise of Entrepreneurship as a Field of Research," The Academy of Management Review, (25:1), pp. 217–226.
Shneiderman, B. 2007. "Creativity Support Tools: Accelerating Discovery and Innovation," Commun. ACM, (50:12), pp. 20–32.
Siemon, D., Narani, S. K., Ostermeier, K., and Robra-Bissantz, S. 2016. "Creativity and Entrepreneurship - The Role of Creativity Support Systems for Start-ups," MCIS 2016 Proceedings.
Siemon, D., and Robra-Bissantz, S. 2017. "A Creativity Support Tool for Cognitive Idea Stimulation in Entrepreneurial Activities," International Journal of Entrepreneurship and Small Business, (forthcoming).

Somech, A., and Drach-Zahavy, A. 2013. "Translating Team Creativity to Innovation Implementation The Role of Team Composition and Climate for Innovation," Journal of Management, (39:3), pp. 684–708.
Stevenson, H. H., and Jarillo, J. C. 2007. "A paradigm of entrepreneurship: Entrepreneurial management," in Entrepreneurship, Springer, pp. 155–170.
Tracy, B. 2006. The Way to Wealth: Part 1 the Journey Begins: Success Strategies of the Wealthy Entrepreneur, Irvine, CA: Entrepreneur Media.
VanGundy, A. B. 1992. Idea power: Techniques & resources to unleash the creativity in your organization, American Management Association.
Vincent, A. S., Decker, B. P., and Mumford, M. D. 2002. "Divergent Thinking, Intelligence, and Expertise: A Test of Alternative Models," Creativity Research Journal, (14:2), pp. 163–178.
Ward, T. B. 2004. "Cognition, creativity, and entrepreneurship," Journal of Business Venturing, (19:2), pp. 173–188.
Whiting, B. G. 1988. "Creativity and Entrepreneurship: How Do They Relate?," The Journal of Creative Behavior, (22:3), pp. 178–183.
Zaccaro, S. J., Mumford, M. D., Connelly, M. S., Marks, M. A., and Gilbert, J. A. 2000. "Assessment of leader problem-solving capabilities," The Leadership Quarterly, (11:1), pp. 37–64.
Zhou, J. 2008. "New look at creativity in the entrepreneurial process," Strategic Entrepreneurship Journal, (2:1), pp. 1–5.

# APPENDIX

| **Item** | **Results (n=103)** |
|---|---|
| **#Demographics** | |
| What is your gender? | Female (13), Male (89), no answer (1) |
| What is your age? | Under 20 (5), 20-29 (50), 30-39 (38), 40-49 (8), 50-59 (1), 60-69 (0), over 70 (1) |
| What is your education level? | • Completed high school (7),<br>• Finished vocational training (6),<br>• Bachelor's degree (50),<br>• Master's degree (27),<br>• Ph.D., law or medical degree (2),<br>• Other advanced degree beyond a Master's degree (2),<br>• Still in education/school/vocational training (0)<br>• Finished degree (9) |
| Which of the following most closely match your job title? | • Working in the Start-up (full-time employment) (71),<br>• Working in the Start-up (part-time employment) (29),<br>• Irregularly occupation (0),<br>• In a professional education (1),<br>• In retraining (0)<br>• Military service/ community service (1),<br>• Voluntary social year (0)<br>• Parental leave, maternity leave, parental time or other leave of absence (0)<br>• Not gainfully employed (including: schoolchildren, students, unemployed, in the preretirement, pensioner, without extra income) (1) |
| **#Start-up information** | |
| In which stage is your start-up? | Pre-Seed (40), Seed (11), Start-up (36), 1st Stage (7), 2nd Stage (2), 3rd Stage or later (1), Exit or Fail (0), Other (6) |
| In what industry is your start-up active? (Multiple answers allowed) | Marketing (5), Education (8), Web-Service (24), Software (15), Technology (15), Entertainment (5), Human resource management (7), Tourism (3), Service (12), Fashion (5), Finance (4) |
| What is your role in the start-up? (Multiple answers allowed) | • Founder, CEO, Founder & CEO, (74)<br>• CTO, CSO, CPO, COO, CIO (5),<br>• Marketing, Communications Executive , Business Development (10)<br>• Commercial Managing Director, Customer Success Manager, Managing partner (4)<br>• Development, product manager (8),<br>• Freelance Writer and Proofreader (1),<br>• Delivery, analysis (2) |
| **#Idea generation** | |
| How did your (start-ups) main idea evolve? | • Out of a question or problem ("For problem X there is still no solution") (45)<br>• From a desire for a product/service ("There should be such a thing") (56)<br>• From an improvement suggestion ("this should be better easier") (35)<br>• From a creative inspiration (20) |
| How many people were involved in the research of the idea? | 1 (34), 2 (32), 3 (19), 4 (9), 5 (2), 6 (1), 7 (1), 10 (5)<br>Mean = 2,56, SD = 2,07 |
| **#External influence** | |
| Was your idea finding process influenced by external information? | Yes (88), No (15) |

| | |
|---|---|
| How/by what/by whom was the idea finding process influenced? (Multiple answers allowed) | Internet research (27), Market research (16), Experience and skills(14), Friends, colleagues and other people (21), Literature, Magazines und Journals (3), Movies (1), |
| Has your idea changed/developed through the external influence? | Yes (86), No (10), I can not say it (7) |
| **#The usage of creativity techniques** | |
| Have you consciously used creativity techniques during any stage of your company start-up? | Yes (56), No (33), I can not say it (14) |
| Which creativity techniques did you use? | • I do not know the name of technique (9)<br>• It was a "mix" from different techniques (14)<br>• Brainstorming/Brainwriting (25)<br>• Mind-Mapping (5)<br>• Others (3) |
| In which stage have you used one of the techniques mentioned above? | Pre-Seed (32), Seed (9), Start-Up (12), 1st Stage (0), 2nd Stage (1), 3rd or later Stage (0), Fail or Exit (0), Other (2) |
| Are the advantages of creativity techniques known to you? | Yes (42), No (14) |
| How strongly have creativity techniques supported you with the idea finding process? | very low (3), low (6), medium (18), high (18), very high (11) |
| Was it easy to generate many different ideas through the usage of creativity techniques? | strongly agree (12), agree (30 ), neither agree nor disagree (10), disagree (4), strongly disagree (0) |
| Does the staff need additional workshops for the usage of creativity techniques? | Yes (18), No (28), I can not tell (10) |
| **#(Benefits of) Creativity support systems** | |
| Have you used supporting information technology in the idea finding process? | Yes (33), No (12), I can not say it (11) |
| Have you used creativity support systems? | Yes (32), No (20), I can not say it (4) |
| Which creativity support systems were used? | Digital Whiteboards (9), Digital Mindmapping (5), electronic Brainstorming systems (4), Blogs (3), Image, and Video editing programs (3), Trello (3), Google Docs (2), different group support systems (4), Visualization software, GIMP, IdeaLab, Project management systems, Confluence, Slack, Hangout, Social Media, Wiki, Asana, Scrum |
| Do you plan to use creativity support systems in the future? | Yes (24), To me none is known, (6) No, the expenditure is too high (1) |
| How strongly did the system affect the creativity process? | very low (1), low (4), medium (13), high (6), very high (6) |
| How strongly could the usage of the system improve the quality of the idea? | very low (0), low (1), medium (13), high (7), very high (8) |
| How strongly has the system supported you with the idea finding process? | very low (1), low (4), medium (8), high (12), very high (4) |
| Was it easy to generate many different ideas through the usage of the system? | strongly agree (5), agree (13), neither agree nor disagree (9) disagree (0), strongly disagree (2) |
| The intuitiveness of the system was very high, so that I could focus on the activity and not on the tool. | Yes (18), No (2), I can not say it (9) |
| How do you estimate the long-term acceptance in the company? | very low (0), low (2), medium (10), high (11), very high (6) |
| Does the staff need additional workshops for the usage of creativity support systems? | Yes (7), No (14), I can not tell (8) |
| The exchange of ideas in the team is facilitated. | very low (0), low (1), medium (17), high (8), very high (3) |
| How do you assess the importance of creativity support systems for entrepreneurs | very low (1), low (1), medium (14), high (9), very high (4) |
| Is it worth to invest in creativity support systems? | • Yes (18)<br>• No, creativity support systems are still too expensive (5)<br>• I have not been involved with CSS (6) |
| **#No usage of creativity support systems** | • |
| Why have you not used any creativity techniques? | • I think it is quite unnecessary (11)<br>• It is not very useful to us (16)<br>• To me none is known (37) |
| Why have you not used any creativity support systems? | • I think it is quite unnecessary (16)<br>• It is not very useful to us (9)<br>• To me none is known (36)<br>• Creativity support systems are still too expensive (7) |
| Up to now I never used any creativity techniques in school/university/or at work. | Yes (37), No (34) |
| Up to now I never used any creativity support systems in school/university/or at work. | Yes (45), No (26) |
| I need additional workshops/training for the usage of creativity techniques. | Yes (25), No (46) |
| I need additional workshops/training for the usage of creativity support systems. | Yes (22), No (48) |
| For past projects/activities I already used creativity support systems but the tools were not at all helpful. | Yes (13), No (58) |
| Have you planned to use creativity technology systems in the future? | • Yes (13)<br>• To me none is known (46)<br>• No, they are to expensive (12) |