Innovation and Creativity A Way to Construct Knowledge: An Explorative Research among Adolescents

Abstract

Ideas are the key to innovation. In this competitive era the excellence of the mankind depends on their innovation. Innovative outcomes laid stress on how to think divergently. Creativity is varied in nature. Several factors are responsible to perform any creative task. Therefore, it is necessary to find out the most important factor which can help to expedite creativity among the person, more specifically to explore the scientific reason behind the specific factor and multivariate relationship between two or more factors. In the present study the investigator used Explanatory-case study method. A scatter analysis is used to compare two data sets for finding out the relationship between them. Simultaneously, curve fitting algorithm is used to examine the relationship between one or more predictors (independent variable) and a response variable (dependent variable) with the goal of defining a best fit model of the relationship. The major aim of this study is to find out the relationship between one or more predictors (independent variable) and a response variable (dependent variable) with the goal of defining a best fit model of the relationship. Exploring the effective factors of creativity is addressed on 14 years age of boys and girls.

~~*Experiential learning is designed into the real nature, scope, importance and conceptual classification of the issues involved to prospective school students in a natural and comprehensive way. Here experiential learning strategy indicates the best medium to expedite creative performances.*~~

Keywords: ***Innovation, Creativity, Personality, Experiential Learning***

1.1 Introduction

Ideas are the key to innovation, while generation of idea is described as the process of creating, developing and communicating abstract, concrete or visual ideas. Traits of divergent thinking are necessary to expedite creation and generation of new ideas. In this competitive era the excellence of the mankind depends on their innovation. Innovative outcomes laid stress on how to think divergently. In this context organizations are paying special attention on its workforce to behave innovatively and creatively (Patterson et al., 2009). Divergent thinking is a key component of creativity and has been defined by Jones et al., (2009, p. 324) “the efficient generation of a variety of ideas to met a given question or problem” (cited in Guilford, 1980). A divergent thinking task requires individuals to generate original and appropriate answers to open ended,

vague problems and it is one of the most often used measures for creativity (Furnham and Bachtiar, 2008). Divergent thinking is comprised of features such as fluency (e.g. the number of responses a person provides to a given question or problem), flexibility of thinking (e.g. the number of categories their responses fall into), originality (e.g. how uncommon a response is within the population sample) and figural or verbal elaboration (e.g. the amount of detail the participant provides in their response) (Batey and Furnham, 2006;"Creativity Test,").

Creativity is varied in nature. Several factors are responsible to perform any creative task. A number of researchers observed that divergent thinking is the result of interactions among multiple dimensions of creativity (Gardner, 1993; Sternberg and Lubart, 1995; Amabile, 1996). Therefore, it is necessary to find out the most important factor which can help to expedite creativity among the person, more specifically to explore the scientific reason behind the specific factor and multivariate relationship between two or more factors.

A most frequent scene observed by us, that a person engage himself/herself in a deep thinking to solve a problem while he/she faces a disequilibrium condition. To solve the problem either he/she repeats a well known path or to use an original idea for solving the problem. Traditionally novel, original ideas have no worth but in the recent century the excellence of mankind depends on the imagination and innovation of human being. The recent literature on 21st century also speaks to this emerging awareness of the need for creativity in our society (Trilling and Fadel, 2009; Bellanca and Brandt, 2010; Thomas and Brown, 2011). Researchers in this field argue that class environments need to shift away from rooms superbly designed for a teacher to stand in front of a class of thirty students set in neat rows, listening, taking notes and doing worksheets to be interactive and collaborative (Pearlam, 2010; p.117).

Curricular standards often stress creativity, innovation and critical thinking. Teachers rarely bring these standards to life as learning outcomes and objectives where rewarding students persist with an idea through failure and reiteration, a skill well known to be common in innovators (Greene 2001; Johnson 2010). So, it is the need of this moment to focus on hands-on-activities in the present teaching-learning system, which can give first hand experiences, that perceived and interpreted by the learner uniquely, resulting knowledge formation.Thinking is an important mental process. It is basically our mind-talking to us. It helps us to evaluate facts and decide what is true and false. Thus one should engage own-self to gather lots of experiences which can help him/her to invent new ways to carry out tasks, solve problems and meet

challenges. Learning as an active individual process that take place when learners are given the opportunity to reflect on a series of consequences and this process has been argued to help individuals for developing sense of the world and become actively engaged in their learning (Kolb 1984, Kuhlthau et.al., 2007). The activities of personal meaning-making and information gathering rely on the engagement of students in order to actively gather and interpret information, simultaneously providing them with the opportunity to gain skills and concepts, which then allow them to learn throughout life while experimenting with and developing innovative and creative thought process (Kolb 1984, Kuhlthau et.al., 2007) .Creative thinking engages and opens the mind. It frees the mind in a way that enables a person to absorb knowledge more easily. It opens the old patterns and allows one for non-linear thinking. It improves the problem solving process in our daily life. It improves the leadership qualities and boosts knowledge productivity. Creativity is such a thought process which helps to generate unorthodox ideas or new associations between existing concepts and their substantiation into a product that has novelty and originality (Dewey,1980). Experiential learning states that knowledge is created through the transformation brought about by experience (Kolb 1984; Mainemelis et.al., 2002; Casanovas et.al., 2010). Experience is the best medium for generating knowledge. Meaningful learning happens when knowledge is created through the transformation of experiences. Because each person experience a phenomenon uniquely, adopt it and through his reflective thinking interpret it in a different manner and by active experimentation and implementation of those ideas lead to create a new idea (Khan and Chattopadhyay, 2019). ~~Experiential learning theory of development presents the most comprehensive description of how students learn by experience through the transactions that occur between a person and the environment (Kolb, 1984). Based on a model of enduring cognitive structures that organize thought and action, the theory proposes that the processes of learning from experience are context dependent and shaped through cycles of integration and differentiation in development (Kolb, 1984). Learning is thus exemplified as a series of interdependent processes growing and changing as the individuals' mental functions mature and greater understandings become implicit. Critical experiences throughout learning that involve the shaping the new ideas and achievements are internalized, providing a scaffold for creating new ideas to further intellectual and personal development (Kolb,1984). Problem solving under experienced peer or adult guidance provides a framework for the identification of personal and global rules and truths~~

~~while allowing the individual learner to shape and construct the cognitive formations that form the basis of that understanding (Kolb, 1984; Moon, 2004). It laid stress the adaptive nature of human functioning and the organic nature of cognitive writing which permits the formation of divergent thoughts and creative idea generation (Kolb, 1984).~~ (Experiential Learning is not the topic of discussion)

2.0 Significance of the Study

Since time immemorial human being are continuously engaging themselves by divergent thinking. It allows us to view and solve several problems more openly and with innovation. A society which has lost touch its creative side is an imprisoned society where generations of people may be closed minded. Research shows that people who are open to acquire new experiences and ideas are more creative than those who are more closed off. Experiences are the gateway of innovation. More one experience more they can generate creative ideas. Several factors are responsible to produce creative ideas. Thus a study is undertaken to explore the most responsible factor and simultaneously to discover the scientific reason behind the specific factor.

3.0 Discussions on Reviewed Studies

Factors influencing divergent thinking

Creativity by nature is multifaceted. Several factors are responsible to perform any creative task. A number of authors have recognized divergent thinking is seen as the result of interactions among the multiple dimensions of creativity (Gardner,1993; Sternberg and Lubart, 1995; Amabile, 1996).

~~The COCO model (Treffinger, 1988) proposes that creative productivity is the function of the dynamic interaction of four factors: i) the personal characteristics of people, ii) the operations they perform, such as problem solving and decision making strategies and techniques, the given context with its cultural and climatic factors, iii) the characteristics of the physical environment and situational factors, communication and cooperation and iv) the final outcomes, products and ideas.~~

Personality and working memory

Working memory is construct related to maintenance, updating and manipulation of information in active memory (Daneman and Carpenter, 1980; Engle et al.,1999; Kane and Engle, 2003;

Unsworth et.al., 2004). It is such a dynamic process which is important in several cognitive processes, higher-order cognition, goal directed behavior and personality.

The study carried out by Zinbarg and Revelle (1989) found that the interaction between anxiety and impulsivity affected the rate of learning in the Go/No Go task. Specifically high impulsive with low anxiety individuals learned quickly how to achieve rewards but could not learn to inhibit responses to avoid punishment. Conversely low impulsive with high anxiety individuals quickly learned how to avoid punishment. (????)

Working memory and creativity

Working memory includes both temporary storage and active processing of information – the workbench of memory, where active mental effort is applied to both new and old information. Thus it is the information that a person are focusing on at a given moment. Traditionally it consists of the central executive as well as two additional storage systems, the phonological loop and the visuo-spatial sketchpad (Baddely, 2003).

Vandervert et. al. (2007) is one of the few researchers examined the relationship between creativity and working memory. They believe that working memory is where creativity and invention begin. This could be because working memory is a system that allows people to piece together different ideas and thoughts, and is sometimes referred to as the blackboard of the mind (Vandervert et al., 2007, p. 3). De Drew et. al. (2012) suggested that creative ability is affected by a person's ability to maintain focussed attention and executive control. This type of control includes working memory which led to their hypothesis that creativity and working memory capacities are positively correlated.

Organizational climate and creativity

Creativity is the only phenomenon which separates man from machines and animals. The awareness of such creative vision produces happiness and joy within the person. Since creativity is an exclusive human trait, it helps one to achieve meaningful life identical to this infinite universe. Most of the people tend to believe that a person can be born as an artist, a poet, a writer, a creative problem solver but teaching these talents is not possible. The process that goes on inside the human brain may still be a mystery but fortunately it is not known whether there are certain things that an organization can do to make the creative process more likely to occur

and even flourish. One of the most important of these elements is organizational climate. Organizational climate is the total environmental qualities within an organization. Halpin (1963) defined organizational climate as a multidimensional perception by its members as well as non-members of the essential attributes or character of an organizational system. Organizational climate of schools may range from open to closed which matters in enhancing creativity among students. Organizational climate varies from school to school and has its effect on student's creativity.

Personality and creativity

A number of studies have examined correlations between personality and creativity. The framework of the Five-Factor Model (FFM), also known as the Big Five, is widely recognized in the personality-studies of community as a reliable approach to capturing individuals' personality traits (Carson et. al., 2005). The FFM divides human personality into five traits: i) openness to experience, ii) conscientiousness, iii) extraversion, iv) agreeableness and v) emotional stability. Openness to experience refers to an individual's intellectual willingness to accept new experience and appreciate a variety of experiences, which may allow him/her to embrace novel ideas. Conscientiousness refers to socially prescribed impulse control, which can inhibit people from taking risks or experimenting and therefore may be detrimental to the generation of new ideas. Extraversion is the set of traits related to activity, energy, and positive emotions, which are likely to boost creativity. Agreeableness includes traits related to altruism and tender-heartedness. Agreeable people are likely to uphold the status quo and may have difficulty in expressing novel ideas or taking unusual actions. Lastly, emotional stability refers to an individual's level of calmness. Emotionally stable people often behave in a self-confident and approachable manner. Therefore, people with high emotional stability are more ready to become involved in the creative process (Sung and Choi, 2009). Out of the five components of FFM, openness to experience has been the most positively and consistently associated with creative traits (Williams, 2004; Lee and Kemple, 2014). However, the relationship of other FFM personality factors to creativity has been less robust. Extraversion has been found to be positively related to creative behavior (Dollinger et.al. 2004), but the other two personality traits were found to be negatively correlated with creativity i.e. agreeableness and conscientiousness. Several studies have attempted to find personality correlates for creativity, beginning with work

by the Institute of Personality Assessment and Research (IPAR) (MacKinnon, 1962; Barron, 1972; Helson, 1999). Creative processes require certain personality characteristics, such as ego strength, because creative ideas do not conform to normative ideas, and a person therefore must have certain personality characteristics that demonstrate his creativity (Runco, 2004).

4.0 Objectives of the study -→ need to be revised

1. To observe whether there is any connection exists between organizational climate and the personality of a student or not → where is the literature review?

2. To find out whether there is any relationship exists between personality and working memory of a student

3. To inquire whether there is any affinity exists between organizational climate and working memory of a specific student → where is the literature review?

4. To discover whether any creative task will be affected by various types of personality of the student or not

5. To examine how organizational climate can influence the creativity of a student

6. To explore how creative task will be affected by the span of working memory of a particular student

7. To find out the interrelationship among working memory, organizational climate and personality with creativity

5.0 Research Questions

1. Is there any relation between OC and Personality of a student? → why use short form?

2. Is there any relation between Personality and WM of a student?

3. Is there any relation between OC and WM of a student?

4. Is there any relation between Creativity and Personality of a student?

5. Is there any relation between OC and Creativity of a student?

6. Is there any relation between creativity and WM of a student?

7. Is there any relation between WM, Personality, OC and Creativity of a student?

6.0 Methodology of the study

the investigator used **Explanatory-case study method** in her present study. Explanatory case studies examine the data closely both at a surface and deep level in order to explain the phenomena in the data. For instance, a researcher may ask the reason as to why a student uses an inferential strategy in reading (Zaidah, 2003). On the basis of the data, the researcher may then form a theory and set to test this theory (McDonough, 1997). Furthermore, explanatory cases are also developed for causal studies where pattern-matching can be used to investigate certain phenomena in different complex and multivariate cases. In the present case studies, an in-depth study of a single case or event is used. The in-depth study provides a systematic way of observing the events, collecting data, analyzing information, and reporting the results over a specific period of time.

Population

In the present study all 9^{th} grade students in West Bengal comprise the target population. Different schools from Burdwan, Nadia, Murshidabad and Kolkata districts are considered accessible population from where samples were drawn.

Sample

Different schools from Burdwan, Murshidabad, Kolkata and Nadia districts are selected purposively to access the willing students. Thus only the willing and accessible 31 subjects are

chosen for this purpose. Out of 31 subjects, 20 students are from Bengali Medium School and remaining 11students are from English Medium School. These schools are affiliated to West Bengal Board of Secondary Education and CBSE Board.

Sampling Technique for the Present Study

The present research included under **non-probability sampling technique**. For conducting the present research work systematically researcher used **purposive sampling** method for sample selection. It is basically selected for solving several purposes properly. Therefore the willing and accessible participants are included as a sample. The present work is based on the purpose, i.e. to find out the responsible factors simultaneously to explore the scientific reason behind the specific factor more specifically multivariate relationship between two or more factors is the main objective of the present study.

Variables of the Study

Independent variable

The following independent variables are considered for collection of data

a) Organizational climate
b) Personality

Dependent variable

The dependent variables are as following:

a) Creative task
b) Working memory
c) Personality

Research Design

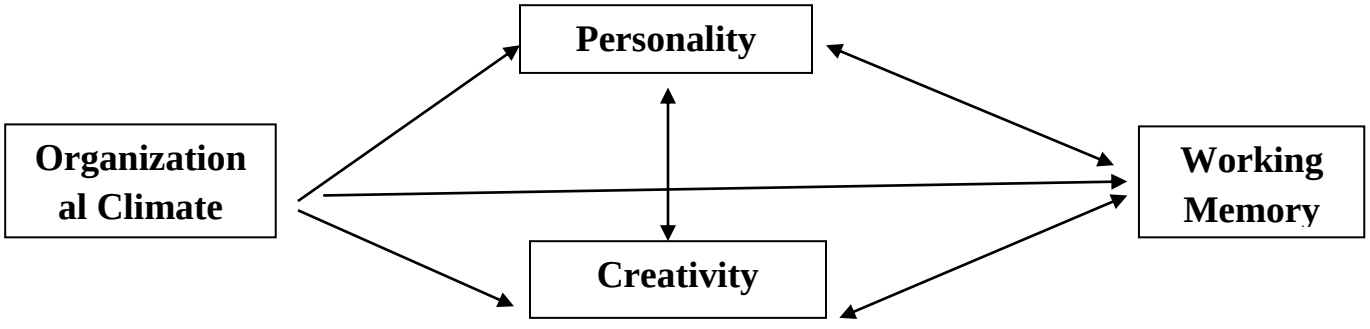


Fig. 1 Flowchart of research design

The research design is depicted through a flowchart (Fig. 1).

Tools used in the Study

For the present study the researcher has selected four types of tool for collection of data. These are:

1. Attitudinal Questionnaire towards one's own organizational climate

2. Dr. Rakhi Bhargava's Span of Immediate Memory (SIM) (Visual and Auditory) → to collect what type of data?

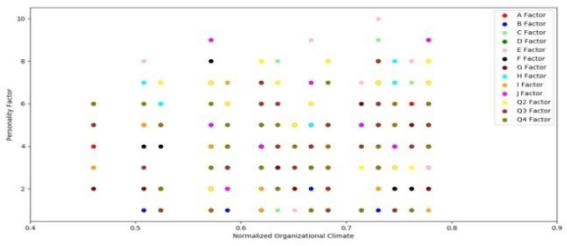
3. B.K. Passi test of Creativity

4. HSPQ tool for personality measurement -→ Why the literature is using FFM?

7.0 Results

The scores of organizational climate, personality, working memory and creativity of 31 students with their numerous demographical factors are plotted and analyzed through scatter diagram and a best fit model is established through curve fitting algorithm.

Fig.2 Relationship between organizational climate and personality scores of the students

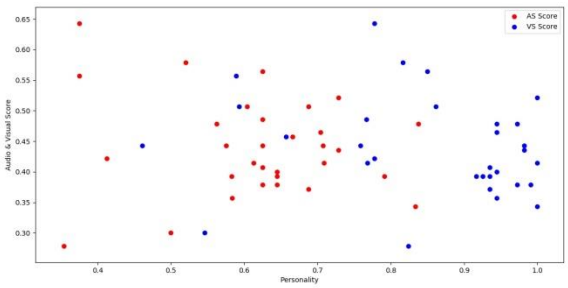


The above figure (Fig.2) is plotted between normalized scores of OC and personality factors of 31 subjects. The different personality factors are indicated by different colors as shown in the

figure. Here it is to be mentioned that the normalized scores of OC is the fraction of individual OC score and maximum possible OC score. Consequently the scores of personality is the fraction of individual personality score and maximum possible score of personality factor. Fig 2 shows that the 14 factors of personality are affected by the different organizational climate scores. So it is undoubtedly considered that among the 14 factors of personality some of them are dominated in different ranges of normalized organizational climate scores. Remaining factors are not abolished but are submissive in nature. For example, between the range of 0.4 to 0.5, five factors G, I, A, Q_3, Q_4 are dominating, and remaining factors are quite submissive. Similarly between the range of 0.5 to 0.6, nine factors E, F, G, H, I, J, Q_2, Q_3, Q_4 are dominating, and remaining factors are submissive in nature. Hence other part of the graph can be explained in this way. But if we explain the graph overall then we find that A and B factors are submissive while G and Q_4 factors are dominated in nature. (????)

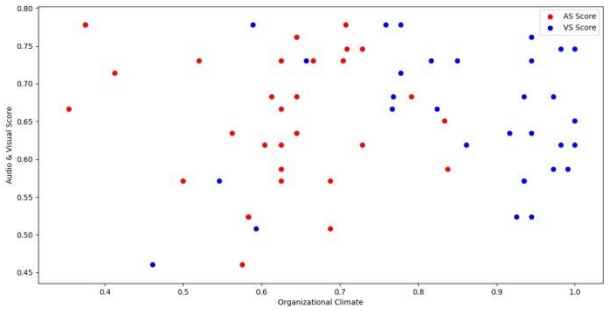
The above analysis of data and its discussion is related to Research Question No. 1

Fig.3 Relationship between personality and working memory scores of the students



The above figure (Fig.3) is plotted between normalized scores of personality factors and working memory scores of 31 subjects. The different working memory scores are indicated by different colors as shown in the figure. Here it is to be mentioned that the normalized scores of personality factors is the fraction of individual personality score and total possible personality score. Consequently the scores of working memory is the fraction of individual working memory score and maximum possible scores of working memory. Figure 3 reveals that the working memory scores are affected by different personality factor. So it is considered that audio working memory scores are affected more by the personality in the range between low to medium; while video working memory scores are affected more by the personality in the range between medium to high value. For example between the ranges of 0.5 to 0.7 audio working memory are more prominent while between the ranges of 0.7 to 1.0 scores of video working memory are more dominant. The above analysis of data and its discussion is related to Research Question No. 2

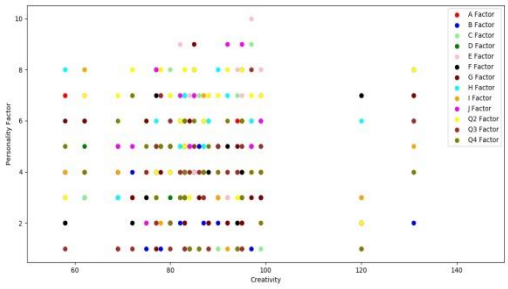
Fig.4 Relationship between organizational climate and working memory scores of the students



The above figure (Fig.4) is plotted between normalized scores of OC and working memory of 31 subjects. The different working memory scores are indicated by different colors as shown in the figure. Here it is to be mentioned that the normalized scores of OC is the fraction of individual OC score and maximum possible OC score. Consequently the scores of working memory is the fraction of individual working memory score and maximum possible scores of working memory. Figure 4 reveals that the working memory scores are affected by different OC scores. So it is considered that the audio working memory scores are more prominent in low to medium range of organizational climate while maximum video scores are falls in between medium to high ranges of organizational climate scores. It indicates organizational climate can expedite working memory power through direct learning experiences during teaching.

The above analysis of data and its discussion is related to Research Question No. 3

Fig.5 Relationship between creativity and personality scores of the students

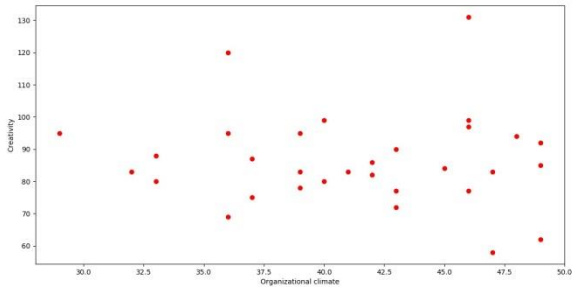


The above figure (Fig. 5) is plotted between normalized scores of creativity and personality factors of 31 subjects. The different personality factors are indicated by different colors as shown in the figure. Here it is to be mentioned that the normalized scores of creativity is the fraction of individual creativity score and maximum possible creativity score. Consequently the scores of personality is the fraction of individual personality score and maximum possible score of personality factor. Fig 5 depicted that the 14 factors of personality are affected by the different

ranges of creativity scores. So it is undoubtedly considered that among the 14 factors of personality some of them are dominated in different ranges of normalized creativity scores. Remaining factors are not abolished but are submissive in nature. For example, between the ranges of 60 to 80 creativity scores, eight factors F, G, H, I, J, Q_2, Q3, Q_4 of personality scores are dominating, and remaining factors are quite submissive. Similarly between the ranges of 80 to 100, twelve factors B, C, D, E, F, G, H, I, J, Q_2, Q_3, Q_4 are dominating, and remaining factors are submissive in nature. Hence other part of the graph can be explained in this way. But if we explain the graph overall then we find that A, C and D factors are submissive while Q_2 and Q_4 factors are dominated in nature.

The above analysis of data and its discussion is related to Research Question No. 4

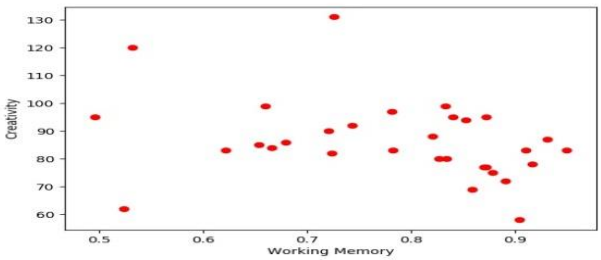
Fig.6 Relationship between creativity and organizational climate scores of the students



The above figure (Fig.6) is plotted between normalized scores of OC and creativity of 31 subjects. The creativity scores are indicated by red colors as shown in the figure. Here it is to be mentioned that the normalized scores of OC is the fraction of individual OC score and maximum possible OC score. Consequently the scores of creativity is the fraction of individual creativity score and maximum possible creativity score. Fig 6 shows that the scores of creativity vary in between the range of 70 – 100. But there is no as such influence of organizational climate scores with the creativity scores although some students who have 90 above creativity scores had a linear relationship with organizational climate scores.

The above analysis of data and its discussion is related to Research Question No. 5

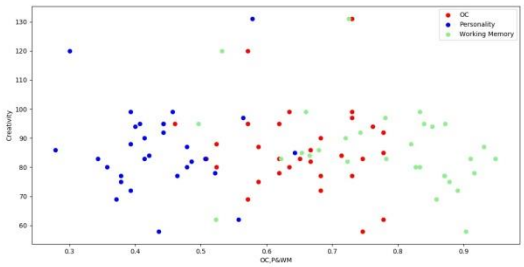
Fig.7. Relationship between creativity and working memory scores of the students



The above figure (Fig.7) is plotted between normalized scores of working memory and creativity of 31 subjects. The creativity scores are indicated by red colors as shown in the figure. Here it is to be mentioned that the normalized scores of working memory is the fraction of individual working memory score and maximum possible working memory score. Consequently the scores of creativity is the fraction of individual creativity score and maximum possible scores of creativity. Fig 7 reveals that the ranges of creativity score falls in between 70 to 100. Creativity scores increases between 0.6 to 0.8 ranges of working memory scores but above 0.8 ranges of working memory scores, creativity scores drastically fallen down. The reason is when students are addicted by lots of information and video mode of teaching-learning they are crippled to think freely and independently.

The above analysis of data and its discussion is related to Research Question No. 6

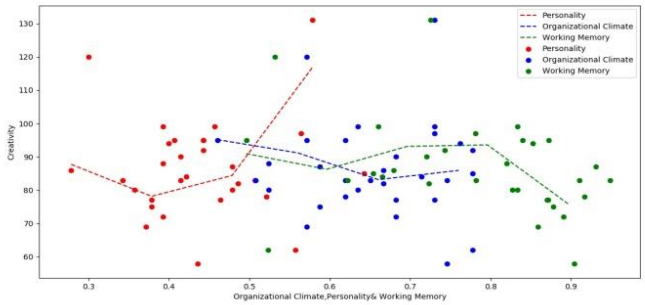
Fig.8. Relationship between organizational climate, working memory, personality and creativity scores of the students



The above figure (Fig.8) is plotted between normalized scores of OC, working memory and personality factors with creativity of 31 subjects. The OC scores, working memory scores and personality factors are indicated by different colors as shown in the figure. Here it is to be mentioned that the normalized scores of OC, working memory and personality are the fraction of individual OC score, working memory score and personality score and maximum possible OC score, working memory score and personality score. Consequently the scores of creativity is the fraction of individual creativity score and maximum possible score of creativity. Fig 8 shows that human creativity depends on organizational climate, personality and working memory factors. Thus the value of this relationship are low i.e. 0.3 to 0.5 then creativity is mostly influenced by personality factors. When the relationship is in medium range creativity is influenced by the organizational climate factors consequently when the function is in high range it is mostly influenced by working memory. (Figure 8 and 9 have the same explanation?)

The above analysis of data and its discussion is related to Research Question No. 7

Fig.9 Relationship between organizational climate, working memory, personality and creativity scores of the students



The above figure (Fig 9) is plotted between normalized scores of OC, working memory and personality factors with creativity of 31 subjects. The OC scores, working memory scores and personality factors are indicated by different colors as shown in the figure. Here it is to be mentioned that the normalized scores of OC, working memory and personality are the fraction of individual OC score, working memory score and personality score and maximum possible OC score, working memory score and personality score. Consequently the scores of creativity is the fraction of individual creativity score and maximum possible score of creativity.

Fig 9 reveals that creativity is the function of organizational climate (OC), personality (P) and working memory (WM) and is expressed as ***C= f (OC, WM, P).***

Thus human creativity depends on organizational climate, personality and working memory factors. When the value of this function is low i.e. 0.3 to 0.5 then creativity is mostly influenced by personality factors. When the function is in medium range creativity is influenced by the organizational climate factors consequently when the function is in high range it is mostly influenced by working memory.

Personality and creativity

When personality scores are in medium range i.e. 5 to 6, creativity scores decreased but when it is in high and low range consequently creativity scores increased.

Organizational climate and creativity

Fig 9 shows that there is as such no effect of organizational climate on creativity although high creativity scores are affected by organizational climate factors.

Working memory and creativity

The above graphical presentation reveals that initially increasing working memory scores increase creativity scores. Whereas high working memory scores deterred human creativity. But after a certain range creativity scores drastically decreases.

8.0 Findings

In the present study an explanative case study method was applied to find out the relationship between OC and personality with particular reference to WM and creativity. For this purpose different types of tools are used upon 31 subjects for collection of related data.

After analyzing the data, researcher has come to conclude the following findings. These are

The 14 factors of personality are affected by the different organizational climate scores. It is undoubtedly considered that among the 14 factors of personality some of them are dominated in different ranges of normalized organizational climate scores. Remaining factors are not abolished but are submissive in nature. Overall A and B factors of personality are submissive while G and Q_4 factors of personality are dominated in nature. (Why never include in literature review?)

The working memory scores are affected by different personality factors. So it is considered that audio working memory scores are affected more by the personality in the range between low to medium; while video working memory scores are affected more by the personality in the range between medium to high value.

The working memory scores are affected by different OC scores. So it is considered that the audio working memory scores are more prominent in low to medium range of organizational climate while maximum video scores fall in between medium to high ranges of organizational climate scores. It indicates that organizational climate can expedite working memory power through direct learning experiences during teaching.

Personality is affected by the different ranges of creativity scores. So it is undoubtedly considered that among the 14 factors of personality some of them are dominated in different ranges of normalized creativity scores. Remaining factors are not abolished but are submissive in nature. Overall A, C and D factors of personality are submissive while Q_2 and Q_4 factors of personality are dominated in nature.

The scores of creativity vary in between the range of 70 – 100. But there is no as such influence of organizational climate scores on the creativity scores although some students who have creativity scores above 90 had a linear relationship with organizational climate scores.

There is an interrelationship between creativity and working memory. The ranges of creativity score lie in between 70 to 100. Creativity scores increases between 0.6 to 0.8 ranges of working memory scores but above 0.8 ranges of working memory scores creativity scores drastically fallen down. The reason is when students are addicted by lots of information and video mode of teaching-learning; they are crippled to think freely and independently.

Human creativity depends on organizational climate, personality and working memory factors. So, creativity is the function of organizational climate, personality and working memory and it is expressed as ***C= f (OC, WM, P).*** Thus when the value of this function is low i.e. 0.3 to 0.5 then creativity is mostly influenced by personality factors. When the function is in medium range

creativity is influenced by the organizational climate factors. Consequently when the function is in high range it is mostly influenced by working memory.

When personality scores are in medium range i.e. 5 to 6 creativity scores are decreased but when it is in high and low range creativity scores increased.

There is as such no effect of organizational climate on creativity although high creativity scores are affected by organizational climate factors.

Initially increasing working memory scores increased creativity scores. Whereas high working memory scores hampers human creativity so after a certain range creativity scores drastically decreases.

9.0 Discussion and conclusion

In this competitive era the excellence of mankind depends on their innovation. Ideas are the key to innovation. Idea generation is described as the process of creating, developing and communicating abstract, concrete or visual ideas. While performing any creative task **it is necessary to find out the responsible factors simultaneously to explore the scientific reason behind the specific factor more specifically multivariate relationship between two or more factors.**

In the present study organizational climate, working memory and personality are the responsible factors of performing any creative task. Where creativity is considered as a function of organizational climate, working memory and personality, i.e**. *C= f (OC, WM, P).***

The scatter diagram plot (Fig. 2. to Fig. 9.) indicates that the effect of the scores of organizational climate, working memory and personality upon creativity varies in different perspectives**. The most important feature of this study is that among several factors working memory is the most responsible factor of creativity.** Working memory is the combination of multiple mental tasks some of which include the ability to focus attention, mental rehearsal, and manipulation of information (Colom et.al.,2004). According to De Dreu et al. (2012), working memory is the system that keeps information available for complicated cognitive activity; this would include activities like language comprehension, planning, and reasoning. There are two basic responsibilities of working memory; the first is to keep new information in an enhanced state of activity and the second is to differentiate between information that is task-relevant or task-irrelevant (Unsworth and Engle, as cited in De Dreu et al., 2012, p.657). Working memory requires not only the retention of information but also the manipulation of information which measure this are characterized as dual tasks. This is because a person must shift their attention between the list items and the processing component of the task at hand (e.g. mentally rehearsing the directions, while driving to a location) (Engle, Tuholski et al., as cited in Colom et al., 2008, p.585; Alloway and Copello, 2013).

Working memory includes both temporary storage and active processing of information – the workbench of memory, where active mental effort is applied to both new and old information. Thus it is the information that a person is focused on at a given moment.

Vandervert et. al. (2007) is one of the few researchers who examined the relationship between creativity and working memory. They believe that working memory is where creativity and invention begin. This could be because working memory is a system that allows people to piece together different ideas and thoughts, and is sometimes referred to as the blackboard of the mind (Vandervert et al., 2007, p. 3). De Drew et. al. (2012) suggests that creative ability is affected by

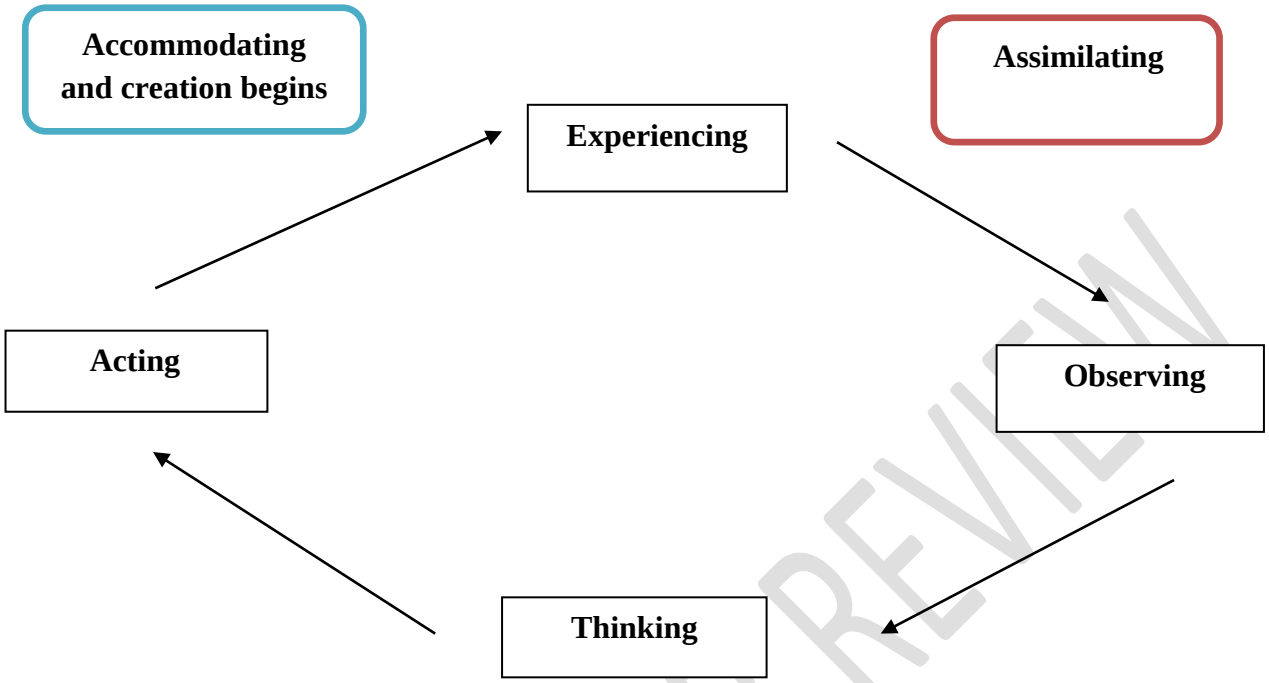
a person's ability to maintain focused attention and executive control. Working memory capacity is the amount of information that people can hold in mind at once. All of us have a relatively limited amount of information we can think about at any one time, but there are differences between people in the size of working memory.

When a person start thinking about something, the first few things come up in his/her mind will have variations on ideas that he/she may have encountered in the past. After thinking those mundane ideas one is likely to start really generating something new. Therefore, when one has high working memory capacity, he/she is better able to pull out both the initial ideas that are not deeply original as well as other more novel ideas. So, thinking is the first and foremost step to generate something new. ~~Experience can help a person to think freely. Experience is the best medium for generating knowledge. Meaningful learning happens when knowledge is created through the transformation of experiences. Because each person experience a phenomenon uniquely, adopt it and through his reflective thinking interpret it in a different manner and by active experimentation and implementation of those ideas lead to create a new idea.~~ The recent literature of 21st century also speaks to this emerging awareness of the need for creativity in our society (Bellanca and Brandt, 2010; Thomas and Brown, 2011). Researchers in this field argue that environments need to shift away from rooms "superbly designed for a teacher to stand in front of a class of thirty students set in neat rows, listening, taking notes and doing worksheets"(Pearlam 2010;117) "to interactive, collaborative, dynamic spaces wherein students learn to collect and sort through information while developing critical thinking and problem solving skills." Though curricular standards often stress creativity, innovation and critical thinking, teachers rarely bring these standards to life as learning outcomes, objectives or by

rewarding students who persist with an idea through failure and reiteration; a skill well known to be common in innovators (Greene, 2001; Johnson, 2010). So, it is the need of this moment to focus on hands-on activities in the present teaching learning system, which can give first hand experiences, that are perceived and interpreted by the learner uniquely, resulting knowledge formation. Experiential learning theory states that knowledge is created through the transformation brought about by experience (Kolb 1984; Mainemelis et.al.,2002; Casanovas et.al.2010). ~~Dewey described learning as an active individual process that take place when learners are given the opportunity to reflect on a series of consequences (Kuhlthaw et.al.2007) and this process has been argued to help individuals make sense of the world and become actively engaged in their learning (Kolb 1984, Kuhlthau et.al., 2007). The activity of personal meaning making and information gathering relies on the engagement of students in order to actively gather and interpret information, simultaneously providing them with the opportunity to gain skills and concepts, which then allow them to learn throughout life while experimenting with and developing innovative and creative thought process.~~ (Learning is not part of the research topic)

So experiences can help a person to observe at first according to their WM, then the person think and makes comparisons between what they have done, reflect upon and what they already know. It emphasizes the practical application of ideas and solving problems. At last they are applied the new idea in a new field. At the time of application their new idea in a new field their personality and the necessary OC influenced a lot. Thoughts and reflection emerge new ideas which lead generation of creativity among the learner.

~~The following figure (Fig. 10) can make the sequence better understand~~



- ~~**Fig 10. Beginning of creation**~~

References

Acar, S., and Runco, M. A. (2012). Psychoticism and Creativity: A Meta-analytic Review. Psychology of Aesthetics, Creativity, and the Arts.

Amabile, T. (1989). Growing up creative: nurturing a lifetime of creativity. New York: Crown.

Amabile, T. M. (1979). Effects of external evaluation on artistic creativity. *Journal of Personality and Social Psychology*, 37, 221-233

Amabile, T. M. (1983). Social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology*, 45(2), 357-376.

Amabile, T. M. (1988). A model of creativity and innovation in organizations. In B. M. Staw, and L. L. Cummings (Eds.), *Research in organizational behavior* Greenwich, CT: JAI Press (Vol. 10, pp. 123-167).

Amabile, T.M. (1993). What does a theory of creativity require? *Psychological Inquiry*, 4(3), 179- 181

Amabile, T.M. (1996). Creativity in context. Boulder, Colorado: Westview Press.

Amabile, T. M. (1998). How to kill creativity?. *Harvard Business Review*, 76(5), 76-87.

Amabile, T. M., Hill, K. G., Hennessey, B. A., and Tighe, E. (1994). The work preference inventory: Assessing intrinsic and extrinsic motivational orientations. *Journal of Personality and Social Psychology*, 66(5), 950-967.

Amabile, T. M., and Mueller, J. S. (2008). Studying creativity, its processes, and its antecedents: An exploration of the componential theory of creativity. In J. Zhou, and C. E. Shalley (Eds.), *Handbook of organizational creativity* New York, NY: Lawrence Erlbaum (pp. 33-64).

Alloway, T.P. (2007). Automated Working Memory Assessment (AWMA). London: Pearson Assessment.

Alloway, T.P. (2012b). Automated Working Memory Assessment-II (AWMA-II). London: Pearson Assessment

Alloway, T., and Copello, E. (2013). Working memory: the what, the why, and the how. *Australian Educational & Developmental Psychologist*, *30*(2), 105-118. doi:10.1017/edp.2013.13

Baddeley, A. D., and Hitch, G. J. (1974). 'Working memory'. In G. H. Bower (Ed.), *The Psychology of learning and motivation* New York: Academic Press. *(Vol. VIII, pp. 47-90).*

Baddeley, A. (1996). Exploring the central executive. *Quarterly Journal Of Experimental Psychology: Section A, 49*(1), 5-28. doi:10.1080/027249896392784

Baddeley, A. D., and Logie, R. H. (1999). Working memory: The multiple component model.In A. Miyake & P. Shah (Eds.), *Models of working memory: Mechanisms of Active Maintenance and Control* Cambridge: Cambridge University Press pp. 28-61.

Baddely, A. (2000). The episodic buffer: a new component of working memory? *Trends in Cognitive Sciences, 4*(11), 417-423. DOI: http://dx.doi.org/10.1016/S1364- 6613(00)01538-2

Baddeley, A. (2003). Working memory: looking back and looking forward. *Nature Reviews Neuroscience, 4*(10), 829-839. doi:10.1038/nrn1201

Baddeley, A.D., Allen, R.J. & Hitch, G.J. (2011). Binding in visual working memory: The role of the episodic buffer. *Neuropsychologia, 49,* 1393-1400.

Bandura, A. (1997). Self-efficacy: The exercise of control. New York, NY: Freeman.

Barron, F(1963). Creativity and psychological health. New York. Van Nostrand

Barron, F. (1969). Creative person and creative process. New York: Holt Rinehart.

Barron, F. (1972). Artists in the making. New York: Seminar.

Barron, F., and Harrington, D. M. (1981). Creativity, intelligence, and personality. *Annual Review of Psychology, 32,* 439–476.

Batey, M., Furnham, A., and Safiullina, X. (2010). Intelligence, General Knowledge and Personality as Predictors of Creativity. *Learning and Individual Differences*, 20(5), 532- 535.

Batey, M., and Furnham, A. (2006). Creativity, intelligence, and personality: a critical review of the scattered literature. *Genetic, Social & General Psychology Monographs*, *132*(4), 355-429.

Beaty, R. E., & Silvia, P. J. (2012). Why do ideas get more creative across time? An executive interpretation of the serial order effect in divergent thinking tasks. *Psychology of Aesthetics, Creativity, and the Arts*, 6, 309-319. doi:10.1037/a0029171

Benedek, M., Könen, T., and Neubauer, A. C. (2012). Associative abilities underlying creativity. *Psychology of Aesthetics, Creativity, and the Arts*, 6(3), 273-281. doi:10.1037/a0027059

Carson, S. H., Peterson, J. B., and Higgins, D. M. (2005). Reliability, validity, and factor structure of the creative achievement questionnaire. *Creativity Research Journal*, 17(1), 37-50. doi:10.1207/s15326934crj1701_4

Cattell, R.B. and Butcher, H.J. (1968). The prediction of achievement and creativity. Indianapolis, IN: BobbsMerrill.

Carson, S. H., Peterson, J. B., and Higgins, D. M. (2005). Reliability, validity, and factor structure of the creative achievement questionnaire. *Creativity Research Journal*, 17(1), 37-50. doi:10.1207/s15326934crj1701_4

Cattell, R.B., Eber, H.W. and Tatsuoka, M.M. (1970). Handbook for the sixteen personality factor questionnaire (16PF). Illinois: Institute for personality and ability testing.

Colom, R., Rebollo, I., Palacios, A., Juan-Espinosa, M., and Kyllonen, P. C. (2004). Working memory is (almost) perfectly predicted by g. *Intelligence*, 32, 277-296. doi:10.1016/j.intell.2003.12.002

Costa, P. T., and McCrae, R. R. (1992). Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEOFFI) professional manual. Odessa, FL: *Psychological*

Assessment Resources

Csikszentmihalyi, M., and Getzels, J. W. (1973). The personality of youngartists: An empirical and theoretical exploration. *British Journal ofPsychology*, 64, 91-104.

Daneman, M., and Carpenter, P. A. (1980). Individual differences in working memory and reading. *Journal of Verbal Learning & Verbal Behavior*, 19, 450-466.

Dellas, M., and Gaier, E. L. (1970). Identification of creativity: The individual. *Psychological Bulletin*, 73, 55-73.

De Dreu, C. W., Nijstad, B. A., Baas, M., Wolsink, I., and Roskes, M. (2012). Working memory benefits creative insight, musical improvisation, and original ideation through maintained task-focused attention. *Personality & Social Psychology Bulletin*, 38(5), 656-669. doi:10.1177/0146167211435795

Deci, E. L., and Ryan, R. M. 1985. Intrinsic motivation and self-determination in human behavior. New York: Plenum Press

Dollinger, S. J., Urban, K. K., and James, T. A. (2004). Creativity and openness: Further validation of two creative product measures. *Creativity Research Journal*, 16, 35-47.

Ekvall, G. (1983). Climate, structure and innovativeness of organizations: a theoretical framework and an experiment. Report 1. Stockholm, Sweden: FA radet, The Swedish council for management and organizational behavior.

Engle, R. W. (1996). Working memory and retrieval: An inhibition resource approach. In J. T. E.Richardson, R. W. Engle, L. Hasher, R. H. Logie, E. R. Stoltzfus and R. T. Zacks (Eds.), *Working Memory and Human Cognition* New York: Oxford University press pp. 89-119.

Engle, R. W., Conway, A. R. A., Tuholski, S. W., and Shisler, R. J. (1995). A resource account of inhibition. *Psychological Science, 6*(2), 122-125.

Engle, R. W., Kane, M. J., and Tuholski, S. W., (1999). Individual differences in working memory capacity and what they tell us about controlled attention, general fluid intelligence, and functions of the prefrontal cortex. In A. Miyake and P. Shah (Eds.), *Models of working memory: Mechanisms of Active Maintenance and Control* Cambridge: Cambridge University Press pp. 102-134

Feldhusen, J.F. (1995). Creativity: A knowledge base, metacognitive skills, and Personality

Factors. *The Journal of Creative Behaviour*, 29, (4), 255-268

Eysenck, M.W., and Graydon, J. (1989). Susceptibility to distraction as a function of personality. *Personality and Individual Differences*, 10, 681-687.

Eysenck, H.J. (1993). The psychophysiology of creativity and genius. Guest lecture in 21sts Annual Meeting of the British Psychophysiology Society for Clinical Neurophysiology, Nottingham.

Eysenck, H.J. (1995). Genius: The natural history of creativity. Cambridge: Cambridge University Press.

Feldhusen, J.F. (1995). Creativity: A knowledge base, metacognitive skills, and Personality

Factors. *The Journal of Creative Behaviour*, 29, (4), 255-268

Feldhusen and Goh, B.E. (1995). Assessing and assessing creativity : An integrative review of theory, research, and development. *Creativity Research Journal*, 8(3), 231,247

Ford, C. (1996). A theory of individual creative action in multiple social domains. *Academy of Management Review*, 21, 1112–1142.

Feist, G. J., and Gorman, M. E. (1998). The psychology of science: Review and integration of a nascent discipline. *Review of General Psychology, 2*, 3–47.

Furnham, A., & Bachtiar, V. (2008). Personality and intelligence as predictors of creativity. *Personality and Individual Differences*, 45(7), 613-617. doi: 10.1016/j.paid.2008.06.023

Furnham, A., Crump, J., Batey, M., and Chamorrow-Premuzic, T. (2009) Personality and ability predictors of the "consequences" test of divergent thinking in a large non-student sample. *Personality and Individual Differences*, 46, 536-540. doi:10.1016/j.paid.2008.12.007

Gardner, H. (1993). Creating minds: An anatomy of creativity seen through the lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi. New York: Basic Books

George, J. M., and Zhou, J. (2001). When openness to experience and conscientiousness are related to creative behavior: An interactional approach. *Journal of Applied Psychology*, 86, 51–524.

Guilford, J.P. (1959). Traits of creativity. In H.H. Anderson (Ed.), *Creativity and its cultivation.* New York: Harper.

Guilford, J.P. (1975). Creativity: A Quarter century of progress. In I.A. Taylor & J.W.Getzels

(Eds.), *Perspectives in Creativity.* Chicago: Adline.

Halpin, A.W., and Croft, D.B. (1963). The Organizational Climate of Schools. *Administrator's Note Book.* XI(7)

Hall, W.B., and McKinnon, D.M. (1969). Personality inventory correlates of creativity among architects. *Journal of Applied Psychology*, 53, 322–326; doi:10.1037/h0027811

Helson, R. (1967). Personality characteristics and developmental history of creative college women. *Genetic Psychologic Monographs*, 76, 205–256

Hollingworth, L.S. (1942). Children above 180 IQ. New York: World Book.

Hosseni,A,.(2003).The effect program of creativity education on knowledge, attitude and skills among students. Tehran: Planning and Research Organization.

Hoyle, R.H. (2006). Personality and self-regulation: Trait and information processing perspectives. *Journal of Personality*, 74, 1507-1525.

Isaksen, S.G., Puccio, G.J. and Treffinger, D.J. (1993). An ecological approach to creativity research: Profiling for creative problem solving. *The Journal of Creative Behaviour*, 21, (3), 149-170.

Johnson, J. (1974). Memory and personality: An information processing approach. *Journal of Research in Personality*, 8, 1-32.

Jones, K. A., Blagrove, M. M., and Parrott, A. C. (2009). Cannabis and Ecstasy/MDMA: Empirical Measures of Creativity in Recreational Users. *Journal of Psychoactive Drugs*, 41(4), 323-329.

Jostmann, N.B., and Koole, S.L. (2006). Waxing and waning of working memory: Action orientation moderates the impact of demanding relationship primes on working memory capacity. *Personality and Social Psychology Bulletin*, 32, 1716-1728

Kane, M. J. and Engle, R. W. (2003). Working memory capacity and the control of attention: The contributions of goal neglect, response competition, and task set to Stroop interference. *Journal of Experimental Psychology*: General, 132, 47 – 70.

Karwowski, M., and Lebuda, I. (2016). The Big Five, the Huge Two, and creative self-beliefs: A meta-analysis. *Psychology of Aesthetics, Creativity, and the Arts*, 10, 214–232; doi:10.1037/aca0000035.

Khan, D., Chattopadhyay, K. N. (2019). Kolb's Experiential Learning Cycle: A new approach for performing any creative task, *International Journal of Innovative Knowledge Concepts, 7(5), 82-84.* ISSN : 2454-2415

King, L.A. McKee Walker, I. and Broyles, S.J. (1996). Creativity and the five-factor model.

Journal of Research in Personality, 30, 189-203.

Kioslosky, J.L. (2002). Happiness, How are environment affects our well-being and performance.From:http://www.clearing house Mwsc.edu.manuscripts/ 292-asp.

Lee, N. J., and Paik, S. H. (2014). Research on 'Flow' and Creativity as Observed in the Daily Lives of Science-Gifted Students. *Journal of the Korean Association for Research In Science Education*, 34(2), 147-153. https://doi.org/10.14697/jkase.2014.34.2.0147

Lee, I. R., and Kemple, K. (2014). Preservice teachers' personality traits and engagement in creative activities as predictors of their support for children's creativity. *Creativity Research Journal*, 26(1), 82-94.

Logie, R. H. (2003). Spatial and visual working memory: A mental workspace. In *The Psychology of Learning and Motivation.* (Vol. 42, pp. 37-78). San Diego, CA: Academic Press

Matthews, G., and Dorn, L. (1995). Cognitive and attentional processes in personality and intelligence. In: D.H. Saklofske, & M. Zeidner (Eds.), *International Handbook of personality and intelligence*. NY: Plenum Press.

Martindale, C. and Dailey, A. (1996). Creativity, primary process cognition and personality. *Personality and Individual Differences*, 20, 409-414.

McCrae, R.R. (1987). Creativity, divergent thinking, and openness to experience. *Journal of Personality and Social Psychology*, 52, 1258-1265.

Mumford, M. D., and Gustafson, S. B. (1988). Creativity syndrome: Integration, application, and innovation. *Psychological Bulletin*, 103, 27-43

Newell, A., Shaw, J., and Simon, H. (1962). The process of creative thinking. In H. Gruber, G. Terrell, & M. Wertheimer (Eds.), *Contemporary approaches to creative thinking* pp. 63–119. New York: Atherton.

Logie, R. H. (2003). Spatial and visual working memory: A mental workspace. In *The*

Psychology of Learning and Motivation. (Vol. 42, pp. 37-78). San Diego, CA: Academic Press

Logie, R. H., and Della Sala, S. (2004). Disorders of visuospatial working memory. In

P.Shah and A. Miyake (Eds.), *Handbook of visuospatial thinking*. Cambridge: Cambridge

University Press.

MacKinnon, D. W. (1965). Personality and the realization of creative potential. *American*

Psychologist, 20, 273-281.

Oberauer, K. (2009). Design for a working memory. *Psychology of Learning and Motivation, 51,* 45-100.

Oldham G. R., Cummings A. (1996). Employee creativity: Individual and contextual factors at work. *Academy of Management Journal*, 39, 607-634.

Osborn, A. (1953). *Applied Imagination: Principles and Procedures of Creative Problem*

Solving. New York: Charles Scribner's Sons.

Parnes, S. J. (1981). *The magic of your mind*. Buffalo: Creative Education Foundation.

Patterson, F. (1999). *The innovation potential indicator*. manual and User‟s guide. Oxford: OPP Ltd.
er‟s guide. Oxford: OPP Ltd.

Rogers, C.R. (1954). Toward a theory of creativity. *ETC: A review of general semantics, 11*,

249-260.

Runco, M.A. (2003). Commentary on personal and potentially ambiguous creativity: You can't understand the butterfly unless you (also) watch the caterpillar. *Creativity Research Journal*, 15, 137–141; doi:10.1207/S15326934CRJ152&3-04.

Runco, M. A., Millar, G., Acar, S., Cramond, B. (2011). Torrance Tests of Creative Thinking

as Predictors of Personal and Public Achievement: A Fifty Year Follow-Up. *Creativity*

Research Journal, 22 (4), 361-368.

Saatchi,M,.(2009). *Applied psychology for managers* .Tehran: Virayesh Publication.

Sauseng, P., Klimesch, W., Schabus, M., and Doppelmayr, M. (2005). Fronto-parietal EEG coherence in theta and upper alpha reflect central executive functions of working memory. *International Journal of Psychophysiology*, 57(2), 97-103. doi:10.1016/j.ijpsycho.2005.03.018

Schacter, D.L. and Addis, D.R. (2007). The ghosts of past and future. *Nature, 445,* 27.

Seligman, M. (2002). Authentic Happiness : using the new positive psychology to realize your potential for lasting fulfillment. New York : Free press.

Shalley, C. E., and Gilson, L. L. (2004). What leaders need to know: A review of social and contextual factors that can foster or hinder creativity? *The Leadership Quarterly*, 15,

Shelton,J., and Harris, T. L. (1979). Personality characteristics of art students. *Psychological Reports*, 44, 949-950.

Simonton, D. K. (1999). Origins of genius. Darwinian perspectives on creativity. Oxford: *Oxford University Press*

Simonton, D.K. (1994). Greatness: *Who makes history and why*. New York: Guilford Press

Spillers, G.J. and Unsworth, N. (2011). Variation in working memory capacity and temporal contextual retrieval from episodic memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 37(6),* 1532-1539.

Stein, M. (1968}. Creativity. In E. F. Borgatta & W. W. Lambert (Eds.), *Handbook of personality theory and research* Chicago: Rand McNally (pp. 900-942).

Sternberg, R. J. (1985). Implicit theories of intelligence, creativity and wisdom. *Journal of Personality and Social Psychology, 49* (3), 606–627.

Sternberg, R. J., and Lubart, T. I. (1996). Investing in creativity. *American Psychologist, 7,* 677–688. doi:10.1037/0003-066X.51.7.677

Suddendorf, T. (2006). Foresight and evolution of the human mind. *Science, 312 (5776),* 1006 – 1007.

Terman, L. M. (1925). *Genetic studies of genius*: Vol. 1. Mental and Physicaltraits of a thousand gifted children. Palo Alto, CA: Stanford University Press.

Treffinger, D. J. (1988). Components of creativity: Another look. *Creative Learning Today*, *2* (5), 1-4.

Unsworth, N., Schrock, J. C., and Engle, R. W. (2004). Working memory capacity and the antisaccade task: Individual differences in voluntary saccade control. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, 30, 1302-1321.

Unsworth, N. (2007). Individual differences in working memory capacity and episodic retrieval: Examining the dynamics of delayed and continuous distractor free recall. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 33, 1020 – 1034.

Unsworth, N. and Engle, R.W. (2006a). Simple and complex memory spans and their relation to fluid abilities: Evidence from list-length effects. Journal of Memory and Language, 54, 68 – 80.

Unsworth, N. and Engle, R.W. (2006b). A temporal-contextual retrieval account of complex span: *An analysis of errors. Journal of Memory and Language*, 54, 346 – 362.

Unsworth, N. and Engle, R.W. (2007a). The nature of individual differences in working memory capacity: Active maintenance in primary memory and controlled search from secondary memory. *Psychological Review*, 114, 104 – 132.

Unsworth, N. and Engle, R.W. (2007b). On the division of short-term and working memory: An examination of simple and complex span and their relation to higher order abilities. *Psychological Bulletin*, 133, 1038 – 1066.

Unsworth, N., Heitz, R.P., Schrock, J.C., and Engle, R.W. (2005). An automated version of the operation span task. *Behavior Research Methods*, 37, 498 – 505.

Vandervert, L. R., Schimpf, P. H., and Hesheng, L. (2007). How working memory and the cerebellum collaborate to produce creativity and innovation. *Creativity Research Journal,19*(1), 1-18. doi:10.1080/10400410701277043

Woodman, R.W., Sawyer, J.E., and Griffin, R.W. (1993). Toward a theory of organizational creativity. *Academy of Management Review*, 18, 293-321

Wolfradt, U. and Pretz, J.E. (2001). Individual Differences in Creativity: Personality, Story Writing, and Hobbies. *European Journal of Personality*, 15, 297-310.

Yin, R.K., (1984). Case Study Research: Design and Methods. Beverly Hills, Calif: *Sage Publications*.

Zernike, K. (2001). The harvand Guide to happiness. From:www.astro.washington.edu/ agueros/teaching/08 Edbook.html

Zinbarg, R., and Revelle, W. (1989). Personality and conditioning: A test of four models. *Journal of Personality and Social Psychology*, 57, 301-314.