Increasing creative self-efficacy through mental imagery: construction and contribution of an online serious game

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Abstract:
This study investigates the impact of an individual online serious game on creative self-efficacy building upon the established link between creativity and marketing success. Utilizing an innovative approach, we integrate mental imagery exercises within a serious game to cultivate creative self-efficacy. Through a within-subject experimental design, 68 participants played the serious game and answered questionnaires before and after having played the game. Our findings reveal significant enhancements in creative self-efficacy. Moreover, participants engaging with the game reported an improvement in global well-being and a reduction in negative affect. These outcomes are consistent with emerging research on the therapeutic benefits of mental imagery techniques. Our study highlights the multifaceted advantages of online platforms for fostering creativity and well-being, offering promising implications for marketing success and personal development in an increasingly digital world.

Introduction

Each of us has an opinion about one's own creative potential, i.e. how well one uses one's creativity in daily personal and professional lives. This subjective opinion is binding because it creates expectations about our creative self-efficacy.
Creativity is often considered as being a key success factor both in strategic and operational marketing (e.g. Rosengren et al., 2020). From a practical perspective, highly performing leader Steve Jobs was famously recognized as being a creative mind. Would it be possible to train ourselves to be as creative as Steve Jobs?
According to Manmiller, Kumar and Pekala (2005), the creative process stems from unconscious processes, as if arising spontaneously or during the exercise of another unrelated activity, in a moment of mental wandering, sometimes even through dreams. In this context, creativity is linked to openness to internal experience and the ability to absorb. To enable creative problem-solving, Sanders (2011) notes that this involves 1) generating a large number of possible solutions without respecting critical thinking; 2) using visual imagery before logical thinking; 3) analyzing spontaneous dreams, which often present total or partial solutions to problems; 4) using imagery and metaphor to enable the subject to try out solutions in his or her imagination before trial and error in real life. In this case, how could we enhance creativity through a voluntary conscious methodology? The current research suggests using the practice of mental imagery in a game setting to increase personal creative self-efficacy.

Theoretical background

In the realm of contemporary business and organizational psychology, an ever-growing body of research underscores the pivotal role of creativity in fostering innovation, adaptability, and ultimately, the success of companies and institutions. Numerous studies have shown that organizations that prioritize and nurture creativity among their employees tend to outperform their competitors in terms of problem-solving, product development, and overall performance (Amabile, 1996; West & Farr, 1990). Furthermore, creative individuals not only contribute novel ideas but also exhibit higher levels of motivation and job satisfaction, leading to improved employee retention and organizational performance (Shalley et al., 2004; Tierney et al., 1999). Creativity has been recognized as a cornerstone of competitiveness and resilience in the face of rapidly changing market dynamics, highlighting the significance of its cultivation. In this context, our study investigates the potential of an online serious game to enhance creative self-efficacy, a key component of individual and collective creativity, as we seek to contribute to this growing body of research.

In marketing in particular, creativity stands as an indispensable asset, profoundly influencing brand differentiation, customer engagement, and market share. Previous research within the marketing domain has consistently demonstrated that creativity is central to the development of successful marketing campaigns (Gatignon et al., 2016; Smith & Yang, 2004). Innovative and imaginative marketing strategies not only capture the attention of consumers but also have the potential to create lasting brand impressions and effective product innovation (Füller et al., 2008). Moreover, creative marketing efforts have been shown to enhance brand loyalty (Kim et al., 2003) and positively impact consumer decision-making processes. In a world characterized by information overload and increasingly discerning consumers, the ability to deliver unique and compelling marketing messages is a critical factor for achieving a competitive edge. As we delve into our investigation of the impact of an online serious game on creative self-efficacy, we recognize its significance in the context of marketing, where innovation and creativity are paramount to market success.

Scientific literature consistently supports the notion that creativity is a trainable skill that can be honed and enhanced through deliberate techniques and interventions. Research studies have illuminated various methods for fostering creativity in individuals. For example, cognitive training programs, such as divergent thinking exercises, could boost creative thinking skills (Beaty et al., 2015). Additionally, techniques like mindfulness meditation have been found to promote divergent thinking and enhance creative problem-solving abilities (Colzato et al., 2012; Lebuda et al., 2016). Furthermore, creativity-enhancing interventions, including creative workshops and brainstorming sessions, have consistently demonstrated the ability to stimulate creative thinking and idea generation (Gatignon et al., 2016; Hennessey & Amabile, 2010; Nijstad et al., 2003). As we investigate the impact of an online serious game on creative self-efficacy, we build upon the robust foundation of scientific evidence that underscores the malleability of creativity through specific, empirically-supported techniques.

One fundamental element that has emerged as crucial in the quest to enhance creativity is creative self-efficacy, defined as an individual's belief in their capacity to perform creative work effectively (Tierney & Farmer, 2002). Numerous empirical studies have underscored the pivotal role of creative self-efficacy as a building block for creative performance and innovation (Tierney et al., 1999; Shalley et al., 2004). A growing body of research has demonstrated that individuals with higher creative self-efficacy not only exhibit greater creative thinking but also display increased willingness to engage in creative tasks (Anderson et al., 2014; Hsu et al., 2011), which further contribute to creative performance (Tierney & Farmer, 2011). Recognizing the significance of this psychological construct, our current research focuses on creative self-efficacy as a central component in the context of an online serious game designed to enhance creativity, contributing to the existing scientific literature.

Hypothesis development

According to the general theoretical framework of embodied cognition (Barsalou, 2008), stimulating the brain's mental imagery capacities enables a real simulation of real perceptions, like brain training. The practice of mental imagery, by activating cognitive processes that simulate real perception, could therefore create a genuine training ground for creativity. In particular, one of the obstacles to creativity is the belief that we are not creative. Through this mental simulation, we suggest that the person learns, through experience, that s/he is creative, which could then help him/her to change his/her own belief that s/he is not. Also, during the proposed mental imagery exercises, the links created in mental imagery simulate real neural links and would therefore activate the brain structures underlying them. This simulation alone could therefore be enough to build a new representation in memory, since memory is a dynamic and contextualized process (Versace et al., 2014).

As a result, the creativity of people guided through mental imagery would find itself activated, and we can therefore hypothesize that creative self-efficacy could be enhanced through the practice of sensory-based visualization.

This leads to the formulation of the following hypothesis H1: the practice of the five sensory-based visualizations from the "Creativity Unlimited" serious game will positively impact perceived creative self-efficacy.

Method and Material

Ninety-eight participants played "Creativity Unlimited", a serious game entirely developed and built ad hoc for this study. It is played individually and is accessible online via a web browser. In this game, participants take on the role of an alien who, along with his/her companion, has a spaceship accident and crash-lands on Earth. During the crash, the aliens lose their senses of hearing, sight, touch, taste and smell, but retain their telepathic abilities. They go in search of their lost senses and meet characters who help them realize their ability to simulate the senses through mental imagery. By the end of the game, the aliens have regained their senses, allowing them to return to their spaceship. They then try to get it airborne using mental imagery. After this sequence in the alien's skin, participants were invited to think about one of their current personal or professional problems, then to work it out in mental imagery. Finally, they were guided through a final mental imagery exercise in which they pictured the problem, the solution objective, the context and all the sensory elements that came to mind.

The participants were students (N=57) and company employees (N=41) hosted as part of an educational activity at Grenoble Ecole de Management. One or two days before their game session, they were invited to fill in the questionnaires (pre-test), then played the game, filled in the post-test questionnaires and took part in a concluding exchange.

The variables measured were collected on Qualtrics through French versions of the following questionnaires: global creative capacity (SPCC: self-perceived creative capacity); creative self-efficacy (CreaSE: creative self-efficacy, Tierney & Farmer, 2002; Carmeli & Schaubroeck, 2007); self-efficacy (SE: Student/Vocational, adapted from the Motivated Strategies for Learning Questionnaire - MSLQ); mental well-being (WEMWBS: Mental well-being, Warwick-Edinburgh Mental Wellbeing Scale); measures of positive and negative affect (PANASPos: items 1, 3, 5, 9, 10, 12, 14, 16, 17, 19; PANASNeg: items 2, 4, 6, 7, 8, 11, 13, 15, 18, 20), and open-ended questions about the gaming experience. No questions were asked about the type of problems participants chose to work on during the game.

Results

Only the participants who completed the questionnaires in totality both before and after having played to the serious game were kept for the analysis, i.e. 44 students and 26 professionals.
The final remaining data were analyzed with a repeated measures ANOVA, with measures coming from the pre-exposition to the game and measures from the post-exposition to the game as a within-subject factor (PrePostGame).
The results showed a significant difference between pre- and post-test scores for CreaSE ($F(1,68)=14.41$, $p<.001$), WEMWBS ($F(1,68)=30.91$, $p<.001$) and PANASNeg measures ($F(1,68)=10.80$, $p<.01$). For professionals as well as for students, the ANOVA revealed an increase in SE after having played to the serious game ($F(1,24)=5.69$, $p<.05$ for ProfSE and $F(1,40)=8.35$, $p<.01$ for StudentSE). Thus, the perception of creative self-efficacy increases, supporting our hypothesis. Also, job self-efficacy increases whatever the status of the participant (student / professional); negative affects decrease and well-being increases.
The two other measures (SPCC and PANASPos) did not demonstrate any significant differences between the pre- and the post-exposition to the game. Table 1 displays the means and standard deviations for the dependent variables.

	CreaSE	WEMWBS	PANASNeg	ProfSE	PANASPos	SPCC
Pre-Game	3.24 (0.75)	3.70 (0.54)	1.73 (0.61)	3.76 (0.43)	3.56 (0.67)	3.08 (1.23)
Post-Game	3.46 (0.73)	3.97 (0.58)	1.53 (0.65à	3.96 (0.44)	3.56 (0.65)	3.21 (1.25)

Table 1: Mean (standard deviation) for each dependent variable of the study

Discussion

The present study sought to investigate the impact of an online serious game on creative self-efficacy, a pivotal element in the realm of creativity and innovation. In the light of the results, it appears that the Creativity Unlimited serious game effectively activates a simulation enabling players to mobilize their creative self-efficacy skills.
Our research builds upon a well-established body of literature that underscores the importance of creativity in organizational success (Amabile, 1996; Tierney & Farmer, 2011; West & Farr, 1990). Moreover, we acknowledge the particular significance of creativity in marketing, where innovative and imaginative strategies are essential for achieving a competitive edge (Gatignon et al., 2016; Smith & Yang, 2004).
Prior research has consistently indicated that creativity is a trainable skill that can be developed through specific techniques (Beaty et al., 2014; Colzato et al., 2012; Hennessey & Amabile, 2010). The current investigation aligns with the established understanding that creative self-efficacy is a building block for creative performance and innovation (Shalley et al., 2004; Tierney et al., 1999; 2011).
Our findings corroborate the existing body of knowledge, demonstrating that the online serious game had a significant positive effect on the creative self-efficacy of our study participants. Creative self-efficacy refers to an individual's belief in their capacity to perform creative work effectively (Tierney & Farmer, 2002). It has been shown to influence creative thinking and engagement in creative tasks (Anderson et al., 2014). The observed enhancement in creative self-efficacy aligns with the broader literature on creativity-enhancing interventions. Techniques such as divergent thinking exercises and mindfulness meditation have previously demonstrated the ability to stimulate creative thinking (Beaty et al., 2014; Colzato et al., 2012). Moreover, creative workshops and brainstorming sessions have consistently shown the potential to foster creative idea generation (Hennessey & Amabile, 2010; Nijstad et al., 2003).

Our study contributes to this body of knowledge by showcasing the effectiveness of an online serious game in cultivating creative self-efficacy. This finding is particularly pertinent in the context of modern organizations, where the ability to nurture creativity and innovation is imperative for sustained success (Shalley et al., 2004; Tierney et al., 1999). By demonstrating that an online serious game can enhance creative self-efficacy, our research offers a practical tool for organizations seeking to foster a culture of innovation. The use of an online platform to enhance creative self-efficacy also holds several advantages in terms of accessibility, engagement, and data collection. In an era where digital technologies play an increasingly central role in our lives, harnessing the power of online platforms to foster creativity represents a forward-looking and pragmatic approach to personal and professional development. Firstly, online platforms provide accessibility to a diverse and global pool of participants. Additionally, the online format accommodates participants' busy schedules and geographical constraints, making it convenient for individuals from various backgrounds and professions to participate. This inclusiveness ensures that the benefits of creative self-efficacy enhancement are not limited to a select few but can reach a wide audience.

Secondly, the gamification and interactivity offered by online serious games are particularly suited to engage participants in the process of skill development. Serious games can provide a dynamic and immersive learning experience that encourages active participation and retention of knowledge. Another serious game currently exists to enhance creativity and product development innovation (Creanov, Merle & Gotteland, 2016). The use of mental imagery within the game, as demonstrated in our study, allows a sensory simulation which activate the corresponding memory network according to the principles of embodied cognition (Versace et al., 2018). It might also offer a personalized and engaging approach to skill enhancement, aligning with the principles of self-determination theory, which posits that autonomy and competence are essential for motivation and learning (Ryan & Deci, 2000).

Our study not only revealed the significant enhancement of creative self-efficacy but also demonstrated a noteworthy improvement in global well-being and a reduction in negative affect among participants who engaged with the online serious game. These findings align with previous research that emphasizes the therapeutic potential of mental imagery techniques in enhancing psychological well-being and reducing negative emotions. Indeed, studies have shown that the practice of mental imagery can foster emotional regulation (Holmes et al., 2006), reduce symptoms of anxiety and depression (Pile et al., 2021), and enhance overall well-being (Kaplan et al., 2014). By incorporating mental imagery exercises within the game, we harnessed a well-established technique to elicit positive emotions and facilitate emotional processing, thereby contributing to the observed reduction in negative affect and the enhancement of global well-being.

Our findings further corroborate the notion that mental imagery can serve as an effective tool for promoting emotional well-being within a novel context – an online individual serious game. This innovative approach extends the potential reach of such interventions, making them more accessible and engaging for a diverse population. While our study focused on creative self-efficacy as a specific outcome, it is evident that the benefits extend to broader aspects of psychological health at work. Future research may delve deeper into the mechanisms through which mental imagery within serious games exerts its effects on well-being and emotions, paving the way for more targeted and effective interventions.

While our study has provided valuable insights into the enhancement of creative self-efficacy through online serious games, several avenues for future research warrant exploration. First, investigating the long-term effects of such interventions on creativity and innovation within real-world organizational settings could provide a deeper understanding of their sustainability and practicality. Additionally, examining the role of individual differences, such as personality traits and prior gaming experience, in the effectiveness of online serious games for creativity

enhancement is a promising direction. Furthermore, the design and customization of serious games to target specific creative domains or industries could be explored to determine whether tailored interventions yield even more significant results. Finally, conducting comparative studies that assess the relative efficacy of online serious games against other creativity-enhancing interventions, such as traditional workshops or training programs, would offer valuable insights into the most effective strategies for fostering creativity in diverse contexts. These avenues for future research hold the potential to further advance our understanding of creativity development and its practical applications.

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