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IN INFORMATION SYSTEMS

Master Thesis

**CREATIVE TEAMS: AN EDUCATIONAL INTERVENTION
TO DEVELOP CREATIVITY WITH THE UTILIZATION OF
INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs)**

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ABSTRACT

Over the past decades, many researchers have proposed various methods for creativity enhancement. However, most of these methods focused on children and adolescents. In the present study an original creativity enhancement intervention was constructed and implemented in an Information Systems course with participants students of mean age $M=18.38$. The game-like, challenging, web-based and team-structured intervention suggests generation of open essay questions by students as main creativity enhancement method. Also, we investigated how personality traits and tendencies of the members and the leader, combined and incorporated into the ‘team personality’, influence teamwork and the creative product. Creativity was measured with pre-post Divergent Thinking tests and evaluation of products with the Consensual Assessment Technique. Personality was assessed with the International Personality Item Pool questionnaire. Additional data were collected with demographic and evaluation questionnaires. Results show that the intervention was effective in stimulating creativity. Also, statistical analysis indicates a negative link between neuroticism and elaboration, and a positive correlation between originality measured by tests and creativity dimensions of the product. Findings also revealed a negative link between extraversion and the creative product, and teams with more sociable, risky and independent members to exhibit less creative productivity. Leaders scored higher on openness to experience and lower on neuroticism, compared to other team members. Also, leaders’ extraversion was positively linked to agreeableness and negatively to the team’s creative outcome. Team personality elevation of extraversion and diversity of agreeableness predicted significantly the value of the creative product. We discuss implications and offer suggestions for future research.

Keywords: student question generation, creativity enhancement, facebook, creativity training, open questions construction, creative team, team personality, creative product, leadership.

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1. INTRODUCTION

“It is change, continuing change, inevitable change, that is the dominant factor in society today. No sensible decision can be made any longer without taking into account not only the world as it is, but the world as it will be.....”

Isaac Asimov.

In the era of risk and instability, in the world of globalization and unpredictability, creativity evolved from being a competitive differentiator to a necessity for survival. The things of the world around us are the result of human ingenuity and creativity. Guilford’s APA presidential address in 1950 stressed the importance of creativity and with the help of other factors like the Cold War, and the space race started a movement in psychology and education (J. A. Plucker, 2001). Policy makers over the past decades acknowledging the significance of creativity, view the enhancement of creativity and its incorporation in education as major issues, investing heavily in both. In recent years, theorists and researchers spoke about the looming creativity crisis and the possible negative consequences, making the subject of creativity a central problem (Florida, 2004; Kim, 2011).

As a consequence, much research in recent years has focused on creativity enhancement and researchers and teachers have proposed several methods to accomplish it (Fasko, 2001). However, as can be seen in table 1, most of these educational interventions aiming to foster creativity, were tested mainly on children and adolescents, because there is the old supposition that the ability to create something original declines with age (Birney, 1966; Lehman, 1953). Though, in recent years empirical studies and meta-analyses suggested that creativity as a dynamic life-long process of self-expression it is possible to be enhanced at any age (Goff, 1992; Ma, 2006; Simonton, 2000; Stine-Morrow et al., 2014; Tsai, 2013). Also, we must bear in mind that another feature of today’s world is an aging population and subsequently an aging workforce, with considerable implications for organizations and whole nations (Burtless, 2013; DeLong, 2004; Kanfer & Ackerman, 2004; Kanfer, Beier, & Ackerman, 2013; Kulik, Ryan, Harper, & George, 2014).

Table 1				
Some recent studies on creativity enhancement				
(Study) Researcher, year.	Age (years)	Measures-Assessment tools and techniques	Intervention – method and tools.	Creative variables increased
Hui, He, & Ye, 2015	M = 4.5	Story Telling Test (STT), Test for Creative Thinking-Drawing Production (TCT-DP)	Arts education	Verbal and figural creativity
Dziedziewicz, Oledzka, & Karwowski, 2013	4-6	Franck Drawing Completion Test, Torrance Test Thinking Creatively with Pictures	Doodle books, drawing.	Imagination, fluency, flexibility, originality-figural.
Alfonso-Benlliure, Meléndez, García-Ballesteros, 2013	5-6	Test de Creatividad Infantil (TCI), Battelle Developmental Inventory	Games (drawing, explore through senses, dance, etc.)	Total creativity.
Maker, Jo, & Muammar, 2008	K to 6th grade	Test of Creative Thinking – Drawing Production TCT-DP	A curriculum with emphasis on problem solving	Total creativity
Garaigordobil & Berruero, 2011	5-6	Torrance Test of Creative Thinking, Behaviors and Traits of Creative Personality Scale	Play sessions	Verbal: fluency, flexibility, elaboration, Graphic: fluency, elaboration, originality
Aqda, Hamidi, & Rahimi, 2011	Junior 1st grade	Torrance Test of Creative Thinking (TTCT)	Computers aided instruction	Originality, elaboration
J. D. Hoffmann & Russ, 2016	5-8	Alternate Uses Task-Wallach & Kogan	Pretend play	Fluency, originality
Chang, 2013	Children 4th grade	Williams Creative Thinking Test, Technological Creativity Test, Creative product Scale	Online problem solving	Product elaboration (no changes in divergent thinking)
Garaigordobil, 2006	10-11	Torrance Test of Creative Thinking, Assessment of the creative product	Play, various games and cooperation	Verbal: originality Figural: originality, resistance to premature closure, elaboration
Doron, 2017	M = 11.57	Tel Aviv Creativity (Test TACT)	Creativity training with the use of media mainly television	Fluency and uniqueness
Hsiao, Chang, Lin, & Hu, 2014	11-12	Creativity Assessment Packet (CAP)	Digital Game Based Learning System	Total creativity and manual skills
Robbins & Kegley, 2010	M = 19.76	Torrance Test of Creative Thinking (TTCT)	Online creative thinking program	Total creativity and self efficacy
Karwowski & Soszynski, 2008	M=22	Test of Creative Thinking-Drawing Test of Creative Imagination	Role play games	Fluency , originality
Hutton & Sundar, 2010	M=22	Abbreviated Torrance Test for Adults (ATTA)	Video Games playing	Fluency and overall creativity index
Yeh, 2015	25	Idea generation task	Action-video games playing	Originality, flexibility elaboration

Thus, in this reality, creativity enhancement in higher education and in adults is a major individual, organizational and societal challenge. Unfortunately, until today, few studies have investigated this aspect of creativity enhancement in adults and more work is needed.

Also, today in this rapidly changing world, ruled by a competitive economy, whether you are an individual, an organization or even a whole nation the only way to survive and succeed, is to seek, find and develop a competitive advantage. A key source of competitive advantage is creativity (Batey, 2011; Brown, 2016; Wagner & Hollenbeck, 2014). Furthermore, in the era of globalization, where mergers, acquisitions and the rapid rise of multinational corporations have become a daily phenomenon, creativity and innovation are not just a basic issue of organizational success but a vital element of organizational survival (Mihaly Csikszentmihalyi, 1999; Mihaly Csikszentmihalyi & Sawyer, 2014).

For creativity to happen we need the four P's, that is the Person, the Process, the Press, and the Product (Rhodes, 1961). But today we also need a T, the creative Team. Organizations and nations that thrive are those that quickly adapted to change, by building up the skills to manage complex multitasking systems and most importantly by mobilizing their greatest resources - the people who work for them, the creative teams (Reeves & Deimler, 2011). A team is something more complicated than simply an assembly of people. Teams are dynamic constructs made from two or more individuals, the team members, who interact with a high degree of interdependence in pursuit of shared objectives (Cohen & Bailey, 1997; Day, Gronn, & Salas, 2004; Dyer, 1984; Vanaelst et al., 2006). Team members bring to the team their distinct skills, expertise, abilities, traits, and their creative personality. However, creativity in teams due to the specific combination of personality traits and distinct interactions, differs from individual creativity (Kurtzberg & Amabile, 2001).

Creativity, creative accomplishments, and how they correlate with personality types are already a puzzle to many scientists, when we add to the equation the complexity and fluidity of teams this issue becomes a challenging area. Nowadays, subjects like teamwork, leadership, team performance and productivity, have attracted considerable research interest (Bell, 2007; Peeters, van Tuijl, Rutte, & Reymen, 2006). There are many theories on how to build and manage an effective creative team. Even though, all of these

previously conducted studies contributed in specific ways to the existing literature, yet, more work and alternative approaches are necessary. There are relatively few studies investigating creativity in teams, in terms of the creative output and its correlations to individual and team personality. The present work will attempt to fill this literature gap.

With the aforementioned in mind, the objectives of this master thesis are:

1. To design an educational intervention that will enhance creativity in young adults, with the implementation of a team-oriented structure and the utilization of Information and Communication Technologies (ICTs).
2. To administer it on a weekly basis, throughout a sufficient and reasonable time interval, so as to bring its cognitive effects.
3. To monitor the process and examine possible correlations between personality, creativity and effective teamwork, team personality and team creativity as it is manifested in the creative product, and to collect beneficial information.
4. To analyse the results and evaluate the effects of the designed educational intervention on subjects' creativity and performance. Furthermore, to draw useful conclusions.

2. LITERATURE REVIEW

2.1. Creativity and the Creative Product.

In ancient Greece people believed that creativity is a talent, a charisma, a divine gift and inspiration that required the mediation of the Muses and for years, even today many people still believe that. Fortunately for some decades now, especially after Guilford's APA presidential address in 1950, scientists have tried by developing experimental methodologies, theoretical models and psychological experiments to replace this mundane belief with solid scientific data and deeper scientific understanding.

Nowadays to the question "What is creativity?", one can give many answers. The eminent psychologist Simonton sees creativity as "*the most important and pervasive of all human activities*" and a "*very special and significant form of optimal human functioning*" (Simonton, 2000). According to the dictionary "*creativity is the ability to make new things or think of new ideas*" ("Merriam-Webster: Definition of Creativity," n.d.) and also "*the cognitive processes that lead to the production of new, original ideas, processes, or artifacts that are judged to be useful or otherwise of some value*" (Houtz, & Patricola, 1999). For Csikszentmihalyi creativity is a high order cognitive skill, part of the elaborate human personality and one of the factors that make us different from apes (M Csikszentmihalyi, 1996). Modern Cognitive Theory sees creativity as a process of living and argues that the human mind is in a continuous process of creating or recreating (e.g. memory) and thinking is a constructive-creative process (Houtz & Krug, 1995).

Creativity is generally classified into two main levels *Big-C* and *little-c*. *Big-C* is the unique, eminent creativity that brings a revolution and a breakthrough in a given domain. *Big-C* is rare and only very few people-that we call geniuses- will ever attain this level of creativity (Beghetto & Kaufman, 2009). Eminent classical composers, famous painters, authors and scientists that contributed to the arts, to science and to humanity with their work are examples of *Big-C* creativity. *Little-c* creativity is the everyday creativity that can be found almost in everyone and everywhere, it is universal and necessary for our survival and progress (Richards, 2010). Some researchers have proposed other levels of inventiveness like the Four C Model of creativity with the addition of the *mini-c* creativity and *Pro-C* creativity which is the professional expertise expressed in any domain (J. C. Kaufman & Beghetto, 2009). Today the conventional wisdom that only some gifted people are creative is replaced by the Componential

Theory of Creativity. The Componential Theory of Creativity defines the creative phenomenon as the production of original and appropriate products (T. Amabile, 2012) and assumes that all humans are able to produce creative work in some domain and the environment, physical and social, can influence this creative behavior (T. M. Amabile, 1997).

Most researchers define creativity as a multifaceted phenomenon that includes the production of something original from a person in the context of a culture that appreciates this product as useful and valuable (Mihaly Csikszentmihalyi, 2001; R. J. Sternberg & Lubart, 1996). Therefore, creativity besides from a *positive and good attribute* for someone to possess is an *ability* to make a *new, unique* product but this *original* product must be also '*meaningful*'. Hence, by definition creativity and the creative product involve both novelty and appropriateness (J. C. Kaufman, Kaufman, Beghetto, Burgess, & Persson, 2009) or in other words originality and effectiveness (Mark A. Runco & Jaeger, 2012). The *uniqueness* of a product, no matter if the product is tangible or intangible, is not enough to be considered 'creative', the second important feature is *appropriateness* or *usefulness*. The creative product must be '*meaningful*' or otherwise useful, relevant to a particular socio-economic context and have to fulfil certain requirements (J. A. Plucker, Beghetto, & Dow, 2004).

Many people confuse creativity with innovation but there is a difference "creativity refers to idea generation, whereas innovation refers to idea implementation" (Rank, Pace, & Frese, 2004). Therefore creativity is the process and production of the creative product in the mind of the creator, while the end result and the materialization of the creative process is innovation. Today we need innovation and the introduction of new products is a vital aspect of our current reality, but for innovation to exist, creativity and the constant creative thinking processes are a requirement (Vehar, 2013).

According to the four Ps of Creativity, creativity is made up of four strands that overlap and intertwine and these strands are 1.Person, 2.Process, 3.Press and 4.Product (Rhodes, 1961; Richards, 1999). Research on the creative person examines the structure of human personality attempting to discover if creativity is an inborn trait of the creative person or something that can be learned. It is easy to understand that researchers from different cultures would have different opinions of what exactly is creativity. Pioneers of the field like Guilford and Torrance from the very beginning-since creativity came to prominence in 1950, recognized that creativity is not a single act but a whole process, a

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multifaceted phenomenon difficult to describe and someone can be very creative in one domain while showing no creativity in all other domains.

2.2. The creative thinking processes – Convergent-Divergent

Creativity as an expression of mental health and emotional well-being (Simonton, 2000) requires a multitude of mental processes combining both convergent and divergent thinking (A. Cropley, 2006) and incorporating several cognitive variables like ideational fluency, originality, flexibility and even sensitivity to problems (DeHaan, 2013). Convergent thinking is a term used by Guilford as the opposite to divergent thinking and he is typically credited with distinguishing between these two ways of thinking (Mark A. Runco, 2011). As a type of thinking convergent thinking assumes that every problem has only one single and well-established correct solution and focuses on finding it (D. K. H. Kim & Pierce, 2013a). It is the application of logic, knowledge and familiar verified techniques to solve problems and respond to challenges in a fashion free from any ambiguity or doubt (A. Cropley, 2006).

Divergent thinking, in a more simplified view, is the opposite of convergent thinking and while convergent thinking typically leads to a limited number of conventional and “correct” ideas and solutions, divergent thinking, by contrast, includes production of multiple alternative and original ideas (Mark A. Runco & Acar, 2012). Divergent thinking the ability to see relationships in unconventional ways, is necessary to solve complex problems and innovate, hence is what is needed in our modern global society. However we have to understand that divergent thinking is the indicator or predictor for creativity it is not creativity itself, it is the *potential* to be creative, the *potential* to innovate (Mark A. Runco, 2010; Mark A. Runco & Acar, 2012). Moreover, we must also acknowledge, that extreme divergent thinking is not exactly desirable because it is often associated with pathological mental conditions like schizophrenia and other psychotic disorders (Karlsson, 1970; Schulberg, 1990). We can enhance creativity by developing divergent thinking with variables like diversity of exposure, encouragement, reward and social support, but according to scientific studies creativity is enhanced only if certain convergent capabilities are already in place (Fiore & Schooler, 1998; Heinzen, Mills, & Cameron, 1993).

It seems that creative people are able to use in an efficient and well balanced way the two opposite styles of thinking: the convergent and the divergent (M Csikszentmihalyi, 1996). On a neurophysiological level it is proved by several neuroscience experiments employing EEG, ERP and fMRI that divergent thinking and the whole complex creative process of problem solving, activates various different brain areas when just convergent thinking uses more stereotypical mental operations and processing units (Fink et al., 2009, 2010; Gabora, 2010; Her & Haron, 2016; R. E. Jung et al., 2010; Razoumnikova, 2000; Ueno et al., 2015; Xiong et al., 2015; Yoruk & Runco, 2014). For this reason it will not be an exaggeration to say that during the creative process there is a real brain-storm inside the brain of creative people with the ignition and activation of multiple brain regions recorded in the aforementioned experiments.

Nowadays all researchers agree that both types of thinking, convergent and divergent, are necessary for creativity (A. Cropley, 2006; DeHaan, 2013; Mark A. Runco, 2004, 2011). In creative people divergent thinking usually is prevalent and it is the source of many novel ideas, but for the evaluation of these ideas, the selection of the feasible and really original ones, and their transformation into *useful creative* products, convergent thinking is needed (D. K. H. Kim & Pierce, 2013a; Mohamed, 2014; R. J. Sternberg, 2006) .

2.3. Creativity and Personality Structure, the Five Factor Model (FFM)

Ancient Greek physicians and philosophers attempting to describe in a systematic way how the human body and psyche function developed Humorism. According to this proto-medical and psychological theory the metabolic agents of the four elements: earth, air, fire and water, are the four bodily fluids or humors in the human body: black bile, blood, yellow bile and phlegm, and the right balance of the humors is essential for the human physical and psychological health (“Internet Encyclopedia of Philosophy,” n.d.). The Father of Modern Medicine the Ancient Greek physician Hippocrates of Kos (450-380 BC) incorporated the theory of the four temperaments into his medical theories suggesting that these bodily fluids are responsible not only for our physical health but also for certain personality traits (Yapijakis, 2009), and the Greek physician and philosopher Galen of Pergamon (c.130AD-c.210AD) named these four temperamental

categories “sanguine”, “choleric”, “melancholic” and “phlegmatic” after the four humors (Henderson & Wachs, 2007).

Therefore, even since ancient times, there were many endeavours to construct a well-validated system for the description and classification of the human personality. In order to achieve this objective during the last century many researchers proposed the **Big Five personality traits** or **Five Factor Model (FFM)**. The Five Factor Model does not originate from a particular philosophical theory but it is the collective result of scientific research, analyses and observations and it summarizes language terms, empirical data and multiple factor analysis. This model following the trait approach suggests that human personality can be construed using five factors or dimensions namely: Openness to experience (O), Conscientiousness (C), Extraversion (E), Agreeableness (A) and Neuroticism (N) (McCrae & Costa, 1999; McCrae & John, 1992). Due to the fact that uses traits as dimensions, the FFM has been questioned several times since its introduction, because traits are not scientifically proven entities they are just ideas that got into our language and this does not prove their existence (Deary, 2009). However, today the Big Five model is vastly used as an empirically justified taxonomy of personality attributes trying to explain individual differences and reactions to situations and many researchers are investigating these five personality dimensions seeking their correlates in personality development and significant life events (J. M. Digman, 1990). In contemporary psychology the Five Factor Model serves mainly classification needs but it has also practical applications: it provides a simple way to define the complex human personality, a common language for researchers from different fields and a descriptive framework for organizing research and developing various assessment methods with useful implementations (McCrae & John, 1992).

Many studies have investigated the association between the five factors of personality, that the Five Factor Model suggests, and specific personality types or individuals, like highly intelligent people, geniuses, prominent leaders or very creative human beings. **Openness to experience** which is defined as appreciation of novelty, independence, vivid imagination, willingness to try new things, curiosity, high tolerance to ambiguity, adventure pursuit and tendency to reject convention (Feist, 1998, 1999a; McCrae, 1999) appears to correlate highly with intelligence, high IQ and academic performance (Bartels et al., 2012; Chamorro-Premuzic & Furnham, 2008; DeYoung, Quilty, Peterson, & Gray, 2014). Since usually intellectual people score high on Openness

to experience some studies perceive this dimension as a subdivision of Intelligence that embodies aspects associated with divergent thinking which is why instead of Openness they use the term Intellect (John M. Digman & Inouye, 1986). What is most striking is that the definition of Openness to experience almost equals the description of the creative personality. Highly creative people in any domain are characterized by exactly these traits: vivid imagination, acceptance of the different and unknown, curiosity, flexibility, high independence to pursue their original goals and high intelligence (Csikszentmihalyi, 1996b; Pritzker & Runco, 1999; Simonton, 1999, 2000; R. J. Sternberg, 2006). Over the past few decades a considerable number of studies have proven that openness to experience has a consistent and strong relationship with creativity and creative achievement in any domain (Feist, 1998; George & Zhou, 2001; S. B. Kaufman et al., 2016; Li et al., 2015; McCrae, 1987; McKay, Karwowski, & Kaufman, 2016; Silvia, Nusbaum, Berg, Martin, & O'Connor, 2009). Today, there is the rationale that openness must be positively related to leadership, because effective and charismatic leaders must be creative, and creativity is strongly associated with openness to experience (Judge & Bono, 2000; D. I. Jung, 2001; Lim & Ployhart, 2004). Studies that addressed the link between openness to experience and the work-environment revealed that openness is associated with innovation at work and charismatic leadership (Araujo-Cabrera, Suarez-Acosta, & Aguiar-Quintana, 2016; Carmeli, Reiter-Palmon, & Ziv, 2010; Hammond, Neff, Farr, Schwall, & Zhao, 2011; Judge & Bono, 2000; D. I. Jung, 2001).

Conscientiousness is the tendency to be responsible and well-organized, disciplined, diligent, meticulous, goal-oriented and to control your emotions and impulses (Amichai-Hamburger & Vinitzky, 2010; Costa & McCrae, 1992; Roberts, Jackson, Fayard, Edmonds, & Meints, 2009). Numerous studies suggest that conscientiousness is strongly associated with high academic performance (Busato, Prins, Elshout, & Hamaker, 2000; Chamorro-Premuzic & Furnham, 2003, 2008; O'Connor & Paunonen, 2007; Poropat, 2009). The connection between conscientiousness and creativity is not clear and varies by the domain investigated, the level of creativity and the environmental factors. Some studies support the notion that conscientious people as self and intrinsically motivated do not need social approval to feed their ambition and perseverance, thus they have more creative accomplishments in both scientific and artistic domains (Feist, 1998, 1999b; Taggar, 2002). Also, as research suggests, at low levels of creativity, conscientiousness is positively related whereas at moderate and high levels the relation is negative (King, Walker, & Broyles, 1996). As for the environmental factors when they

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are unsupportive and oppressive, people with high conscientiousness exhibit low creativity (George & Zhou, 2001). The connection between conscientiousness leadership is inconsistent, although most studies report the existence of a positive link (Bono & Judge, 2004; Deinert, Homan, Boer, Voelpel, & Gutermann, 2015). Also, according to some studies there is a positive relationship with team performance (Peeters et al., 2006).

Extraversion which is defined as sociability, warmth, high energy and activity, assertiveness, excitement seeking and tendency to experience joy, enthusiasm and high positive emotions when being with other people (Costa & McCrae, 1992) is strongly correlated with effective team-work, positive leadership traits and transformational leadership (Araujo-Cabrera et al., 2016; Barrick, Mount, & Judge, 2001; Crant & Bateman, 2000; Judge & Bono, 2000; Lim & Ployhart, 2004). However, many studies report a negative link between extraversion and academic performance (Busato et al., 2000; O'Connor & Paunonen, 2007). The association between extraversion and creativity is unclear and research results are inconsistent. There is evidence for the existence of a positive relationship especially on individual level (Crant & Bateman, 2000; S. B. Kaufman et al., 2016; King et al., 1996; Martindale & Dailey, 1996; Sung & Choi, 2009; Wolfradt & Pretz, 2001). However, on organizational level and when the job scope is high studies suggest that extraversion is negatively linked to creativity (N. Anderson, Potočnik, & Zhou, 2014). Also, there are many studies emphasizing the fact that highly creative people frequently feel uncomfortable when socializing and get easily drained in social situations. Therefore instead of extraversion introversion is positively related to creativity (Feist, 1998; Kline, 1966).

Agreeableness is one of the five personality factors that can also be used as a dimension of interpersonal behaviour. Agreeable people are kind, mild, loyal, sociable individuals, trusting and trustworthy, who avoid antagonism and conflict while demonstrating a high degree of cooperation and compliance (Costa & McCrae, 1992; McCrae & John, 1992). In projects where collaboration and teamwork are needed agreeableness is a major behavioural requirement (Witt, Burke, Barrick, & Mount, 2002). The relationship between agreeableness and creativity according to most studies is negative (Feist, 1998; King et al., 1996) because agreeableness equals conformity, while creative people by definition have to be unconventional rebels that are not afraid to challenge the status quo, to explore the unknown and create new realities. As for a leadership trait the results of empirical studies are ambiguous. Trust, straightforwardness,

compassion and sensitivity to the needs of subordinates are considered important for a charismatic leader and this perceptions are supported by the results of relevant studies (Judge & Bono, 2000). However, at the same time research suggests that there is a negative link between agreeableness and leadership (Lim & Ployhart, 2004; Witt et al., 2002) because people with high levels of compliance and tolerance are often seen as naive and submissive by others, and workers or other team-members begin to lose respect for the leader and thus teamwork disintegrates. Also charismatic leaders should be creative and if creativity is proved to be incompatible with agreeableness then agreeableness is obviously not a desirable quality of a leader.

Another trait of the human personality **Neuroticism** is associated with anxiety, hostility and envy, emotional instability and vulnerability, low self-confidence and self-esteem, depression and a general tendency to experience negative emotions and react negatively to stressors (Costa & McCrae, 1992; Widiger, 2009). Neuroticism and creativity are positively linked according to several studies (Feist, 1998). However there are also many studies indicating that there is not any link and neuroticism is unrelated to the creative ability and accomplishments (Batey, Furnham, & Safiullina, 2010; King et al., 1996) or even negatively related to the creative personality and divergent thinking (Martindale & Dailey, 1996; McCrae, 1987). Some studies suggest neurotic individuals to be doubtful and suspicious towards anything new and less inclined to accept technological innovations (Vreede, Vreede, Ashley, & Reiter-Palmon, 2012) and neuroticism negatively linked to scientific creativity (Furnham, 2015) and creativity on organizational level (N. Anderson et al., 2014). The association between the trait of neuroticism and leadership is negative by its definition since most studies of the leadership personality describe the leader as a self-confident and emotionally stable individual, with a lot of drive, internal energy and motivation (Hogan, Curphy, & Hogan, 1994; Judge, Bono, Ilies, & Gerhardt, 2002; Kirkpatrick & Locke, 1991). People high in neuroticism are not easily accepted as leaders by their subordinates, they can not be effective leaders and often suffer from burnout (Crant & Bateman, 2000; De Hoogh & Den Hartog, 2009; Lim & Ployhart, 2004). Although the existent researches and empirical data are relatively limited the negative relationship between neuroticism and transformational leadership is not supported in the field of business and organizations (Judge & Bono, 2000; Walumbwa & Schaubroeck, 2009). Viewed from the organizational perspective most studies indicate that neuroticism affects negatively teamwork and job performance due to less communication, cohesion and collaboration in

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teams and more personal stress, resulting in loss of attention, more errors, and lower productivity (Barrick & Mount, 2000; Neal, Yeo, Koy, & Xiao, 2012; Rasmussen & Jeppesen, 2006).

2.4. Creativity and knowledge.

Creative ideas are not produced out of nothing, creativity demands a certain level of systematic training and practice to acquire a large set of skills and rich domain-relevant knowledge (Simonton, 2000). A certain degree of expertise is of importance to creativity because only experts can readily retrieve relevant knowledge of a field and apply it to solve novel problems (DeHaan, 2013). The foundation of all creative work is expertise and expertise includes knowledge, technical proficiency and special talents in the target domain (T. M. Amabile, 1997). Moreover knowledge is correlated with intelligence and according to the ‘threshold theory’ creativity requires a certain level of IQ. Several studies have estimated this necessary level of IQ to be above-average, suggesting a strong relationship between knowledge, ‘traditional’ intelligence and creativity (Jauk, Benedek, Dunst, & Neubauer, 2013; R. E. Jung et al., 2009). Therefore, knowledge is necessary to engage in problem solving, to think creatively and make contribution to a specific field but is not sufficient and furthermore knowledge should not undermine flexibility of thinking (R. Sternberg, 2007; R. J. Sternberg & Lubart, 1995). As Sternberg emphasizes knowledge can be a double-edged sword, experts sometimes become stuck in a particular way of thinking that they lose their flexibility and ability of true creativity (R. Sternberg, 2007).

Fortunately one of the many characteristics of the creative person is not only the need to acquire knowledge and to reach an expert level but also flexibility of thinking. According to Robert Sternberg creativity is a habit, and creative people habitually respond to problems not mindlessly and automatically but in fresh and novel ways (Mark A. Runco, 2010; R. Sternberg, 2007; R. J. Sternberg, 2006). Creative people use their expertise to find solutions related to the problem and at the same time avoid the common or high-frequency solutions that according to their knowledge work for other similar problems (Gupta, Jang, Mednick, & Huber, 2012). Instead they restructure the whole problem and choose to follow a totally different path to solve it. This skilful re-

structuring or re-definition of the problem is part of the complex creative thinking process and according to recent studies can be practised by everyone, everyone has creative potential (M. A. Runco, 2004)

2.5. Creativity And Education

In his “Structure of Intellect”, Guilford pictures the human intellect as the chemist’s periodic table with known elements but also vacancies that indicate unknown elements. In the same way, the human adult intellect structure includes known elements but also has vacancies that point to still undiscovered factors (J. P. Guilford, 1966). This complex picture of the human intellect explains to some point the complexity of human creativity as an expression of the human psyche. But creativity is even more complex, it is the expression of the synergistic interaction of heredity, intelligence, personality and environment (Bouchard Jr, Lykken, Tellegen, Blacker, & Waller, 1993; Eysenck, 1993) and creative achievement requires both nature and nurture (Simonton, 2000).

Creativity in the past and even today is often seen as a special talent, a charisma or an inborn trait and this is partially true if we refer to the so called big-C creativity that alters a whole intellectual domain. However, if we speak about everyday creativity or creativity in general as a cognitive skill, according to Bloom’s Taxonomy of Learning Domains or Behaviours – remembering, understanding, applying, analyzing, evaluating, creating - creativity belongs to the higher order cognitive processes and can be taught and developed (L. W. Anderson, 2005; Ben-Zvi & Carton, 2014; Forehand, 2010; Krathwohl, 2002). Indicators of scientific creativity and innovation potential like attention span, perseverance and self-directed inquisitiveness can be easily detected and measured and educational techniques, that will identify and support these characteristics and the individuals that possess them, can be developed (Diamond & Lee, 2011; Heinzen et al., 1993).

According to the ‘Baldwin effect’, proposed in 1896, the ability of an organism to learn and assimilate a new behaviour will affect its reproductive success and its survival (Hinton & Nowlan, 1987; Turney, Whitley, & Anderson, 1996). Guilford believed that a creative act is an instance of learning, for it represents a change in behavior and in his

APA presidential address asked why there is so little correlation between education and creative productiveness and why schools were not producing more creative persons (J.P. Guilford, 1950).

Furthermore, creativity is not static but a dynamic process, an activity that develops throughout the human life span and contrary to popular belief that is declining with age, research on the relationship between creativity and age has shown that this is not the case. At different life stages there are different modes of thinking and qualitative changes in the creative process, creativity takes on new forms in adulthood and we have different kinds of creativity (Sasser-Coen, 1993). Therefore everyone and at every age can be engaged in these cognitive processes, that with the right methodology can be enhanced and we can attain ample creative output and the production of new, unique, meaningful products (Binnewies, Ohly, & Niessen, 2008; Houtz, & Patricola, 1999; J. C. Kaufman & Beghetto, 2009). Several meta-analyses suggest that creativity training programs are generally effective (Scott, Leritz, & Mumford, 2004; K. C. Tsai, 2013).

Nowadays creativity is a highly regarded ability. Thus, there is much research, theories and suggestions as to how to develop creative abilities from childhood to adulthood, and several teaching techniques that intend to stimulate creativity (Fasko, 2001). Unfortunately, the creative process if not addressed properly can also be discouraged and suppressed. For Sternberg “Creativity is a Habit” but the problem is that today our schools and the world of conventional standardized tests treat creativity as a *bad* habit (R. Sternberg, 2007) and this destroys the whole educational process of learning. Creative thinkers are at a disadvantage when taking traditional intelligence tests, like multiple choice tests, because these tests reward the individual that is able to find the single correct answer and they assess mainly convergent thinking the opposite of divergent thinking (J. A. Plucker & Makel, 2010; R. J. Sternberg, 2012). Therefore, in most assessment programs, today, a culture that rewards the answers conforming to what is considered “correct” is cultivated, a culture that rewards uncreative thinking and at the same time discourages novel perspectives and fresh ideas (Rosen & Tager, 2013).

Even though all educators agree that creativity is an important skill, that must be taught and fostered if we want to maintain global competitiveness, they also agree that

due to various societal constraints the current educational system do not promote creative thinking (Baer & Kaufman, 2008; Clapham & Schuster, 1992; K. Robinson & Aronica, 2015). In many countries the curriculum is oriented towards memorization, knowledge acquisition and development of basic literacy skills leaving no room for creativity (Gardner, 2006). Around the world, there are many educational programs for struggling students when at the same time curricula for talented, gifted and creative students are much fewer. In these systems nonconforming divergent thinkers are considered as rebels and are unwelcome. Nonconformity-a prerequisite of creativity- is unwelcome because the natural human tendency is to keep our surroundings as familiar and predictable as possible, to preserve the status quo. In this preserved environment creative people are often seen as a threat (Chamorro-Premuzic, 2015).

This constant standardized testing and the lack of engagement with the natural world does not leave to children and students an outlet for physical and creative expression, causes more stress and finally backlashes since it appears to be one of the main reasons for poor student performance (Beres, 2016). The evidence comes from neuroscience, and it is known as the “amygdala hijack”, the ‘reptilian’ part of our brain when it is threatened hijacks everything else like the prefrontal cortex, the rational brain part, which we use to think and learn, and constant testing and examinations are perceived as threats (Goleman, 1998; Zhang & Lu, 2009). If we add to this the fact that our brain is not fully developed until the age of thirty and according to research myelination continues even until the age of forty (Pujol, Vendrell, Junqué, Martí-Vilalta, & Capdevila, 1993), we can understand the detrimental effects of the constant standardized testing and the complete lack of creative engagement and expression, on brain development and the process of learning.

The educational system, in most countries, needs an overhaul if we want to have better learning, improved student performance and a more creative, productive and competitive society. Education reform is one of the most contentious issues today and educators, scientists and even politicians agree that enhancing creativity is key factor and a must of this education reform. Creativity can be fostered and there are various methods to achieve that. But before fostering creativity we have to measure it.

2.6. Can We Measure Creativity?

The assessment of creativity is a critical element for its development. The last decades there is a growing interest in creativity because people have acknowledged its importance for our existence and researchers developed various methods to assess creativity. But what we must not forget is the complex definition of creativity as a phenomenon and from this we can understand that when we try to measure creativity we actually measure one facet of the whole phenomenon. To achieve real creativity we need several other factors including the right environment, timing, disposition, opportunity and other. Also we can understand that it is very difficult if not impossible to measure Big-C creativity which can be found in geniuses. This level of creativity, Big-C, is appreciated by humanity and it can be evaluated with *historiometric measures* (J. C. Kaufman & Beghetto, 2009). The other levels of creativity: mini-c, little-c, Pro-C, according to researchers can be assessed in many ways through non-testing approaches, like judgement of actual creative products (consensual assessment by experts, peer evaluation, opinions etc.) and through various testing approaches (D. K. H. Kim & Pierce, 2013b).

Probably the most simple way to measure little-c creativity is to ask someone how creative he/she is. Obviously this kind of self-assessment will lack validity because of potential bias and may include several distortions either intentionally or unintentionally (J. C. Kaufman, Lee, Baer, & Lee, 2007). A better approach is to ask individuals questions and measure attitudes and values, like curiosity, independence, self-confidence and imagination that are indirectly linked to creativity. To achieve this we can use inventories based on psychological studies of personalities and some of them even include creativity as a scale. A well known self-report inventory is the **Khatena-Torrance Creative Perception Inventory-KTCPI**, designed in 1998, which is comprised of two sub-inventories that assess an individual's self-perception of creativity, the **Joe Khatena's SAM-Something About Myself**, and **E.Paul Torrance's WKOPAY-What Kind Of Person Are You** (Houtz & Krug, 1995). The KTCPI categorizes respondents as *low*, *medium*, or *high* in creativity based on their answers' scores. Other worthy to mention inventories and introspective self-report questionnaires are **the Myers-Briggs Type Indicator (MBTI)** based on the typological theory introduced by C.Jung, the **Group Inventory for Finding Talent (GIFT)** developed by Rimm in 1976 and also **Renzulli's 10-item creativity rating scale** (D. K. H. Kim & Pierce, 2013b).

An example of non-testing approach is the **Consensual Assessment Technique (CAT)** which was first proposed by Amabile in 1982 and further developed by her and several other researchers. According to CAT subjects are asked to create some kind of product, tangible or intangible, and then experts with deep knowledge of the domain in question, that work independently and do not influence one another's judgements, are asked to evaluate the creativity of the products (T. M. Amabile, 1983; J. C. Kaufman, Plucker, & Russell, 2012). The CAT is based on the idea that the best measure of the creativity of just about anything, in a particular field, is the combined assessment of recognized experts in that field who serve as judges (Baer & McKool, 2009).

As a technique the CAT is a powerful and well validated tool widely used by researchers to assess creativity in any field (J. C. Kaufman, Baer, Agars, & Loomis, 2010; J. C. Kaufman et al., 2007). However, and although there are many studies on how to measure a creative product, there are relatively few studies that aim to evaluate creativity of tangible scientific or technological products (D. H. Cropley, Kaufman, & Cropley, 2011). Also the CAT technique has certain limitations and drawbacks. One limitation stems from the subjectivity of judgements and another from the fact that all judgments are constrained by the constantly evolving standards of every domain in which creativity is assessed (J. C. Kaufman, Baer, & Cole, 2009). Also, since expert judges belong to a particular domain then CAT measures only one of the many facets of creativity (J. C. Kaufman et al., 2007). Other limitations are just practical: the whole process can be very time-consuming and assembling groups of experts is difficult and quite possibly expensive (Baer & McKool, 2009).

One main disadvantage of the Consensual Assessment Technique originates from its conception: CAT evaluates the result of the creative performance, the actual creative product, but what happens when we want to assess the creativity of an individual that has not created anything yet? What instrument can we use to detect the ability of an individual to be creative in the future and to measure the so called creative potential? Because of these constraints of non-testing methods researchers developed several creativity tests.

2.7. Creativity Tests

Due to the inherent complexity of creativity a reliable and valid assessment should be based on several and different creativity tests (Arthur J. Cropley, 2000). Guilford, whom we can regard as the father of the modern creativity era, because of his address to the American Psychological Association in 1950 (“APA Presidential Addresses,” 2016; J. Plucker, 2016), developed the first creativity tests to measure what he called divergent thinking and many eminent researchers built on his work and further developed the field of testing. Creativity Tests attempt to assess qualities, abilities and traits that according to theory are components of creativity, and they actually measure creative accomplishments in practice so by definition and construct they have more validity and less bias than self-assessment inventories (Arthur J. Cropley, 2000; J. C. Kaufman et al., 2007; K. H. Kim, 2006). Torrance and Golf in 1989 identified more than 255 such instruments and today there is a great number of creativity tests available that measure various cognitive and non-cognitive features of creativity (Arthur J. Cropley, 2000).

Guilford and his group of researchers developed a wide variety of psychometric tests to measure specific abilities predicted by the Structure of Intellect Theory (J. P. Guilford, 1966; J.P. Guilford, 1956, 1967) and with his work he associated divergent thinking and the production of divergent ideas with creativity. Of course, Divergent Thinking (DT) Tests like any human construction are not perfect and their results are influenced by many factors such as the conditions under which they are administered, experience, memory, environmental factors or even the personality and the disposition of the raters (Mark A. Runco & Acar, 2012; Mark A. Runco, Millar, Acar, & Cramond, 2010). Therefore, it is more accurate to say that DT Tests are not measuring general creativity but they are merely helpful estimates of the creative *potential* (Mark A. Runco & Acar, 2012). The four most commonly used of Guilford’s tests are Alternate Uses, Plot Titles, Consequences and Simile Insertions (Mark A. Runco, 2011; Stein, 1974).

The Alternative Uses Test or Task was designed by J. P. Guilford and asks respondents, in three minutes, to think of as many alternative uses as they can for a simple object like a paperclip, a brick, a newspaper, a knife, a shoe etc. (Benedek, Mühlmann, Jauk, & Neubauer, 2013; P. Christensen, Guilford, Merrifield, & Wilson, 1960; Drapeau

& DeBrule, 2013). This test measures DT - divergent thinking since it asks subjects to find many possible solutions to a problem and to generate many different ideas, contrary to standardized and conventional tests who measure convergent thinking and want subjects to find a single correct solution. The Alternative Uses Task was further developed by several other researchers like Torrance, Wallach and Kogan and there are many studies supporting its validity and reliability, both internal consistency and inter-rater reliability (Kogan, 1983; Mark A. Runco, 1984; Mark A. Runco & Acar, 2012). Alternate Uses, as a divergent thinking test, it is often used in creativity studies because it allows reliable assessment of the potential for creative thought (Dippo & Kudrowitz, 2013). When Guilford developed the Alternate Uses Test it was scored only for fluency and originality (Houtz & Krug, 1995), but today scoring is comprised of four sub-categories or four components of divergent thinking: fluency, flexibility, originality and elaboration.

Fluency – number of responses : the total number of uses the subject can come up with. Duplicates are not included.

Flexibility – the degree of difference of the responses: number of categories or domains that the answers cover.

Originality – statistical infrequency of response: how uncommon those uses are.

Elaboration – level/ amount of detail of the responses.

(“Guilford Uses Task,” 2016; Lemons, 2011).

The **Plot Titles Test** designed by Guilford and also developed by other researchers, evaluates mainly fluency and originality, subjects are presented with one or two short stories and asked to generate as many appropriate and clever titles they can. The responses are later counted, to evaluate fluency, and duplicates are not included. To evaluate originality the answers are independently scored by two judges, and each response receives a rating on a 1 to 5 scale of cleverness, where a value of 1 indicates not at all clever response while 5 indicates highly clever (Berger & Guilford, 1969; P. R. Christensen, Guilford, & Wilson, 1957; Zaccaria, Chorness, Gerry, & Borg, 1958a).

The **Consequences Test** was originally developed by Guilford and his associates and used to measure ideational fluency and originality. In this task subjects are presented with a hypothetical situation and are instructed to think of as many different consequences or results as they can and list them (Berger, Guilford, & Christensen,

1957). Since the given situation is almost improbable to happen, the possibility of experience is non-existent, which is why the subject has to use imagination and originality (Sarsani, 2006). The Consequences Test was later modified and adapted by Torrance and many other researchers, and today it can be used to evaluate fluency (total number of responses), originality (statistically rare responses), remoteness of flexibility (number of different domains or categories covered by responses) and elaboration (level of detail) (Harris, 2016).

The **Wallach and Kogan battery of Creativity Tests** was developed in 1965. It is one of the most widely used measures of divergent thinking and contains a number of tests that are somehow extensions of Guilford's tests (Sawyer, 2012). The Wallach and Kogan tests according to specifications for administration (Hattie, 1980; Wallach & Kogan, 1965; Ward, Kogan, & Pankove, 1972) must be individually administered to children in a game-like, non-evaluational atmosphere and with no time constraints. The tests or procedures are five, three verbal and two visual, and subjects must generate associates. Each test is scored for the total number of associates-fluency and for uniqueness or originality of associates (Wallach & Kogan, 1965). The verbal tests include Instances – where the subject must generate multiple members of a group or class, Alternate Uses – generation of multiple uses of common objects like knife, button, key, newspaper, shoe, and Similarities – finding analogies and likeness between two objects. The visual tests include Pattern Meanings and Line Meanings and ask the subject to propose possible interpretations or meanings of various abstract designs-patterns and line forms (Wallach & Kogan, 1965).

Since their development in 1965 the Wallach-Kogan Tests were administered to different groups of subjects on various occasions and results confirmed that performance to these divergent thinking tests did have a relationship with success and achievements in non-academic domains while at the same time have the least relationship with scores on standardized intelligence tests (Mumford, 2011). The tests are also found to be highly reliable and inter-correlated forming a well defined separate cluster with virtually no relationship with IQ testing (A. J. Cropley & Maslany, 1969). Over the years Wallach and Kogan argued that test results show the existence of a distinctive independent facet of cognitive functioning and divergent thinking tests that measure creativity potential should

also be a part of the evaluation process in college admissions (Houtz & Krug, 1995; Mumford, 2011).

Ellis Paul Torrance, very early in his career and while working on a research project with the US Air Force, was surprised to discover that when pilots had to cope with unexpected situations the critical factor for survival was their creativity. This discovery was the beginning of his long research career in creativity and he developed the **Torrance Tests of Creative Thinking (TTCT)** (A. G. Robinson & Stern, 1998). The TTCT initially published in 1966 and revised several times since then, are based on Guilford's theories and are used to measure four divergent thinking factors like Fluency, Flexibility, Originality and Elaboration (Arthur J. Cropley, 2000; D. K. H. Kim & Pierce, 2013b). Torrance constructed his tests aiming to develop an efficient tool to measure cognitive abilities that are associated with creativity and that could be administered across a wide range of ages predicting creative potential and future achievements (Mark A. Runco et al., 2010). The Torrance Tests of Creativity are perhaps the most well known and widely used tests of creativity today, they are highly reliable and can be scored for several factors (D. K. H. Kim & Pierce, 2013b). The TTCT tests, like Wallach and Kogan Tests, is recommended to be administered in a game like atmosphere (D. K. H. Kim & Pierce, 2013b) the main difference is that contrary to the W-K Tests in the TTCT there is a time limit. The Tests have two versions Verbal and Figural and introduce subjects with a number of open-ended situations requiring written responses or drawing a picture or sketch (Torrance & Others, 1967).

The RAT Test – Remote Associates Test, created by Professor Sarnoff Mednick and his wife Martha, is one of the many tests used to determine the creative potential of a person. The test usually lasts forty(40) minutes and it consists of forty(40) questions. Each RAT question lists a group of words (typically three) and requires the subject to find one extra word that is related to the provided group of words and links all of them together (S. Mednick, 1962; S. A. Mednick & Mednick, 1967). Today RAT is considered to measure mainly convergent creative thinking (Taft & Rossiter, 1966) and as we understand the main disadvantage of the Remote Associates Test is that it is possible to be verbally biased (Vernon, 1972) individuals that do well in verbal ability tests usually do well on the RAT (Mark A. Runco, 2011).

2.8. Creativity – Methods of enhancement.

The enhancement of creativity has long been of concern to teachers and researchers. That is why, in the same way that there are hundreds of tests to assess creativity, there are hundreds of methods that try to develop and enhance it. In the past many researchers have proposed various methods of creativity enhancement, and we can see some of them in table 1. Cognitive models of learning propose methods and techniques that involve learners more directly in active roles like computer-aided and multimedia instruction, work-groups, role play, discussion and other like questioning techniques, reviews and summaries that enhance learner participation and transformation of the covered material (Houtz & Krug, 1995).

Dan Meyer ‘*the most famous math teacher in America*’ an educator that “*wants to radically change the way we learn math*” (Upholt, 2015), in his blog and his TED Talk, among other things recommends to “*use multimedia to bring the real world into the classroom*”, “*let students build the problem*”, “*encourage student intuition*” and “*be less helpful*”(Meyer, 2010).

Educators must find a way to enable creative exploration, encourage sensible risk-taking and curiosity by establishing a creative environment, allowing their students the right to make mistakes and explore alternative routes, and rewarding students who are willing to endeavor to develop new ideas and construct new realities (Mann, 2006). However, educators should be careful because extrinsic motivation can inhibit creativity (T. M. Amabile, 1997). It seems that when individuals view the task engagement as a job or a duty or a task motivated primarily by expectancy of a promised reward, meeting a deadline or an expectation of evaluation, the result is to exhibit strikingly low levels of creativity. However, when individuals receive the same reward as a bonus and are intrinsically motivated by viewing the task engagement as motivated by their own *interest, enjoyment, satisfaction and challenge*, they usually exhibit greater creativity (T. M. Amabile, 1985, 1997; Erbas & Bas, 2015).

Other researchers propose to *engage* the students in the educational process and to make them feel “*partners of the teacher*” (Mann, 2006, 2015). Also to enable creative exploration, and provide them the opportunity to test and demonstrate their

creativity and instead of reward offer bonuses for more creative products (quantity) or exceptionally creative products (quality) (Blašková, 2014). Several studies suggest to create a supportive cooperative environment which will influence positively the student's intrinsic motivation to participate and to learn, and this will subsequently enhance creative performance (C.-Y. Tsai, Horng, Liu, Hu, & Chung, 2015). Also, in order to develop creativity in students other suggestions include challenging students, systematic monitoring and highlighting even tiny achievements, openness, objectiveness, keeping promises and agreed rules, and posing questions that provoke and inspire students to seek their own solutions, definitions and truth (Blašková, 2014).

2.8.1. Creativity-Methods of Enhancement - Play

A very effective way to establish optimal settings for the development of creativity and to engage someone in the creative process is to create a game-like atmosphere and to present a task in the form of a play. Play as a behavior is an intrinsically motivated set of acts and includes the notion of freedom, fulfillment, exploration, curiosity, choice, enjoyment, satisfaction and other positive concepts and feelings (T. M. Amabile, 1996; Willett, Robinson, & Marsh, 2012). Research suggests that play allows individuals to practice re-combining ideas and making new associations which is a part of the complex creative thinking, and there is a positive relationship between play and creativity (J. Hoffmann & Russ, 2012; Russ, 2003). As we can see in table 1, many researchers use play and games as a method for creativity enhancement, that is because according to empirical research when a task is presented as a play individuals are intrinsically motivated, more engaged in the process and respond with more elaborated products (Glynn, 1994). Play stimulates creativity, regardless of the form of the game and the age of the player, in children participating physically in recreational activities (Garaigordobil, 2006), in adolescents playing videogames (Hsiao et al., 2014; Jackson et al., 2012; C. S.-H. Yeh, 2015) and even in adults engaged in organizational tasks in their workplace (Mainemelis & Ronson, 2006; S. West, Hoff, & Carlsson, 2013).

2.8.2. Creativity-Methods of Enhancement – The importance of Questioning

“In a global information environment, the old pattern of education in answer-finding is of no avail: one is surrounded of answers, millions of them, moving and mutating at electric speed. Survival and control will depend on the ability to probe and to question in the proper way and place.”

(McLuhan & McLuhan, "Laws of Media", 1992, p. 239)

Problem Solving is accepted as an efficient way to develop creativity, especially when we have the so called open-ended-problems (those that have many solutions) that demand a genuine creative cognitive process of thinking. Open unstructured questions, assignments and case studies require individuals to engage their higher cognitive abilities including analysis, synthesis and restructuring of the problem, thus stimulating divergent thinking and creativity (Arthur J. Cropley & Urban, 2000; Horng, Hong, ChanLin, Chang, & Chu, 2005; Mumford, Medeiros, & Partlow, 2012). The theory of assimilative and explorative cognitive styles can explain to a point the relation between creativity and problem solving where *explorers* are the more innovative and original individuals who seek new types of solutions and ways of solving problems (Martinsen, 1995). But what about the problem itself? As Albert Einstein put it: *“The formulation of a problem is often more essential than its solution”* and *“To raise new questions, new possibilities, to regard old problems from a new angle requires creative imagination and marks real advances in science”*(Einstein & Infeld, 1967). The French philosophy teacher Paul Souriau in his “Theory of Invention” (1881) stressed the fact that *“A question well put is half resolved”* and *“True invention thus consists in finding questions”* . Souriau also emphasized the fact that there is something mechanical in finding solutions and *“The truly original mind is that which discovers problems”* (cited in Radnitzky, Bartley, & Popper, 1987 p.97; Wakefield, 1991 p.185). Recognizing the importance of the construction of the problem itself, Balka in his Creative Mathematical Ability Test provided participants with situations from which they were to develop problems (Balka, 1974). To discover a new problem and to construct a meaningful question is part of the critical and creative thinking process, hence, it is an efficient way to stimulate the complex process of creative thinking (Ennis, 2011; Reiter-Palmon, Illies, & Kobe-Cross, 2009).

There are numerous studies and meta-analyses investigating the effect of problem based learning and student question generation, on knowledge elaboration and learning (Furtak, Seidel, Iverson, & Briggs, 2012; Luxton-Reilly & Denny, 2010; Schmidt, Rotgans, & Yew, 2011). Several of these studies conclude that questions generated by students are an effective way of actively engaging the students in the learning process, leading to very positive learning results (Luxton-Reilly & Denny, 2010). Also there are some studies that evaluate the quality of constructed questions in terms of creativity (Yu & Pan, 2014). However, we could not find in the literature, any study specifically designed to use student question generation as a creativity enhancement technique. The aim of the present study is to fill this gap in our knowledge.

2.9. Creativity in Teams

Most scientific studies tend to assume that creativity occurs when creative people work alone and they usually view creativity as individualistic in nature. However, in reality we can see that in today's competitive world most creative success stories are a result of team effort. Teams are generally more effective than individuals because of the variety of ideas contributed to the creative process, the open communication, exchange of ideas and error-checking, that enables members to build on each other's ideas (McMahon, Ruggeri, Kämmer, & Katsikopoulos, 2016). Of course creativity in teams differs from individual creativity and this has its advantages and disadvantages. Although team members contribute to the group's creative outcome, team creativity is not the aggregate of all team members' creativity (Kurtzberg & Amabile, 2001). Individual creative performance will be enhanced in supportive groups and decreased if the group is not supportive and has high conformity expectations (Somech & Drach-Zahavy, 2013; Woodman, Sawyer, & Griffin, 1993).

In group creativity there are two important factors : the team structure and the nature of the leader. Adaptability and flexibility are necessary elements for divergent thinking and creativity, but they are also essential features of the team structure if we want to have a creative team. Creativity on the group level is a more complex phenomenon than individual creativity, and is intertwined with communication and open exchange of ideas (Kristensson & Norlander, 2003). A liberal fluid group structure where there is openness, selflessness, cooperation, trust and a feeling of safety to speak up and

to take risks, stimulates creative thinking and nourishes creativity (Somech & Drach-Zahavy, 2013).

As for the nature of the leader, because creative people are characterized by high degree of autonomy and creativity is a process that can be pursued both individually and collectively, in groups the main role of the leader is to inspire and motivate the members of the group (Hounsell, 1992). The most important elements of this motivation are a value placed on creativity, orientation toward risk, a sense of pride and enthusiasm and offensive strategy toward the future (T. M. Amabile, 1997).

Although much research in recent years has focused on teams collaboration, transformational leadership, and teamwork quality, still, there are not many studies about how groups should be structured to achieve maximum creativity and innovational productivity. Several studies and observations indicate that differentiation, integration, professionalism and communication represent the most important structural influences on innovation (Mumford, 2000). Even though team diversity is beneficial to creativity, work groups should not be very heterogeneous and this increased diversity should be carefully managed to avoid conflicts and other negative consequences (Kurtzberg, 2005). Teams can be constrained by their composition specifically in terms of knowledge and expertise possessed by team members, to achieve maximum creativity there should be increased diversity of knowledge and expertise, however teams should not be so diversified and large that it will prohibit effective communication (Mumford & Hunter, 2005).

2.10. Creativity and Information and Communication Technology (ICT).

Information and Communications Technologies (ICTs) have an important role in the advancement of creativity: from computer tests to access cognitive processes, genetic algorithms that can provide theoretical models of the creative process in the human mind (Simonton, 1999), to the various networks that bring people together and help them to form and transmit information, to collaborate and combine ideas, it is more than evident that Information Technology *enhances* creativity.

Several studies provide evidence that e-learning and knowledge sharing improve students' creativity (Y. Yeh, Yeh, & Chen, 2012). Moreover one of the main advices given to teachers that want to engage their students in a new learning process that will

stimulate their creativity is to “*bring the real world into the classroom*” and to make the creative and learning process part of their everyday life (Mann, 2015). Generation Z is born into the era of digital technology, social media, tablets, smartphones and mobility, the first generation to grow completely connected and online uses information technology and social media for everything: from getting new information to staying in touch with family and friends (Hall, 2016). If someone wants to engage this generation, today’s technology-empowered and digitally savvy students, he has first to embrace their habits, styles and everyday practices. Information technology provides all the necessary tools and means to achieve that: from multimedia to social network platforms.

Schools and universities all over the world use Learning Management Systems to support the learning process. Some institutions use commercial LMS and other use free or open source LMS or Course Management Systems. Although Learning Management Systems are developed exactly for this purpose: to assist learning and obviously they have many functionalities to meet the needs of educational institutions, they also have many disadvantages. Even if they are free of charge like open source LMS: Moodle, ATutor, ILIAS, Claroline, Canvas etc. they still need installation on a server, parameterization or configuration, and maintenance by someone with technical skills, users also need a separate account and they use the LMS exclusively for learning (Hustad & Arntzen, 2013; Meishar-Tal, Kurtz, & Pieterse, 2012).

Nowadays, several surveys and studies show that students outside classroom use as major learning resources cell phones, Facebook and YouTube (Petrovic, Jeremic, Cirovic, Radojicic, & Milenkovic, 2013, 2014; Ractham & Firpo, 2011; Thomas, 2012; Thomas & Brown, 2011a, 2011b; Towner & Muñoz, 2011). Students use social media services like Facebook, Twitter and YouTube all the time for communication, recreation and getting information, they are accustomed with these media and the various collaboration apps they provide. Although these applications were not developed for learning purposes we can take advantage of the fact that young people feel comfortable to use the Social Networking Sites or Services (SNS) in their everyday life and we can engage students in a truly active creative learning process.

Social networking services or sites (SNS) like Facebook are very popular today and researchers show that up to 90% of undergraduates use Facebook on a daily basis

(Meishar-Tal et al., 2012; Tella & Babatunde, 2014; Wang, Woo, Quek, Yang, & Liu, 2012) and it is the most popular networking site (Moreau, 2016; “Top 15 Most Popular Social Networking Sites | October 2016,” 2016). Facebook is not an LMS and obviously it does not provide the same powerful tools, storing capacity or content variety, solely for educational purpose, like an LMS. However, if we decide to use it as an alternative LMS we will notice that “Facebook Groups” contain some very similar components of LMS and one main advantage: Facebook is part of the everyday life of most students and they do not need another account, they will have the same account for leisure and learning (Aaen & Dalsgaard, 2016; Miron & Ravid, 2015). Of course students use the SNS like Facebook to communicate with their peers and share information and they prefer to use them instead of other communication technologies mainly for two reasons: low cost and the various applications they offer, that make it easy for young people to use their smartphones, tablets and other gadgets to meet online with their friends (Dahlstrom, Grunwald, de Boor, & Vockley, 2011; Junco, 2012; Mastrodicasa & Metellus, 2013). Despite the fact that Facebook shows some limitations in terms of capacity to upload content, at the same time has many features that can be used for educational purposes and does not have the rigid hierarchical structure of LMS that had aroused criticism among educators (Meishar-Tal et al., 2012). Facebook and Facebook Groups offer a unique type of engagement to students, the learning process in a closed group is inherently intimate, flexible, interactive and decidedly collaborative, dialogue is a prerequisite and the synergy and mutual reinforcement of the group can make the whole activity extremely inspirational and creative (Wang et al., 2012).

Based on the above theories the main intention of this study was, by integrating all the beneficial tools and means of ICTs, to develop an appealing to students method, that will stimulate and foster their creativity not by transmitting ready-made answers for uncritical assimilation and neither by problem-solving where again the instructor will *lead* the students to find the ‘*correct*’ answers and the ‘*right*’ knowledge for acquisition, but by problem discovering, questions making and posing. Therefore, in the method developed students were encouraged to make their own questions and pose them to their classmates in the context of a ‘challenge game’, presuming that they have already ‘assimilated’ the relevant knowledge provided in class and they were ready to explore it and creatively expand it.

3. METHODOLOGY

3.1. Participants

Subjects were 90 undergraduate students (46 male and 44 female) enrolled in the “Information Systems in Economy and Management (MIS)” course at the University of Macedonia in Thessaloniki-Greece during fall 2016. The age of the participants ranged from 17 to 21 ($M=18.38$, $SD=0.65$). All participants, who volunteered for the study, had no previous experience and participated in an educational intervention of this kind for the first time. Participants completed paper-and-pencil Divergent Thinking Tests (pre-tests and post-tests) administered in class. Also, they completed online a demographic and an evaluation questionnaire (self-assessment, peer-assessment and method assessment), and the 50-Item International Personality Item Pool-IPIP questionnaire. Participants volunteered for the study after being told that it was an educational intervention aiming to stimulate their creativity and that the procedure would involve the pre-tests, the intervention including project assignments, some questionnaires, and the post-tests. Also, participants were informed that their individual responses to all tests and questionnaires would be strictly confidential and would not influence their academic future in any way. Students who participated in the study received an extra credit in the form of bonus points.

3.2. Design and Procedure

3.2.1. Key points

During the game design process, it was decided to consider the following conclusions extracted from the literature:

1. Play enhances creativity, therefore a game-like atmosphere in which students would freely participate, form teams, communicate, collaborate, play with ideas and compete, without the fear of penalties or punishment, will promote their creativity and generally the learning process (Fasko, 2001; Garaigordobil, 2006; Jackson et al., 2012; Mainemelis & Ronson, 2006; R. J. Sternberg & Lubart, 1995; S. E. West, Hoff, & Carlsson, 2016).

2. Healthy competition stimulates commitment, intentness and hard work and consequently creativity (Wu, Wu, Chen, & Chen, 2014).
3. Many surveys and studies indicate that students outside classroom use as major learning resources cell phones, Facebook and YouTube (Petrovic et al., 2014; Ractham & Firpo, 2011; Thomas & Brown, 2011a; Towner & Muñoz, 2011)
4. More than 90% of undergraduates use Social Networking Services or Sites (SNS) like Facebook on a daily basis for communication, recreation and getting information, they are accustomed with them and the multiple communication and collaboration apps that they provide and feel comfortable to use them (Meishar-Tal et al., 2012; Petrovic et al., 2014; Tella & Babatunde, 2014; Wang et al., 2012).
5. Facebook Groups, and especially their new version 1, provide a unique type of engagement, the communication process in a closed group is inherently intimate, interactive and decidedly collaborative, dialogue is a prerequisite and the synergy and mutual reinforcement of the group can make the whole activity extremely creative (Miron & Ravid, 2015; Wang et al., 2012).
6. Several studies indicate that when people are intrinsically motivated by their own interest, enjoyment, satisfaction and challenge, they usually work harder and exhibit greater creativity (T. M. Amabile, 1996, 1997, 1998). Also, instead of promised or agreed rewards, it is advisable to use bonuses or prizes that reward the creative process itself and the willingness to explore, to discover and to innovate (T. M. Amabile, 1996; Blašková, 2014; Erbas & Bas, 2015)

3.2.2. The Game Structure and the Facebook Group

Based on the aforementioned key points, the whole educational intervention was designed in the form of a challenge game called “Creativity Challenge”. The word *challenge* was included to emphasize the competitiveness of the procedure, thus stimulating creativity. The game was played mainly online and particularly inside a Facebook Group, making it extremely convenient to students to follow the procedure using their tablets and smartphones. The structure of the educational intervention can be seen in the conceptual map provided in Diagram 1 and the procedure is depicted in the activity Diagram 2.

Before the procedure. At the beginning of the semester and a week before the presentation of the creativity enhancement educational game to the students, a Facebook group was created and called *CreativIS* (Creativity + Information Systems). This Facebook group, created solely for the purpose of the educational intervention was closed to the public for two reasons. First to be kept away from random access and protect the privacy of the educational game and the students that wanted to participate. The other reason to create a closed group was to give the feeling and impression of exclusivity and privilege to those that would choose to join the game, thus enhancing the bond between the participants and stimulating teamwork within each team. A link to the group was sent by email to the students who expressed their willingness to participate and when they asked to join the group the administrator instantly approved their request. In the group the members of *CreativIS* were completely free to post and upload anything without approval, exchange of ideas and information, discussions and collaboration were encouraged. The Wall of the Facebook group was used to disseminate information, make regular announcements about the process and upload several files (mainly portable documents) with content relevant to the lesson and the game. The rules of the game were posted too and full instructions were given at the beginning and regularly as the game was evolving. All the questions of the students were answered and explained in detail.

Diagram 1 Creativity Challenge procedure (flowchart)

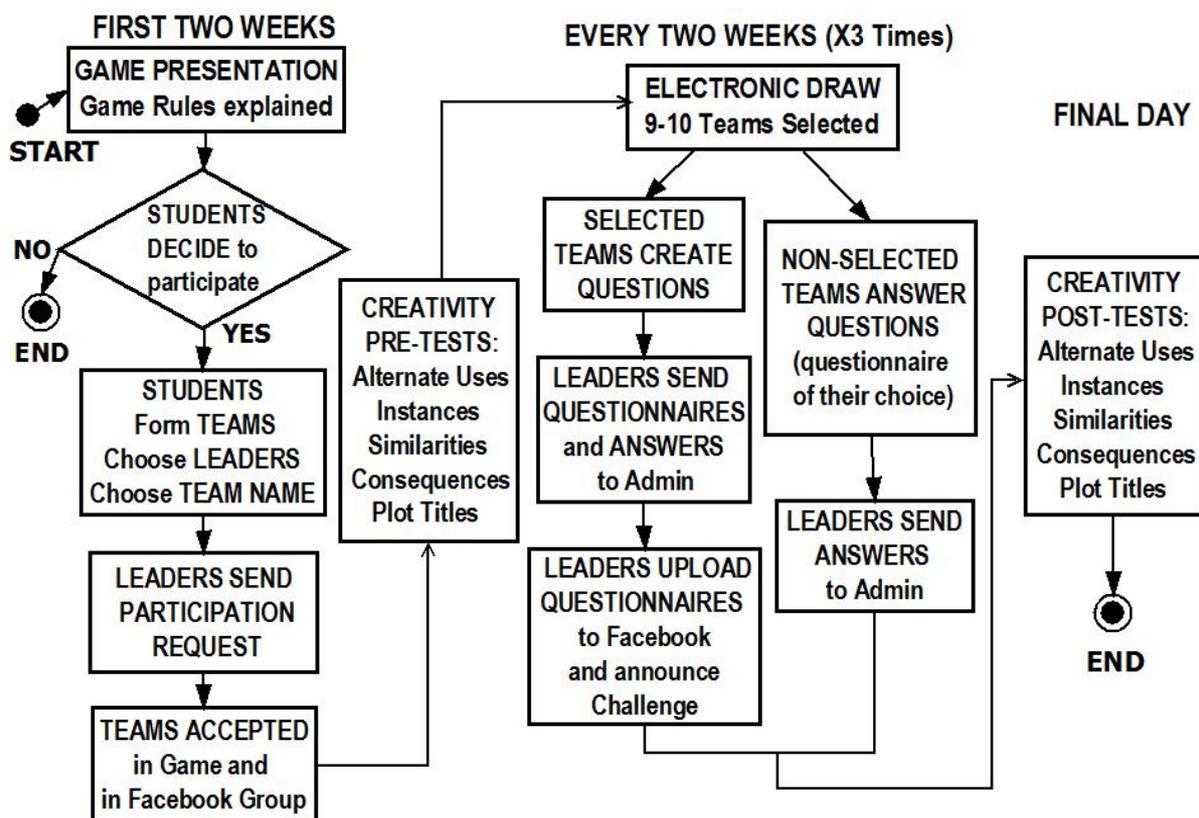
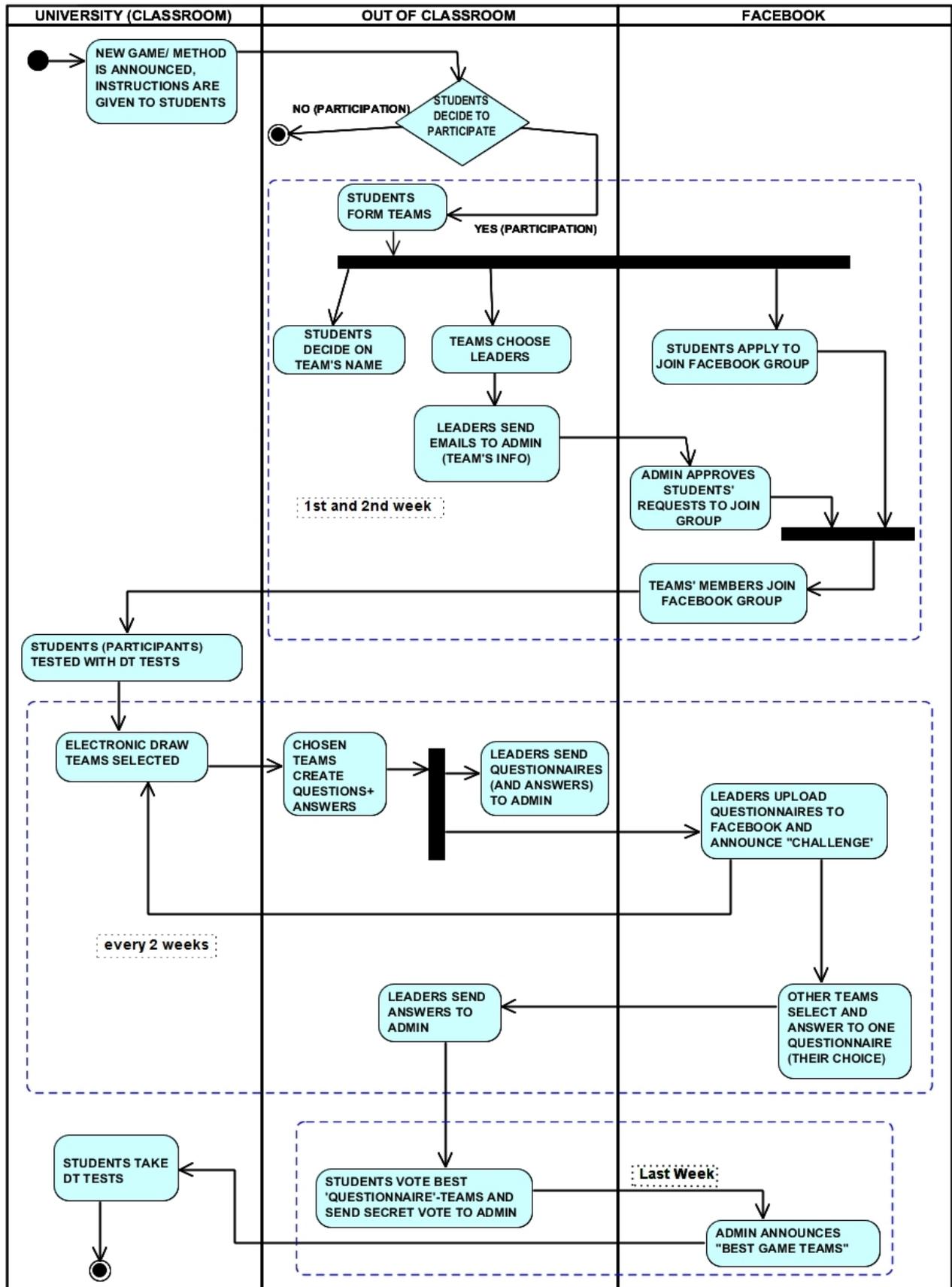


Diagram 2 Creativity Challenge procedure (activity diagram)



3.2.3. The procedure

First Day. The initial sessions of the experimental procedure consisted of an introduction, presented in class, using multimedia. During the presentation the rules of the educational game were explained thoroughly and written material with initial instructions was delivered. Also, a short note called by researchers “*motivation note*” was distributed to the students with the aim to intrinsically motivate them to participate.

In this note the students were informed that they would receive a bonus for their participation and upon the completion of the projects they had to prepare. Also, that the goal of this educational intervention was to rise their creativity, teach them to collaborate and equip them better for their future professional and everyday life.

First Two Weeks. After the presentation the students had an introductory period of two weeks to decide if they were going to participate. According to the rules of the game students that wanted to participate had to form teams. The researchers did not interfere in any way in the formation of the teams; the only requirement was that the number of students per team to be three members and only for exceptional reasons four members were allowed. Finally, 28 teams were formed (90 participants) and participated in the game. Also, according to the game rules the members of each team had to choose a name for their team, and they were informed that all future communication with other teams and the administrator of the game would be under that name. To find a name for their team was requested by researchers for two reasons. First, to boost the game-like atmosphere, and provide an amusing opportunity to teams to show their creativity even from the beginning of the procedure. Second, to facilitate the formation of team identity with all the beneficial consequences like pride, enthusiasm, motivation, bonding, sense of security and protection, collaboration and other positive effects, eventually leading to better creative products and improved educational results (Haslam, Powell, & Turner, 2000; Prati, Douglas, Ferris, Ammeter, & Buckley, 2003). For the same reasons mentioned above and also for the purpose of the study participants were asked to elect a leader for their teams.

Afterwards the leader had to send an e-mail to the administrator of the game – one of the researchers, announcing the formation of his/her team and the willingness to participate in the educational intervention and join the challenge game. The administrator then replied with a confirmative welcome-email, that the team was accepted and the name

was registered to them -if the same name was already registered to another team, the second team was informed that they had to choose a different name. Also the administrator in the confirmative mail invited all members of the team to join the closed Facebook group if they wanted to do so.

Pre-Tests. Before the beginning of the educational intervention called “Creativity Challenge” and implemented in the form of a game, students were tested for creativity with paper and pencil Divergent Thinking Tests administered in class. The tests administered included Alternative Uses, Instances, Similarities, Consequences, and Plot Titles. Following existent research results that when participants are specifically instructed to produce original answers and they are told that the quantity of their answers is also important, they respond accordingly and divergent thinking scores tend to increase (Nusbaum, Silvia, & Beaty, 2014; M. A. Runco & Okuda, 1991), students were instructed to give as many original answers as they could. After the pre-tests the first electronic draw was conducted and nine teams were randomly selected.

During the procedure. According to the game, every two weeks an electronic draw was held in class, and a number of teams (9-10) were randomly selected. The names of the teams that were drawn were announced and appeared on the Facebook group Wall with full description of their project assignment. According to their project assignment, the selected teams within two weeks had to prepare a set of essay questions with their answers based on the theory and educational material taught by the professor the past two weeks prior to the electronic draw. Plenty of educational material and guidance explaining how to construct essay questions, were supplied to them through the “files” section in the Facebook Group and also with the use of Google Drive. Essay questions (and answers) were chosen to be the creative product due to their open structure that provides opportunity to students to employ their higher levels of cognition, and to demonstrate both their critical thinking and creativity (A. Copley & Urban, 2000; Husain, Bais, Hussain, & Samad, 2012; Snyder & Snyder, 2008). Students were allowed to use freely books, notes, the internet and any other material they considered necessary to complete their task with the sole limitation that the essay questions and their answers had to be conceptually within the taught theory. Teams were also encouraged and prompted to take advantage of the various Facebooks apps, online search machines, files storage, synchronization, video, voice and instant messaging services, and several other tools of information and communication technology, to stimulate their knowledge

accumulation, communication, collaboration, and creative work and enrich their creative product. Also, several scientific studies of creativity suggest that specific instructions to be more creative, original, and inventive have a very positive effect on creative performance, even when these instructions are not explanatory and do not specify *how exactly* to be creative (O'Hara & Sternberg, 2001). Thus, with the intention to enhance the creative process and the quality and quantity of the creative outcome, the researchers gave directions to the teams to be as much creative and original as they could. The leaders of the teams, following the rules of the game, upon the completion of their main assignment – to create a number of essay questions (with their answers) based on the theory they were taught the previous weeks – sent an email to the administrator with their creative product-the essay questions and their answers. Then the leaders posted a message on the Facebook Wall and uploaded only their questions (without the answers) as a separate file, announcing the *challenge* to their classmates.

The first cycle of the game was followed by another electronic draw held in class and again a number of teams were selected to create their questions within two weeks. During these two weeks the rest of the teams, were free to choose one of the uploaded set of questions (provided that it was not *their* questions but the questions of another team), answer them in the most creative and elaborative way they could, and send the answers to the administrator of the game. The whole educational intervention lasted one semester. During the last month of the procedure, students completed online the 50-Item Personality questionnaire to measure their FFM-traits, a demographic questionnaire, and an “evaluation questionnaire”. In the evaluation questionnaire students had to evaluate the procedure, themselves, their teams, their leader and also assess the products of other groups through secret voting where they elected the three most creative groups according to their opinion. This type of *indirect peer assessment* was chosen to be included in the procedure for two reasons. First, to engage students more into the process and enhance the competitive ‘game like atmosphere’. Second, because several studies suggest that as long as we keep certain rules and do not confuse students with particular measures and technicalities, peer assessment and especially assessment of academic products can be equally successful as experts’ estimate and in any case the wider the audience the better the judgment (Falchikov & Goldfinch, 2000; Lan & Kaufman, 2012).

Students had to log into their student account to answer the aforementioned questionnaires, and researchers used identification numbers to match responses.

Throughout the whole intervention participants were ensured that all the data gathered from their answers to the creativity tests, demographic, personality and all other questionnaires were strictly confidential and would be used only by researchers inside the research context and for the purpose of this particular scientific study.

Post-Tests. On the last day of the educational intervention all the students were tested again in class with a new set of paper and pencil Divergent Thinking Tests.

3.3. Measures

3.3.1. Divergent Thinking Tests (DT)

Creativity or Creative potential of participants was measured with the use of **Divergent Thinking Tests**. First, with a version of **Alternative Uses Test** in which subjects had three minutes to think of as many uses as they could for a simple object (objects that we used: a towel, a brick (pre-tests) and a newspaper, a rope (post-tests) (Benedek et al., 2013; P. Christensen et al., 1960; Drapeau & DeBrule, 2013). The second test was a version of the **Wallach-Kogan Test** **Instances** were participants were given 4 minutes and asked to list as many items as they could think of and contain a specific component like wheels (pre-test) and buttons (post-test). This test was followed by the **Similarities** Test, the examinees were given 3 minutes to discern and note down analogies, similarities and commonalities between pairs of common items like an orange and an apricot (pre-tests), and an airplane and a bus (post-tests) (Wallach & Kogan, 1965). The fourth test was Guilford's **Consequences** Test with the time limit of 5 minutes and where subjects were presented with a hypothetical situation and were instructed to think of as many different consequences or results as they could and list them, hypothetical situations used: "*What would happen if all people suddenly lose their hearing ability?*" (pre-tests) and "*What would happen if man does not have any need for food?*" (post-test) (Berger et al., 1957; P. R. Christensen et al., 1957). Since the given situation was almost improbable to happen the possibility of experience was non-existent, and students had to use their imagination and originality (Sarsani, 2006). The final creativity test delivered was Guilford's **Plot Titles** in which subjects were presented with a short story and had 6 minutes to generate as many *appropriate* and *clever* plot titles as they could and write them down (Berger & Guilford, 1969; P. R.

Christensen et al., 1957; Zaccaria, Chorness, Gerry, & Borg, 1958b). Table 2 shows the tests that we used and times for administration (minutes).

Table 2 Divergent Thinking Tests.			
Test	Time (min)	Instruction	Objects used (1.pre-test 2.post-test)
Alternative Uses	3	For the given object - Think of as many uses as you can and list them down.	1. a towel, a brick 2. a newspaper, a rope
Instances	4	List as many items as you can think of, that contain this specific component.	1. wheel 2. button
Similarities	3	Write down analogies, similarities, commonalities between these objects.	1. orange-apricot 2. airplane- bus
Consequences	5	Think of as many results or consequences as you can of the following hypothetical situation and write them down.	1. What would happen if all people suddenly lose their hearing ability? 2. What would happen if man does not have any need for food?
Plot Titles	6	Read the following short story, and write as many appropriate titles as you can think of.	

We chose the aforementioned tests because of their high reliability, internal consistency and validity (A. Cropley, 1972; A. J. Cropley & Maslany, 1969; Arthur J. Cropley, 2000). Also, these tests were chosen for practical considerations including simplicity of constructions and implementation, low-cost, testing time, and uncomplicated scoring procedures. All tests were scored by two raters for fluency, flexibility, elaboration, originality (Mark A. Runco & Acar, 2012). *Fluency* is the total number of responses, therefore responses were counted and one point was given for each response (doubles were not included). *Flexibility* is the degree of difference of the responses, that is the number of categories or domains that the answers cover and according to scoring instructions one point was given for each category. *Elaboration* is the level of detail of the response, scoring: one point for an elaborated response and two points for very elaborated responses. *Originality* is the statistical infrequency of each response, each response was compared to the total amount of responses from all the participants, responses that were given by only 5% of the students were regarded *unusual* and were given 5 points, responses given by only 1% were considered *unique* and scored 10 points (“Guilford Uses Task,” 2016; Lemons, 2011). The internal consistency of the tests was very good with Cronbach’s Alpha for fluency $\alpha = .94$,

flexibility $\alpha = .91$, elaboration $\alpha = .82$, originality $\alpha = .77$, and reliability for test-retest $r(79) = .87, p < .001$ for fluency, $r(79) = .77, p < .001$ for flexibility, $r(79) = .70, p < .001$ for elaboration, and $r(79) = .72, p < .001$ for originality. Also, inter-rater reliability was high with Cronbach's Alpha $\alpha = .98$ for fluency, $\alpha = .91$ for flexibility, $\alpha = .87$ for elaboration and $\alpha = .85$ for originality. For the purpose of the study the creativity measures of the two raters were standardized and added together to form a composite measure. Because of absences and failure to follow instructions creativity scores are unavailable for 9 students, thus from the 90 original participants 81 participated in the Divergent Thinking Tests of Creativity.

3.3.2. Questionnaires

The **Five Factor Model (FFM)** or Big five personality traits of the students were measured with the 50- Item International Personality Item Pool (IPIP) version of the Big Five Markers, that measures the FFM with 10 items for each personality factor (Goldberg, 1990, 1992, 1999; Goldberg et al., 2006). Each item was assessed with the use of a 5 point scale, the response *very inaccurate (strongly disagree)* was assigned a value of 1 and *very accurate (strongly agree)* the value of 5. This study used the 50-Item IPIP questionnaire because of its convenience to find it free online. It was translated and delivered with the use of Google forms. Also, this particular version of the IPIP questionnaire was chosen because it was relatively short (compared to the 100-item version) and because of its high reliability and validity: Cronbach's alpha reliability estimates are $\alpha = .87$ for extraversion, $\alpha = .82$ for agreeableness, $\alpha = .79$ for conscientiousness, $\alpha = .86$ for neuroticism and $\alpha = .84$ for Intellect or Openness to experience ("Big Five Broad Domain Table," n.d.; McCrae & Costa, 1987; McCrae, Kurtz, Yamagata, & Terracciano, 2011; Zheng et al., 2008). To examine the personality traits of team personality and based on existing studies and scientific research we used Team Personality Elevation (TPE) and Team Personality Diversity (TPD). TPE refers to the overall level or strength of the trait within the team, and is calculated using the mean scores for each personality trait and for all team members. TPD describes the diversity of a trait within a team and is measured using the variance of members' scores (Keller, 1986; Kichuk & Wiesner, 1997; Kramer, Bhawe, & Johnson, 2014; Neuman, Wagner, & Christiansen, 1999; Peeters et al., 2006)

The **demographic questionnaire** was delivered online together with the **evaluation questionnaire** and as all questionnaires were strictly personal, private and confidential. Several variables were collected like age, gender, high school grades and the results of university entrance examinations, preferences, extracurricular activities and hobbies, hours spent online and in social networks. Also students were asked to describe and evaluate their social and collaboration skills, their creativity, independence, perseverance and many other traits and personal characteristics. In the evaluation questionnaire participants evaluated their leader, the product of their team and other teams, answered to questions about the collaboration and relationships inside their team. Participants were assured of the confidentiality of their responses. They were informed that their responses would not be seen by anyone from their team or other teams and this information would be held in strict confidence by researchers and used only for the scientific research.

3.3.3. Consensual Assessment Technique (CAT)

At the end of the semester the Creative Products of the teams were rated independently by two raters using the **Consensual Assessment Technique (CAT)** (T. M. Amabile, 1983; Baer & McKool, 2009). According to CAT experts with deep knowledge of the domain in question, that work independently and do not influence one another's judgements, are asked to evaluate the creativity of the products, tangible or intangible (T. M. Amabile, 1983; J. C. Kaufman et al., 2012). The CAT was chosen to assess the little-c creative product of the teams, because of its relative easiness to be applied for research purposes (simple guidelines and low-cost tool when expert raters are already present and involved in the research), but mostly because of its high inter-rater agreement, consistency and reliability (J. C. Kaufman et al., 2010, 2007). Each judge rated independently the creative products of the teams - their projects- for three factors or dimensions of creativity: originality, functionality and complexity-elaboration on 5 point scales, where 1 was assigned for "not at all", 2= "very little", 3= "average", 4= "high", and 5= "very high/extremely". The projects were scored solely based on the above criteria, raters assigned scores based on their own personal definitions of originality, functionality and elaboration, while grammar and spelling issues didn't affect ratings. The inter-rater reliability was high with Cronbach's Alpha $\alpha = .90$ for originality, $\alpha =$

.96 for functionality and $\alpha = .91$ for complexity. Inter-rater correlations were also high $r(26) = .84, p < .001$ for originality, $r(26) = .92, p < .001$ for functionality and $r(26) = .84, p < .001$ for complexity. For better interpretation of the total value of the creative product score as a whole, the three creativity measures were added together to form a composite measure and then converted into a 100 point scale.

The teams' projects were also rated by their classmates. At the end of the procedure the students filled in an "evaluation questionnaire" that was delivered online and they voted and chose the three most creative teams according to their opinion. They were not allowed to vote for their team or vote for the same team more than once. Following guidelines of other researchers that investigated the validity of **peer assessment** in the higher education context we avoided to ask students to rate the projects of their peers on many different dimensions but instead a collective-global creativity mark was used based on their secret online votes for the most creative teams (Falchikov & Goldfinch, 2000; Lan & Kaufman, 2012).

Students' responses were completely confidential and an identification number was used to match responses and team members. They had to sign into their student account to answer and in this way the evaluation process was limited to one questionnaire per student without the option of revision and resubmission or future changes by anyone.

4. RESULTS

4.1 Results - Study 1

Table 3 shows the descriptive statistics, means and standard deviations for pre-tests and post-test indicators of creativity. As can be seen in Table 3, and as expected, fluency (the total number of responses) is the dimension of creativity which has the highest maximum value both in pre-test and post-tests, followed by flexibility, originality and elaboration.

	N	Min.	Max.	M	SD
F1	81	16.00	77.00	48.94	12.33
FL1	81	10.00	72.00	39.11	11.43
EL1	81	1.00	7.00	3.20	1.27
O1	81	.00	20.00	5.31	5.50
F2	81	21.00	103.00	60.90	16.78
FL2	81	13.00	94.00	45.96	12.79
EL2	81	1.00	8.00	3.83	1.53
O2	81	.00	25.00	9.94	5.56

F1, F2= fluency (pre-post tests), FL1, FL2=flexibility (pre-post tests)
EL1, EL2 = elaboration (pre-post tests), O1, O2= originality (pre-post tests)

Table 4 shows the bivariate Pearson's correlation coefficients between the scores of the DT tests, the three creativity dimensions of the product, the total value of the creative product and the personality FFM-factors. There we can see a statistically significant and consistent negative link between Neuroticism (N) and elaboration (EL) in both tests pre and post. N-EL1 $r(79) = -.23$, $p = .035$ and N-EL2 $r(79) = -.34$, $p = .002$. The table also shows that there is a significant positive link between the originality scores of the DT tests, both pre and post, and the creative factors of the product:

Originality pretests and product originality O1-ORI $r(79) = .24$, $p = .032$ originality pretests and product functionality O1-F $r(79) = .23$, $p = .036$, originality pretests and product complexity O1-COM $r(79) = .26$, $p = .017$, originality pretests and creative product as a whole O1-CP $r(79) = .25$, $p = .023$. Originality post-tests and product originality O2-ORI $r(79) = .28$, $p = .010$ product functionality O2-F $r(79) = .31$, $p = .004$, product complexity O2-COM $r(79) = .33$, $p = .002$, and whole creative product O2-CP $r(79) = .32$, $p = .004$

Table 4
Correlations between DT tests scores, the creative product and the FFM-personality traits

	F1	FL1	EL1	O1	F2	FL2	EL2	O2	ORI	F	COM	CP	E	N	A	O	C
F1	1	.853**	.328**	.339**	.863**	.791**	.350**	.317**	.062	.111	.109	.101	.072	-.122	.057	.177	.045
FL1		1	.397**	.379**	.757**	.767**	.372**	.357**	.000	.041	.049	.038	-.012	-.156	-.013	.141	.188
EL1			1	.224*	.271*	.288**	.687**	.135	.114	.122	.153	.140	.058	-.234*	.152	.158	.181
O1				1	.423**	.448**	.318**	.716**	.239*	.233*	.264*	.253*	-.008	-.192	.069	.036	.105
F2					1	.890**	.368**	.366**	.135	.175	.177	.170	-.056	-.124	.116	.133	.092
FL2						1	.397**	.342**	.028	.084	.044	.056	-.047	-.218	.036	.155	.119
EL2							1	.219*	.192	.199	.212	.200	.024	-.343**	.199	.196	.155
O2								1	.283*	.313**	.333**	.318**	-.198	-.037	-.047	.052	.074
ORI									1	.847**	.938**	.958**	-.365**	-.087	-.066	-.074	-.018
F										1	.920**	.956**	-.271*	-.062	.068	-.056	.035
COM											1	.983**	-.303**	-.083	.019	-.088	.033
CP												1	-.329**	-.075	.014	-.085	.010
E													1	.064	.264*	.217	-.053
N														1	-.160	-.161	.079
A															1	.118	.285**
O																1	.008
C																	1

N= 81 * . $p < 0.05$ level (2-tailed), ** . $p < 0.01$ level (2-tailed).

Pre tests: F1= fluency FL1=flexibility EL1= elaboration O1= originality Post tests : F2 = fluency FL2 =flexibility EL2 = elaboration O2 = originality Product: OR = Originality, F = Functionality, COMP= Complexity, CP= Creative Product E = Extraversion, A = Agreeableness, C = Conscientiousness, N = Neuroticism, O = Openness

We assessed the effects of the educational intervention using multiple tests. First we conducted paired-samples t-tests for all the factors (dimensions) of creativity and for the same group of participants and the results can be seen in Table 5.

Table 5
Results of Paired Samples t-test

Pairs	Paired Differences					d	t	df	Sig. (2-tailed)
	Mean	SD	SE	95% CI					
			Mean	Lower	Upper				
F1 - F2	-11.96	8.75	.97	-13.89	-10.02	1.37	-12.299	80	.000
FL1 - FL2	-6.85	8.37	.93	-8.70	-5.00	0.82	-7.370	80	.000
EL1 - EL2	-.63	1.13	.13	-.88	-.37	0.56	-4.997	80	.000
O1 - O2	-4.63	4.17	.46	-5.55	-3.71	1.11	-10.000	80	.000

Pre tests: F1= fluency FL1=flexibility EL1= elaboration O1= originality
Post tests : F2 = fluency FL2 =flexibility EL2 = elaboration O2 = originality

The results, presented in table 5, indicate that there was a significant difference in the scores between pre tests and post- tests. Students' fluency (F1) before the intervention ($M = 48.94, SD = 12.33$) was significantly lower than fluency after the intervention F2 ($M = 60.90, SD = 16.78$), $t(80) = -12.30, p < .001$, Cohen's $d = 1.37$. Flexibility pre-tests FL1 ($M = 39.11, SD = 11.43$) was significantly lower than flexibility after the intervention FL2 ($M = 45.96, SD = 12.79$), $t(80) = -7.37, p < .001, d = .82$ and the other two dimensions of creativity were also significantly higher after the educational intervention elaboration: EL1 ($M = 3.20, SD = 1.27$), EL2 ($M = 3.83, SD = 1.53$), $t(80) = -5.00, p < .001, d = .56$ originality: O1 ($M = 5.31, SD = 5.00$), O2 ($M = 9.94, SD = 5.56$), $t(80) = -10.00, p < .001, d = 1.11$

A one-way within subjects ANOVA, with Time as within-subjects factor with two levels (level 1= pre-test, level 2= post-test) and with dependent variables the four components of creativity (fluency, flexibility, elaboration and originality) confirmed that the implemented educational intervention was successful, results can be seen in table 6 and the change of the four creativity dimensions is displayed in figures 1, 2, 3, 4.

Table 6 shows that there was a significant linear increase between pre-tests and post-tests for all four components of creativity, that is for :

fluency $F(1,80) = 151.26, p < .001, \eta^2 = .65$,

flexibility $F(1,80) = 54.32, p < .001, \eta^2 = .40$,

elaboration $F(1,80) = 24.97, p < .001, \eta^2 = .24$,

and originality $F(1,80) = 100.00, p < .001, \eta^2 = .56$

Source	Measure	SS	df	MS	F	Sig.(2-tailed)	η^2
Time	Fluency	5796.056	1	5796.056	151.262	.000	.654
	Flexibility	1901.389	1	1901.389	54.323	.000	.404
	Elaboration	16.056	1	16.056	24.968	.000	.238
	Originality	868.056	1	868.056	100.000	.000	.556
Error(Time)	Fluency	3065.444	80	38.318			
	Flexibility	2800.111	80	35.001			
	Elaboration	51.444	80	.643			
	Originality	694.444	80	8.681			

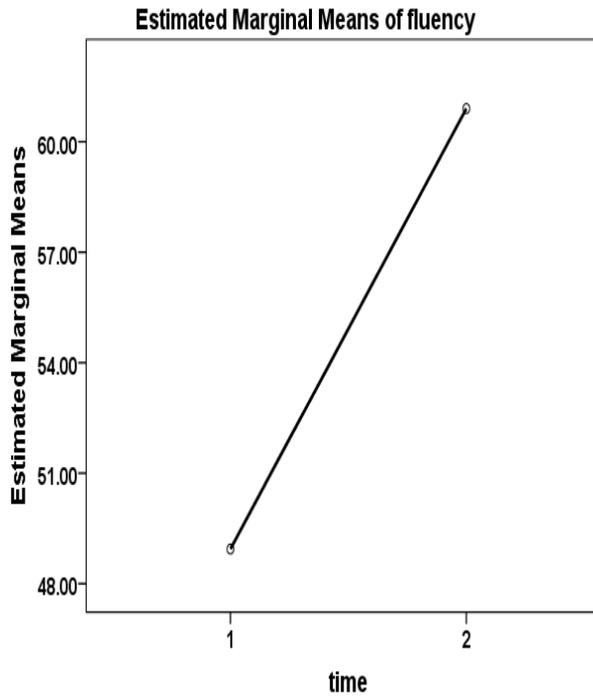


Fig.1 test-retest fluency change (means)

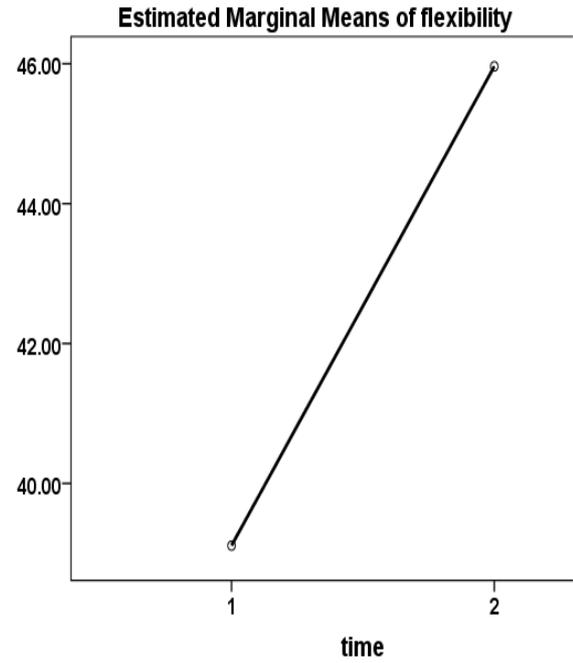


Fig.2 test-retest flexibility change (means)

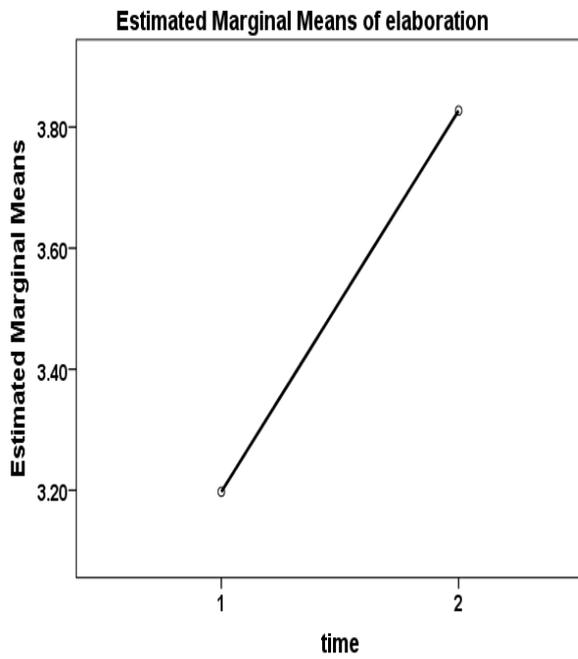


Fig.3 test-retest elaboration change (means)

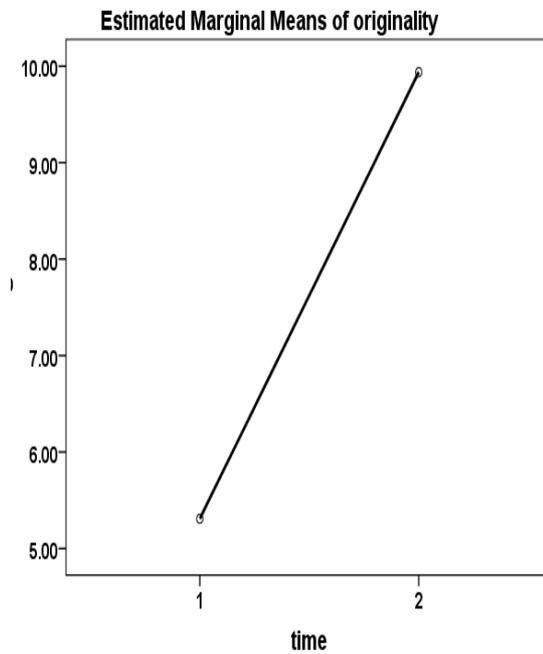


Fig.4 test-retest originality change (means)

4.2. Results - Study 2

Table 7 and fig.5 present the descriptive statistics for all participants' Big-Five scores and table 8 and fig.6 for the leaders' FFM scores, where we can see a difference in neuroticism and openness levels, with leaders having lower neuroticism and higher openness, compared to all participants:

Neuroticism: All Participants ($M = 29.43$, $SD = 7.59$), Leaders ($M = 26.46$, $SD = 7.42$)

Openness: All Participants ($M = 34.79$, $SD = 5.53$), Leaders ($M = 35.96$, $SD = 6.32$)

Table 7

Descriptive Statistics: FFM scores-All participants				
	Min.	Max.	<i>M</i>	<i>SD</i>
Extraversion	16.00	47.00	34.97	6.74
Agreeableness	24.00	50.00	41.98	5.03
Conscientiousness	19.00	50.00	36.23	6.98
Neuroticism	14.00	45.00	29.43	7.59
Openness	16.00	49.00	34.79	5.53

N = 90

Table 8

Descriptive Statistics – Leaders, FFM-scores				
	Min.	Max.	<i>M</i>	<i>SD</i>
Extraversion	21.00	47.00	34.61	6.47
Agreeableness	24.00	48.00	41.32	5.44
Conscientiousness	22.00	46.00	37.43	6.32
Neuroticism	14.00	39.00	26.46	7.43
Openness	24.00	49.00	35.96	6.32

N = 28

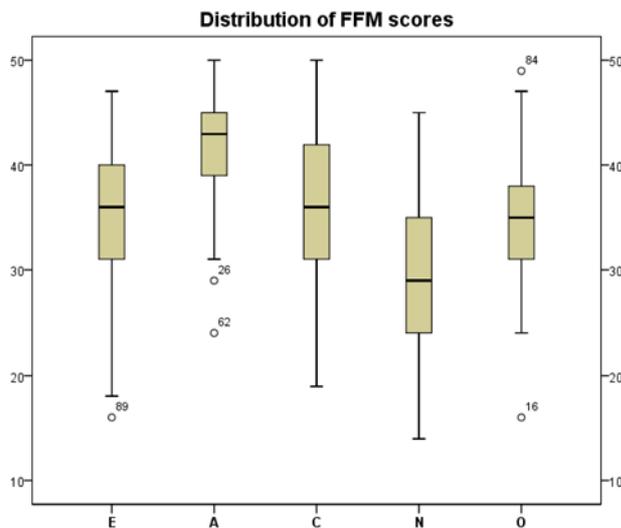


Figure 5 : Distribution of FFM scores-all participants

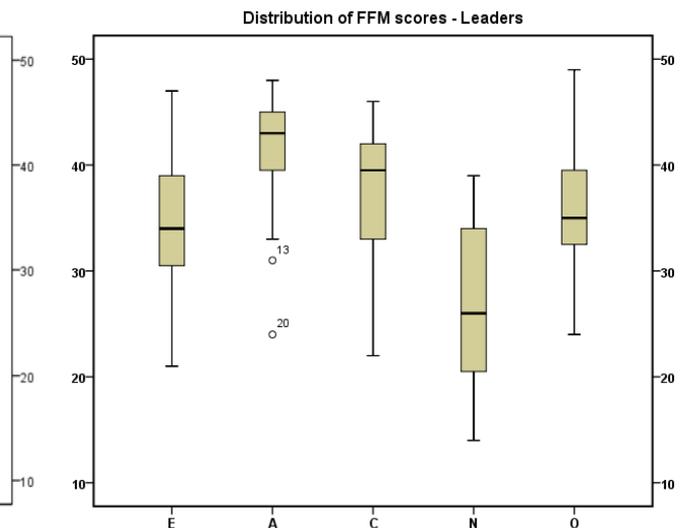


Figure 6: Distribution of FFM scores- Leaders

Table 9 presents the bivariate Pearson correlation coefficients for the personality traits and the product on individual level. There was a positive link between extraversion and agreeableness $r(88) = .25$, $p = .016$, extraversion and openness $r(88) = .25$, $p = .02$ and agreeableness and conscientiousness $r(88) = .23$, $p = .026$. The only personality factor that was linked to the product was extraversion and the link was negative:

extraversion – originality $r(88) = -.38$, $p < .001$,

extraversion – functionality $r(88) = -.31, p = .003$,
 extraversion – complexity $r(88) = -.34, p = .001$,
 and extraversion – creative product $r(88) = -.36, p < .001$.

Table 9									
Correlations between FFM factors of all participants and the Creative Product									
	E	A	C	N	O	ORI	F	COMP	CP
Extraversion	1								
Agreeableness	.253**	1							
Conscientiousness	-.068	.234**	1						
Neuroticism	.060	-.194	.114	1					
Openness	.245**	.170	-.029	-.183	1				
Originality	-.384***	-.025	-.024	-.126	-.071	1			
Functionality	-.313***	.081	.033	-.090	-.080	.854***	1		
Complexity	-.335***	.044	.031	-.113	-.095	.939***	.926***	1	
Product	-.360***	.040	.008	-.109	-.094	.959***	.958***	.984***	1

Note: N = 90 OR = Originality, F = Functionality, COMP = Complexity CP= Creative Product
 * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$ (2-tailed)

Table 10 shows the correlations between the personality factors and the creative product on the Leaders' level and there we did find a significant positive correlation between extraversion and agreeableness $r(26) = .59, p = .001$. Also, leaders' extraversion correlated negatively with the product: leaders extraversion-originality $r(26) = -.37, p = .056$, extraversion-functionality $r(26) = -.33, p = .091$, extraversion-product $r(26) = -.35, p = .072$

Table 10									
Correlations for personality traits - FFM and Creative Product (Leaders)									
	E	A	C	N	O	OR	F	COMP	CP
E	1								
A	.590***	1							
C	-.136	.142	1						
N	-.174	-.259	.259	1					
O	.226	.089	-.259	-.212	1				
Originality	-.365*	-.115	-.254	.036	-.223	1			
Functionality	-.326*	-.098	-.216	.150	-.203	.869***	1		
Complexity	-.316	-.025	-.246	.053	-.240	.941***	.936***	1	
Product	-.345*	-.080	-.246	.078	-.230	.967***	.959***	.988***	1

Note: N=28 OR = Originality, F = Functionality, COMP = Complexity CP= creative product
 * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$ (2-tailed).

According to the procedure the creative product was the result of teamwork, therefore we examined the correlation between ‘*team personalities*’ and their product. To investigate how the traits of ‘team personality’ affect the value of the creative product we used Team Personality Elevation (TPE) and Team Personality Diversity (TPD). To find TPE for each team, we calculated the mean of individual scores for a certain personality trait and for all team members. For TPD we used the variance of members’ scores. In this way we had the composite team-personality factors Extraversion-TPE (ETPE), Agreeableness-TPE (ATPE), Conscientiousness-TPE (CTPE), Neuroticism-TPE (NTPE) and Openness-TPE (OTPE). Also, the diversity of the team personality ETPD, ATPD, CTPD, NTPD and OTPD. The descriptive statistics of the team personality variables can be seen in Table 11 and the distribution in fig.7

Table 11					
Descriptive Statistics: Team Personality Elevation – FFM scores					
	Min.	Max.	Mean	SD	Var.
ETPE	28.00	41.00	35.03	3.60	12.99
ATPE	34.33	46.67	41.96	3.08	9.50
CTPE	30.00	45.67	36.28	3.80	14.40
NTPE	21.00	38.00	29.61	4.63	21.45
OTPE	28.33	41.00	34.70	3.20	10.27

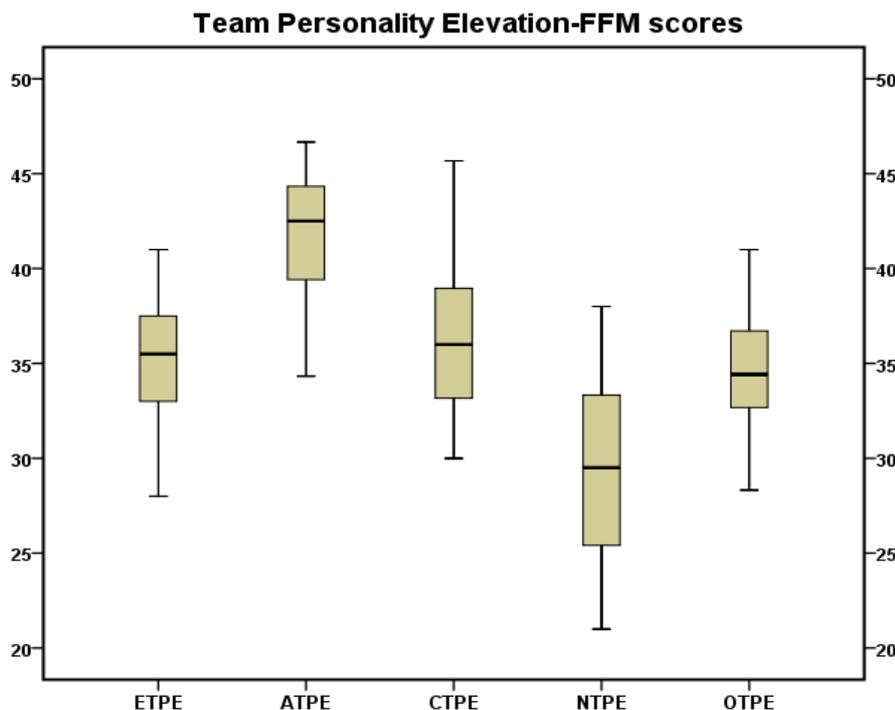


Fig.7 Team Personality Elevation FFM scores distribution

Table 12 presents the results of bivariate Pearson correlation analysis between teams' TPE scores and their creative products. There was a significant negative correlation between team's composite extraversion and all variables of the creative product: Extraversion(TPE)-originality $r(26) = -.78, p = .001$, Extraversion(TPE)-functionality $r(26) = -.61, p < .001$, Extraversion(TPE)-complexity $r(26) = -.68, p < 0.001$ and Extraversion(TPE)-creative product $r(26) = -.71, p < 0.001$.

In the evaluation questionnaire participants answered to several questions and among them questions concerning their independence, sociability and the relationships with their teammates. The answers to these questions were scored individually on a VAS Scale and they introduced three variables S=sociability, Risk= risky and adventurous behaviour, IND=independence. After scoring, the individual scores were combined into a group total for each team, and the composite team variables calculated in this way were named TS (total team sociability), TRisk (total team risk) and TIND (total team independence) respectively. Then we examined the correlations between these variables, the dimensions of the team personality elevation and the creative product. The results are given in Table 12.

	ETPE	ATPE	CTPE	NTPE	OTPE	TS	TRisk	TIND	ORI	F	COMP	CP
ETPE	1											
ATPE	.228	1										
CTPE	.153	.315	1									
NTPE	.244	-.025	.020	1								
OTPE	.374	.159	-.154	.023	1							
TS	.665***	.309	.345	.267	.142	1						
TRisk	.591***	.011	.039	.525***	.323	.422**	1					
TIND	.495***	.217	.055	.022	.133	.318	.208	1				
ORI	-.776***	-.091	-.105	-.177	-.177	-.748***	-.531***	-.368	1			
F	-.612***	.078	.006	-.123	-.180	-.656***	-.306	-.406**	.869***	1		
COMP	-.678***	.019	-.012	-.153	-.214	-.701***	-.471**	-.375**	.941***	.936***	1	
CP	-.712***	-.001	-.039	-.156	-.197	-.723***	-.455**	-.393**	.967***	.959***	.988***	1

Note: N = 28, E= Extraversion, A=Agreeableness, C= Conscientiousness, N= Neuroticism, O=Openness, OR = Originality, F = Functionality, COMP= Complexity, CP= Creative Product TPE=Team Personality Elevation
TS= team sociability, TRisk=team risk , TIND = team independence
*p< 0.1 **p< 0.05 ***p< 0.01 (2-tailed)

The correlation statistics (Pearson's r) showed a significant negative link between TS and the three dimensions of the creative product TS - originality: $r(26) = -.75, p < .001$, TS-functionality: $r(26) = -.66, p < .001$, TS-complexity: $r(26) = -.70, p < .001$, and a negative correlation to the product $r(26) = -.72, p < .001$. The TS variable was significantly positively linked to the team's extraversion $r(26) = .67, p < .001$ and to the risk variable although the link was not that strong TS-TRisk: $r(26) = .42, p = .025$. The collective risk variable was positively linked to the team's extraversion and neuroticism and the link was significant TRisk – ETPE $r(26) = .59, p = .001$ and TRisk – NTPE: $r(26) = .53, p = .004$. Also the correlation between TRisk and quality factors of the product was significantly negative TRisk-originality: $r(26) = -.53, p = .004$, TRisk-complexity: $r(26) = -.47, p = .011$, TRisk-product: $r(26) = -.46, p = .015$. The team-independence variable (TIND) as presented in Table 12 was linked positively to the collective extraversion $r(26) = .50, p = .007$, and negatively correlated with the functionality and complexity of the product TIND-functionality: $r(26) = -.41, p = .032$, TIND-complexity: $r(26) = -.38, p = .049$, and TIND-product: $r(26) = -.39, p = .039$.

To investigate further the effect of team personality on the creative product a Stepwise Multiple Regression Analysis was conducted to see if the personality traits of the collective 'team-personalities' significantly predicted the total value of the creative product. Results can be seen in Table 13. An analysis of standard residuals was carried out, which showed that the data contained no outliers (Std.Residual Min. = -2.13, Std.Residual Max. = 2.73). Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (*Tolerance* = .92, *VIF*=1.09). Also the data met the assumption for independent errors (Durbin-Watson value = 2.06). The results of the multiple regression analysis indicated that E-TPE explained 51% of the variance ($R^2 = .51, F(1,26)=26.67, p<.001$) and significantly predicted the total value of the creative product ($\beta = -.712, t(26)=-5.16, p<.001$). Also, it was found that ATPD accounted for 9% of the variance ($\Delta R^2 = .09, F(1,25) = 5.52, p = .027$) and when ATPD was added the regression was also significant $\beta = -.31, t(25)=-2.35, p = .027$.

Table 13
Results of stepwise multiple regression analysis

Model	R	R ²	Adj.R ²	SE	ΔR^2	F	Sig. F	B	SE B	β	t	Sig.	B CI 95.0%	
													Lower	Upper
1 (Const.)	.712	.506	.487	15.12	.506	26.67	.000	206.10	28.41		7.25	.000	147.70	264.50
ETPE								-4.18	.81	-.712	-5.16	.000	-5.83	-2.51
2 (Const.)								228.94	27.97		8.19	.000	171.34	286.54
ETPE	.772	.596	.563	13.95	.089	5.52	.027	-4.70	.78	-.802	-6.04	.000	-6.30	-3.09
ATPD								-.18	.08	-.312	-2.35	.027	-.34	-.02

Model 1: df1=1, df2=26, Model 2: df1=1, df2=25

ETPE = Extraversion-Team Personality Elevation, ATPD = Agreeableness – Team Personality Diversity

5. DISCUSSION

5.1. Discussion –Study 1

Creativity today is a highly valued ability and its development has become an educational objective. With the present study we suggested, designed and implemented an original educational intervention aiming to stimulate the creative ability of young adults in an academic environment. We used open essay questions generation, where open questions were generated by students as the main creativity enhancement method. After the implementation of the educational intervention we conducted statistical analysis of the collected data and the results showed that it had a very positive impact on students' creativity.

One main finding is that the educational intervention significantly enhanced all four dimensions of students' creativity, as measured by paper and pencil divergent thinking pre-post tests. Participation in the program improved participants' creativity in quantity (fluency, flexibility) and quality (elaboration, originality). This finding is in good agreement with numerous studies and previous research suggesting that creativity can be stimulated and developed at any age if we use the right methods and techniques (Binnewies et al., 2008; Scott et al., 2004; Stine-Morrow et al., 2014; K. C. Tsai, 2013). Furthermore, examination of each creativity factor separately indicates that our intervention, like many previous creativity training programs, had a different size effect on each creativity component. The most significant increase was found in fluency scores followed by originality scores and these results are also congruent with past research and several meta-analyses which indicate that originality and fluency are the creativity components most affected by creativity training (Rose & Lin, 1984; Scott et al., 2004). An increase in fluency, which is defined as the number of produced ideas, indicates a stimulation of divergent thinking and according to existent research sometimes is the only dimension of creativity assessed when we view and assess creativity in terms of productivity (Mark A. Runco & Acar, 2012). Originality which is the statistical infrequency or the novelty of the produced ideas is strongly correlated with fluency – when the number of ideas produced rises it is more probable to find an original idea (K. H. Kim, 2006) and this explains to a point the equally significant increase. Results also show a statistically significant increase in flexibility and elaboration. However, of interest is the fact that elaboration was the dimension of creativity that changed the least. This

finding could be explained by previous studies proposing that elaboration is a higher level cognitive ability, associated with both convergent and divergent thinking skills that require more time, knowledge, expertise, dedication and practice to be developed (Mihaly Csikszentmihalyi, 1996a; Michael & Wright, 1989). Therefore in the relatively short period of one semester elaboration was the creativity dimension the least enhanced.

The results also revealed the existence of a strong negative link between individual levels of neuroticism and elaboration in both tests pre and post. According to literature elaboration or complexity is the creative ability to ‘fill the gaps’ of an idea, to develop, embellish, refine and perfect the original creative idea (K. H. Kim, 2006). Although, it seems more as an ‘aesthetic’ dimension of creativity, researchers suggest that elaboration is necessary for the completion and realization of an idea. Elaboration is the process of enrichment, evaluation, completion, and leading the idea to fruition, the last step of the creative functioning and the one that needs hard work, time, stable feelings, focus and concentration, attention, and rich domain relevant knowledge (Mihaly Csikszentmihalyi, 1996a). The aforementioned description of elaboration and the fact that neuroticism by definition is associated with anxiety, hostility, envy, emotional instability, vulnerability, anxiousness, low self-confidence and self-esteem (Costa & McCrae, 1992; Widiger, 2009) provide one possible explanation to our finding. Also, although some studies indicate that neuroticism is positively linked to creativity (Feist, 1998) our results are more in line with many other studies which suggest that there is a negative link between neuroticism and everyday creativity, scientific creativity, technological innovations and anything new and unknown (Furnham, 2015; Patterson & Zibarras, 2017; Vreede et al., 2012). Furthermore, by its definition, elaboration appears to be correlated with the convergent thinking part of the creative process, where knowledge, focus, logic and well known techniques are employed to complete the creative product, therefore, it could be assumed that more neurotic individuals did not have the emotional stability to engage convergent thinking in the creative process.

The dimension of originality assessed with the Divergent Thinking tests according to our findings correlated significantly with all three creativity dimensions of the creative product. According to the procedure the creative product was the outcome of a collective project assignment thus the result of teamwork, however, it seems that originality, which is defined as the ability to produce unique novel ideas (K. H. Kim, 2006) is manifested in all creative products-individual tests or teams’ projects- and can be evaluated using

different methods of assessment. Also, as mentioned above, scientific literature suggests that originality is one of the two components of creativity most affected by interventions aiming to develop creativity (Rose & Lin, 1984; Scott et al., 2004). Since, according to our results participation in the educational intervention enhanced in general students' divergent skills, it is understandable that the enhancement of originality as a critical manifestation of the creative ability would be expressed in both test results and creative products of teams.

5.2. Discussion -Study 2

In our global fast-paced world working in teams is not an option but a necessity and a critical element of survival. In this competitive world to produce the necessary quantity of products is not enough, and even when the quantity is high and quality is good it is still not enough. Nowadays 'plenty' and 'good' is not satisfying anymore, it has to be also original, new, innovative or plainly said "*exceptionally creative*". Organizations that want to survive must embrace creativity and innovation in practice. However, in organizational creativity the most important aspect to consider is the incorporation of individual creativity into the team-based structure of the organization. Nowadays it is largely acknowledged that personality traits, attitudes and skills influence team performance, and the literature on team creativity provides several guidelines for building, managing and maintaining highly effective teams (Bell, 2007; Kramer et al., 2014). Though, it is not thoroughly investigated and explained how exactly the personality traits affect the collective team personality, team's creativity and performance, and subsequently the quantity and quality of the creative product. With the present study we attempted to provide some insight into this subject.

Our results indicated a strong negative link between the personality trait of extraversion and creative team work. This finding was illustrated with two variables ETPE- Extraversion Team Personality Elevation and TS - Team Sociability both negatively correlated with all three creativity dimensions of the product and the total value of the creative product. Also, regression analysis indicated that 51% of the variance in the value of the creative product was predicted by TPE of extraversion. More specifically, the higher the elevation of extraversion in teams, the lower the quality of the productive outcome or in other words, the lower the value of the creative

product. There are some meta-analytical studies that suggest that extraversion does not influence team performance (Peeters et al., 2006), but according to our findings this is not entirely true, especially if we examine the team's *creative* performance assessed through the value of the creative product.

In the literature we can find many scientists suggesting that introversion and solitude are intertwined with creativity (Feist, 1998) it seems that they are also an essential part of the creative teamwork process. Our results are in good agreement with existent research indicating that on organizational level extraversion is negatively related to creativity (N. Anderson et al., 2014). Also, this finding is congruent with previous studies suggesting that the inclusion of extroverts in a group is detrimental to team effectiveness, because extraversion and sociability are negatively correlated with the capacity of the group to focus on the task (Barry & Stewart, 1997). It appears that, even in teams, to achieve high performance and productivity, *creative* team members have a stronger need to concentrate their thoughts and mental abilities and tend to avoid sociability.

In agreement with previous studies on transformational leadership our results support the theory that leaders usually have lower neuroticism and higher openness compared to the rest of the population due to the unique characteristics of leader personality (Hogan et al., 1994; Judge & Bono, 2000; Judge et al., 2002; Lim & Ployhart, 2004). An interesting finding of our study is the positive correlation between extraversion and agreeableness on the leaders' level and their negative link to the team's creative product. Several previous studies propose that extraversion is positively associated with transformational leadership (Judge & Bono, 2000; Judge et al., 2002), thus suggesting a positive link to team performance and productive output. But, according to our results high leaders' extraversion paired with agreeableness resulted in worse products. This result is in part consistent with results obtained in previous studies suggesting that agreeableness, even though is positively linked to teamwork, is negatively correlated with creativity (Feist, 1998, 1999a; King et al., 1996) and with leadership, because very agreeable leaders are often perceived by other team members as 'soft', naive, manageable and non demanding, resulting in disorganization of the team, poor creative performance and low quality of the product (Boudreau, Boswell, & Judge, 2001; Lim & Ployhart, 2004; Witt et al., 2002).

Regression analysis indicated that 9% of the variance in the value of the creative product was predicted by TPD of agreeableness. The effect of diversity in agreeableness is consistent with previous research suggesting that the more diverse are team members in agreeableness, the worse their team performs (Peeters et al., 2006) and it is somewhat expected, considering the strong positive link between agreeableness and teamwork (Witt et al., 2002). Also, this finding is in line with previous results indicating a negative link between member performance and team diversity in agreeableness (Prewett, Brown, Goswami, & Christiansen, 2016).

Although, as stated in some studies individuals produce more creative work when they have high **independence** or **autonomy** (T. M. Amabile, Conti, Coon, Lazenby, & Herron, 1996; Sheldon, 1995) our results revealed that in teams, the opposite is true and very high independence is negative for teamwork and demonstrated creativity in the team context. Also, we must notice that our results indicated that independence is negatively linked to the functionality and complexity of the product mainly, and despite the fact that it is also negatively correlated with originality, the link is not statistically significant. This finding can be interpreted in several ways. One possible explanation is that very high autonomy and independence are accompanied by stubbornness, and people who perceive themselves as very autonomous are also very opinionated, to the point that they become restricted by their own opinions and do not accept any different opinion, do not attempt to develop others' creative ideas or try the solutions proposed by other team members. They do not lose their personal originality or creativity, but in teams it is necessary to appreciate every original idea and support it, because creativity in teams depends heavily on the free flow and exploitation of *all* ideas. (Nijstad, Stroebe, & Lodewijkx, 2002). In organizational context, openness, availability and accessibility are important elements for all members and especially for leaders resulting in enhanced creative work (Carmeli et al., 2010). Really creative people are open to new ideas (Florida, 2002) and they can recognize a creative idea even when it comes from someone else, they will adopt it, reform it, expand it and incorporate it into an original, functional and elaborated product. This explanation is in good agreement with relevant literature suggesting that high autonomy possibly undermines the implementation of good ideas (Rank et al., 2004) causing a multitude of negative effects on the project and the team. Another interpretation of our results, is

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that high independence and individuality, by definition, are concepts rather negatively linked to internal team cohesion, collaboration and collective teamwork, while in teams, all members should be united to work towards the same goal and should have smooth interactions to reinforce each other (Hunter, Bedell, & Mumford, 2007).

A part of the existing literature suggests that **risk** taking is inherently linked to creativity (R. J. Sternberg & Lubart, 1996) and there are empirical studies providing evidence that willingness to take risks is positively related to employee creativity (Dewett, 2007; Zhou & George, 2001). On the team level, and in terms of the final creative output, our results indicated the opposite, the variable that we used as a measure for risky behavior was negatively linked to the creative product. The risk variable was also found to be positively linked to elevation of extraversion and the collective team sociability (TS) which is in agreement with previous research suggesting that extroverts are inclined to engage in risky behaviors (Cooper, Agocha, & Sheldon, 2000). Our finding which indicates a negative link between risk and the creative product, can be explained if we consider the multifaceted nature of creativity. Creativity, as a complex phenomenon, requires a multitude of mental processes combining convergent and divergent thinking, both necessary for the creative process (A. Cropley, 2006; DeHaan, 2013; Mark A. Runco, 2011). From literature we know that divergent thinking is associated with risk, sociability and increased interpersonal relations and trust even to unfamiliar others (Sellaro et al., 2014). Also according to many studies divergent thinking has the ability to generate a multitude of unconventional, complex, original ideas, but divergent thinking is not creativity, it is the indicator or potentiality of creativity (Mark A. Runco & Acar, 2012). For creativity to occur we also need convergent thinking, which employs logic, knowledge and well-known techniques to evaluate the proposed ideas and select the original, useful and really creative ones (A. Cropley, 2006; D. K. H. Kim & Pierce, 2013a; R. J. Sternberg, 2006). So, while divergent thinking includes the risk of producing pseudo-creativity, convergent thinking does not takes risks as it uses existent experience, knowledge, validated reliable standard methods and techniques (A. Cropley, 2006). Maybe, the risky teams, did have some great unconventional *divergent* ideas, but without the contribution of convergent thinking they were never selected and materialized into a useful creative product.

5.3. Limitations and suggestions for future research.

Like any human construct the present study has several limitations and they need to be noted. Although it may sound a bit paradoxical one limitation is that participation in this study was voluntarily. And it is a limitation because the available subject pool was limited and constrained, since we could recruit participants from only one university course. Also, we had one test-group and we did not have a control group. This particular selectivity of our sample may limit the generalizability of our findings. It is possible that from the very beginning, we recruited the most creative students who voluntarily applied to participate in the study because they were curious, interested, and willing to explore the unknown. Moreover, it is probable that only individuals with certain personality types chose to participate and form teams, resulting in teams with specific team personalities. Also, in this academic environment teams had rather limited diversity due to the specific profiles of the participants: young adults in an academic setting, who chose to participate with the incentive of a bonus.

Unfortunately, as we can understand, the design of this educational intervention, a challenge creativity game with bonuses and prizes, did not allow the existence of a control group, because obviously all the students involved in the process, wanted to compete and show that their team was the best. In the future it would be interesting if other researches are able to find a modification of the game and replicate the procedure with a control group. Also, it would be of interest future research to repeat the study in an organizational or business environment using other incentives. Researchers that would replicate this study, in a business environment, can also use other techniques for product evaluation (e.g. consumers' acceptance or rating).

Another limitation is that we did not use any tests to measure convergent thinking, possibly some IQ-tests, traditional knowledge tests or examinations to investigate how the results of these tests correlate with our findings. We did not include this aspect in our study, since our main objective was to design an original method to stimulate the creative process in a game-like atmosphere and evaluate the results. We decided to avoid any traditional testing methods that could possibly increase participants' stress and affect negatively the relaxed playfully creative atmosphere. Certainly, we encourage other

researchers to explore possible improvements of the game and techniques that would measure convergent thinking (IQ-tests, RAT-test etc).

Although, we collected quantitative measurements using several reliable strategies from creativity research, because of the nature of the sample and the data, a related potential biasing factor is existent. Creativity, personality and the creative product are all multifaceted constructs, and there are many methods of assessment, therefore, it would be unrealistic to claim that our findings regarding the correlations between these constructs are definite.

Despite the aforementioned limitations, this study is beneficial because it suggests an original creativity enhancement method and moreover it provides useful information towards a better understanding of the team and its performance. Also, although it was conducted in an academic setting, with participants students, the findings could be applicable in other contexts as well.

6. CONCLUSIONS, IMPLICATIONS AND SIGNIFICANCE OF THE STUDY

In the present study, we developed a creativity enhancement method aiming to make it appealing to students, of low cost and easy to implement, yet very effective and with the most possible positive results. After its design and development, we implemented it, tested it and evaluated the results. Also, with the present study we tried to shed light on some hidden aspects of the complex phenomenon of team personality and examine its links to team performance and the creative product.

To summarize our findings:

1. Our results indicate that our intervention was successful and creativity of participants was enhanced in quantity (fluency, flexibility) and quality (elaboration, originality).
2. Also, our study reveals an interesting negative correlation between neuroticism of individuals and creativity results in terms of elaboration.
3. After the creativity enhancement procedure, originality emerged as a prevalent component of creativity, stimulated by creativity training and expressed in both divergent thinking test results and creative products.
4. We found that extraversion and sociability of team members affect negatively team performance as measured by the value of the team's creative product.
5. In agreement with previous studies our findings reinforce the suggestion that leaders, due to the specific characteristics of leader personality, have higher openness to experience and lower neuroticism levels, compared to other team members.
6. Leaders' extraversion correlated positively with their agreeableness and negatively with the creativity dimensions and the value of the product. This finding indicates that very extrovert leaders with high agreeableness might have a negative effect on the team's performance and creative output.
7. Team personality elevation extraversion and diversity of agreeableness predicted significantly the value of the creative product and both had a negative effect. According to this finding teams with highly extrovert members and very different in agreeableness will produce creative products of a lower value.

8. Teams with more independent, autonomous and risky members produced less valuable products in terms of creativity.

Our study provides useful results and is of significance for several reasons:

1. To the best of our knowledge the present study is unique in suggesting and testing the use of student question generation and particularly the use of open essay questions as a main method for creativity enhancement. Several studies suggest that questions generated by students promote active learning (Furtak et al., 2012; Luxton-Reilly & Denny, 2010). Moreover, with our study we provide empirical evidence that open essay questions constructed by students promote and benefit creativity. Teachers that want to enhance their students' creativity should consider a more extensive use of open essay questions and study cases in their teaching.

2. The educational intervention that we propose is original and according to our results effective. In addition, it is relatively simple, of very low cost and easy to implement. In the creativity literature, many researchers and teachers have developed and suggested various methods to develop creativity and most of them were proved to be successful. Some researchers even proposed separate courses focused on creativity and have designed and used their own tools and techniques for implementation. However, several of these interventions are complicated and it is hard to replicate the techniques or the particular tools used. Also, to introduce new courses into the curricula of educational institutions is difficult and demanding. The intervention that we suggest can be easily replicated and incorporated into an existing course, without any changes in the curriculum.

3. In line with numerous previous studies our results show that play stimulates creativity at every age. Our game-like, challenging, web-based and team-structured intervention was successfully tested in an academic setting, but it might be easily reproduced and adjusted for use in an organizational setting. We believe that our method can be modified and applied as a motivational game of creativity training in the industry and especially in the creative industries. We propose an easy and inexpensive way to stimulate the creativity of research and development teams, and work teams in various business sectors.

4. Educators, trainers and also managers that aim for enhanced creative performance of creative teams in terms of quality, according to our results, must pay attention to the

neuroticism factor. To facilitate creativity and achieve productivity of high quality instructors should provide a less stressful context for creative work.

5. Also, educators should take into account that the complex phenomenon of creativity needs time, persistence and systematic approach including the widespread use of ICT and especially social networks. Creativity today is intertwined with today's technologies.

6. Our research contributes to existing literature by examining team performance using a more straightforward, practical and pragmatic viewpoint. In many previous studies teamwork and team performance were assessed with the use of observation techniques, managers' opinions and assessments, various questionnaires and interviews. We chose a more direct approach by assessing the actual team work outcome: the creative product. Obviously we suggest more researchers to use this practical approach and draw more "tangible" conclusions concerning teamwork.

7. We provided more evidence for some already known correlations concerning team personality and team performance. However, we also draw the attention to some less studied aspects of team personality like sociability, independence, risk and how they affect the value of the product. We believe that more research is needed in this field.

8. Although our research was conducted in an academic environment, the findings have implications for the process of team building, maintenance and management in various fields. Traditionally the selection process, when building a creative team, considers mainly individual skills, personality traits and creativity of the members. According to our findings, personality traits and how they collectively affect the productive outcome, should be also seriously considered. Previous research suggests that on the individual level high independence and risk are positively related to creativity. However, our results indicate that on the team level and in terms of creative productivity they are not very advantageous.

9. Regarding implications for building an effective creative team, our results suggest to avoid the inclusion of very extrovert, extremely sociable, independent and risky members. However, when this is unavoidable, it is advisable to take care so as the collective team extraversion, sociability, independence and risk to be kept low. Also, when building a creative team, aiming for high productivity and creative products of high quality, leaders with high extraversion paired with high agreeableness should be avoided.

10. In regard to implications for effective management of a creative team, our results suggest to establish the appropriate climate for the more introvert creative team members. In a creative team, team members should communicate and collaborate efficiently to accomplish their collective goals, but for high performance and productivity, creative team members should have their privacy, serenity and peace of mind.

To conclude, this thesis presents an original educational intervention for the development of creativity, which is simple, effective and easy to implement in various contexts. Also, it used a team personality and product-based approach to evaluate the team performance of a creative team and to provide useful suggestions for building an effective creative team. Creativity and creative products are important for our survival and evolution. We hope that researchers and practitioners will benefit from our findings and transform them into useful applications.

Creativity as a whole is a complex phenomenon, a compound of intelligence, character traits, aptitudes and skills, physical abilities, training and education, resources, environmental and socioeconomic factors, circumstances and even luck or in a few words we can say that creativity is the convergence of the right time, place, person and idea. We understand that even if creativity exists if not discovered, encouraged and developed, it is possible never to be expressed and thus much human potential and human talents will be lost and never exploited. With our research we attempted to discover and stimulate it and according to results we were successful. But, we must note that this intervention enhances only one aspect of creativity as measured by divergent thinking tests and creative products. Considering the complexity of creativity as a phenomenon, we acknowledge that this intervention, although beneficial, does not ensure creative achievement. However, we believe it helps the collective human effort to discover, encourage and develop creativity and hopefully it would be useful to researchers, teachers, instructors and anyone else that works towards this goal.

It would be an achievement if even tiny particles of this thesis are of use to other researchers and educators and they implement them into a modern educational system that will provide to our society the necessary creatively productive individuals.

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