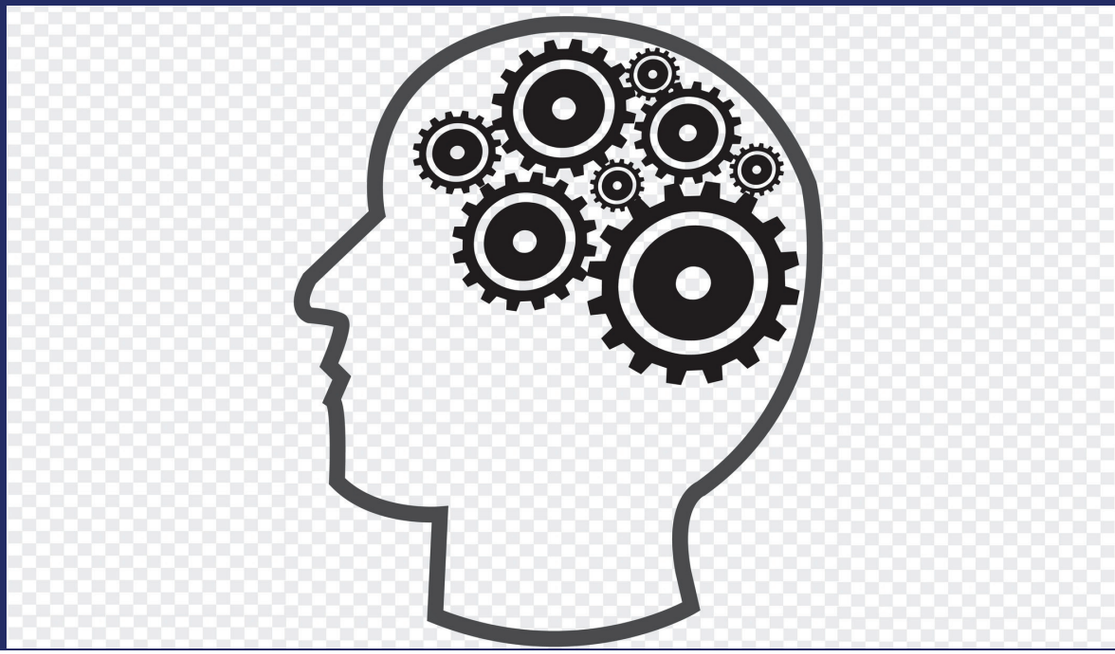
The current era is characterized by rapid changes, successive discoveries and a knowledge revolution covering all fields, which requires the preparation of individuals who are capable of straight thinking and qualified to face the challenges of the progress of knowledge and technology in this era. Creative thinking is a complex mental activity that results from guided mental processes, the use of mathematical skills and related knowledge, with the aim of reaching new and valuable production that enable the individuals to adapt to life variables, handle mathematical and non-mathematical problems intelligently, and make right decisions. Creativity has three major skills; Fluency, originality, and flexibility that enable individuals to identify their problems, emotions and to express them accordingly. Discovering creativity in its root theories, models and best implications according to the surrounding environment. Beyond creativity compromises; Theoretical Perspective, researched models and the practical implications from recent research.



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Beyond Creativity

Theories, Models and Implications

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Content

CHAPTER ONE

INTRODUCTION

The current era is characterized by rapid changes, successive discoveries and a knowledge revolution covering all fields, which requires the preparation of individuals who are capable of straight thinking and are qualified to face the challenges of the progress of knowledge and technology in this era.

The goal of the teaching and learning process is to shift interest from knowledge and information to the development of the students' minds to acquire the ability to conclude, imagine, invent, critique, create, in addition to other higher thinking skills. To achieve this, we should focus on the development of thinking patterns and refine the learner's abilities to develop, organize, store and employ the methods of mental processing of acquired knowledge (Al Sayyed and Ahmed, 2009).

Mathematics has been and will continue to be the servant and queen of all sciences, being a school of creativity and a forum for creators, for which its study develops the mental abilities of the learner, orienting them towards authenticity and flexibility, and its passion stimulates the mind and pushes it towards challenges. Moreover, educators agree that mathematics is one of the most important subjects that is considered a fertile ground for the development of thinking methods generally, and creative thinking particularly (Muselhi and Abdullah, 2012). Also, The National Council of Teachers emphasizes the need to provide appropriate methods to develop students' ability to practice creative thinking, by focusing on strategies that develop creative thinking within the classroom (Forster, 2012).

Creative thinking is a complex mental activity that results from guided mental processes, the use of mathematical skills, the recall of mathematical expertise and related knowledge, with the aim of reaching new and valuable production that

enables the individual to adapt to life variables, handle mathematical and non-mathematical problems intelligently, and make right decisions.

Creativity has three major skills: Fluency, originality, and flexibility (Adam, 2014). Creative thinking enables high achieving students to recognize their problems and emotions and to express them accordingly, which is of high importance as those students are considered the munitions of the present and the leaders of the future; thus, their welfare is an essential sphere for educational development. In this regards, educators believe that the investment in the talents of the outstanding students is one of the important fundamental issues in our contemporary world, as the educational curriculum does not stimulate their imagination, nor their curiosity, nor does it challenge their abilities, or leave an opportunity for them to express their opinions, which results in the student's loss of the spirit of challenge as a result of repetitive routine practiced in the classroom. Therefore, if not provided with programs that meet their needs, students become more prone to problems (Sa'adu, 2008).

The creation process is commonly structured in stages. It starts with an initial Inspiration; followed by a rational stage of Preparation; an unconscious phase of ideas Incubation; the discovery of an concept in Illumination; and finally the Verification of such idea's usefulness to the problem at hand (Mostert, 2007; Baxter, 2011). According to Amabile (1997), creativity in the individual sphere is a result of combinations between expertise, creative skills, and intrinsic task motivation. While expertise and intrinsic motivation depend on the team background and personal factors, creative skill is a trainable aspect (Starkey *et al.*, 2016).

Adequate approaches, such as creativity techniques, can provide higher cognition flexibility, pushing team members to be more tolerant to risks and creating adequate ambiance to develop the creative thinking (Bertoncelli *et al.*, 2016).

To appropriately explore those individual skills, an organizational environment should be adequate in also three components, according to Amabile (1997): organization motivation to innovate, resources, and management practices.

Training and knowledge are imperative resources for innovation to occur, which includes information on how to select and use creativity techniques to provide a sufficient base to creation.

CHAPTER TWO

MODELS OF CREATIVITY

Poincare (1913) Model

Poincare describes the creative process as commencing with conscious thought followed by unconscious work, resulting in 'inspiration'.

However Poincaré gave particular attention to the post-Illumination phase. Poincaré narrowed his focus of attention by concerning himself with mathematical discovery since in this the human mind "seems to take least from the outside world" acting "only of itself and on itself" thereby offering insights into what is "most essential" in the mind (Poincaré, 1908/1952, p.22).

Poincare said that: "It is necessary to put in shape the results of this inspiration, to deduce from them the immediate consequences, to arrange them, to word the demonstrations, but above all is *verification* necessary" (Poincaré, 1908/1952)

Furthermore, He added "It usually happens that it [the illumination] does not deceive him [the mathematician], but it also sometimes happens, as I have said, that it [the illumination] does not stand the test of *verification*" (Poincaré, 1908/1952)

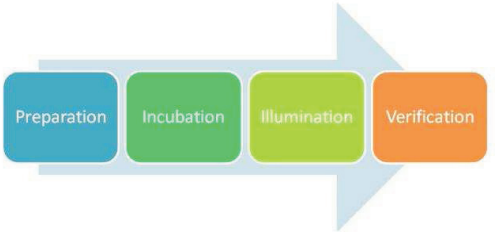
However, Pioncare stated "…we might hope to find the product ready-made upon our awakening, or again that an algebraic calculation, for example a *verification*, would be made unconsciously. Nothing of the sort, as observation proves." (Poincaré, 1908/1952).

Wallas model

Graham Wallas model invented in (1926) as a process of creativity, which still today most commonly cited in recent studies (Hoff, 2014).

The process of creative thinking according to Wallas' theory, understood as a path from problem to solution, can be demonstrated in four stages of creation: ***Preparation, Incubation, Illumination, Verification*** (Hoff, 2014). (1)*The stage of* ***preparation*** implies achieving new knowledge, facts and impression, as well as defining the problem. *(2) The stage of* ***incubation*** deals with the somewhat passive

processing of the information or the “problem”. Where, Wallas saw that many great ideas came to be only after having spent a time away from the problem, normally when one is having a “pause” from the problem, rather than being actively engaged in it. This “pause” can consist of only a few minutes or of several years. *(3) The stage of* ***illumination*** is when insights are gained, new ideas are born and strategies for further work are clarified. Consequently, Wallas suggests it is by resting the mind doing other activities (*incubation*) that creative ideas are born (*illumination*), (4) In the stage of ***verification***, efforts are made to see if the new idea or solution actually “solves the problem”. This is the final stage of the creation process and it is where the idea reaches its final shape and is actually carried through (Hoff, 2014).



Wallas' Four-Stage Model

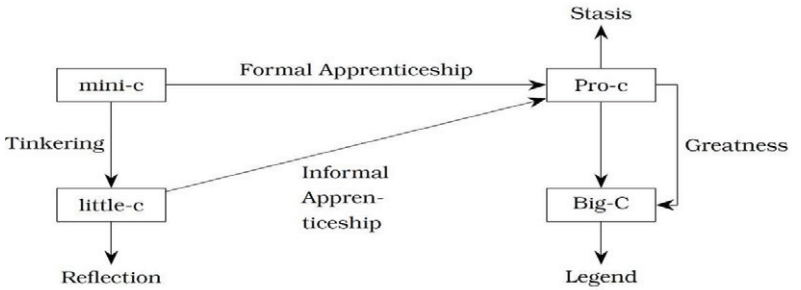
Four "C" Model for creativity

According this model creativity can be subdivided into many levels of creativity. Kaufman and Beghetto (2009) proposed Four C model, they claim that the majority of the researchers of creativity usually take one of two main parts: the first one the research approach that focuses on ***everyday creativity*** also classified as ***little-c***, that creativity which can be found in most of people. The second one is the studies that focus exclusively on outstanding creativity and classified as ***Big-C*** which only concerns the creative geniuses (Kaufman & Beghetto, 2009).

Kaufman and Beghetto (2009) proposed that these two sections are not sufficient to cover the wide spectrum of human creativity and fail to consider the parts, gradations, and gaps between ***Big-C*** and ***little-c***. Kaufman & Beghetto (2009) expand the ***little-c*****/Big-*****C*** dichotomy by proposing the Four C model.

Frequently, they present two new categories, namely ***mini-c*** and ***Pro-C.*** The ***mini-c*** classification was invented to take into consideration the creativity that takes place during the learning process, asserting on the new and personally meaningful interpretation of experiences, actions, and events (Kaufman & Beghetto, 2009). The ***mini-c*** classification can be thought of as the little-c of the ***little-c*** class. Furthermore, the inclusion of this new level is of great importance to make sure that children's creative potential is nurtured.

The ***Pro-C*** was invented to give accomplished personality with a high-level of expertise in any creative area. This category is intermediate position between everyday creativity (***little-c***) and the place reserved for the eminent creative geniuses (***Big-C***) (Kaufman & Beghetto, 2009).



Csikszentmihalyi Model:

Csikszentmihalyi is considered one of many researchers who identified the cooperation between the individual and the environment in order for creativity to occur (Csikszentmihalyi, 1996). This point-view now, it is not sufficient with only a creative person for creativity to be brought about, but also the context in which creativity occurs is of fundamental importance: Csikszentmihalyi says:…

"Creativity does not happen inside people's heads, but in the interaction between a person's thoughts and a sociocultural thoughts and a sociocultural context. It is systemic rather than an individual phenomenon." (Csikszentmihalyi, 1996).

According to Csikszentmihalyi's systems model, there are three essential parts for creativity to demonstrate.

The first part of the model is the ***domain***, which means an art form or a particular area of science. An example of a domain can be mathematics, which consists of a set of rules and procedures (Csikszentmihalyi, 1996).

The second part of creativity is the ***field,*** which is confirmed by the experts, who act as gatekeepers to a particular domain, who are competent enough to evaluate what is considered new and appropriate. An example of field, visual arts the gatekeepers are art teachers, gallery owners, art collectors, critics or foundations and institutions that work with culture (Csikszentmihalyi, 1996).

The last part of the creative system is the individual ***person*** who contributes with something new and appropriate to the domain. The creative person must have genuine knowledge within the domain as well as good contact with the field (Hoff, 2014). Thus, creativity occurs when a person, using his or her genuine knowledge in a given domain such as music, visual arts, mathematics or economics, comes up with a new idea, which is accepted and selected by the experts of the field to be included in the corresponding domain (Csikszentmihalyi, 1996).

In conclusion, according to Csikszentmihalyi's systems model, the definition of creativity is: "any idea or product that changes an existing domain, or that transforms an existing domain". The definition of a creative person is "someone whose thoughts or actions change a domain or establish a new domain". Furthermore, according to the author, it is fundamental to remember that "a domain cannot be changed without the explicit or implicit consent of a field responsible for it." (Csikszentmihalyi, 1996, p. 28).

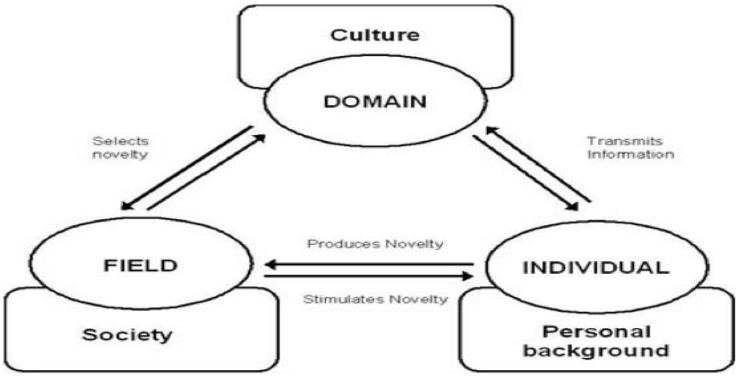


Figure 1 - Csikszentmihalyi's systems model of creativity (2003, p. 315)

The Six P's Model:

The model of the Six P's serve as a complement to the mentioned model but it may also work as a tool itself when understanding and investigating creativity(Calonico, 2017). This model is widely used in creativity research and provides a framework to identify and organize the different aspects, categories or areas of study of creativity in a comprehensive way (Kaufman & Sternberg, 2010).

Conventionally, the model proposed by Rhodes known as "the four P's of creativity" consisted of four aspects: ***process***, ***product***, ***person*** (or personality**)** and ***place*** (or press) (Kaufman & Sternberg, 2010; Calonica, 2017).

A modified version of this framework added two more components enlarging the model to what is known as "the six P's of creativity". The newly added aspects are ***persuasion*** introduced by Simonton, and ***potential*** introduced by Runco (Kaufman & Sternberg, 2010; Calonica, 2017).

Where, (1) ***Process:*** refers to *how* the path from problem to an idea takes place, that is to say, *how* the creative process occurs at a cognitive level. The goal is to understand the type of psychological mechanisms that take place during creative thought or creative activity (Kaufman & Sternberg, 2010). ***(2) Product:*** refers to the end product, such as a product for sale, different types of services, solutions to problems, publications, ideas for change or artistic expressions (Hoff, 2014; Calonica,

2017). ***(3) Person (or personality):*** refers to the individual that creates, namely the creative person (or personality) as explained by Kaufman & Sternberg> . The tendency in early research of creativity was focused essentially on personality traits and compared mathematicians, architects, writers and other groups of creative people in order to identify distinctive personality attributes that imply creative potential. Several attributes appear to be more prevalent and common among creative persons including: intrinsic motivation, wide interests, openness to experience and autonomy. Nowadays most theories consider personality as only one aspect or influence of creative behavior (Kaufman & Sternberg, 2010).

(4) Place: refers to the place where creativity arises. This is often connected with the phase of *illumination* and refers to when/where insights are gained. The creative place can, apart from being a physical place, also be a mixture of good conditions, as can be the presence of "the appropriate" people, the presence of an infrastructure, access to material and know-how, a financier who can offer economic solutions and offer advantageous working conditions. *Place* can also refer to the psychosocial environment and the presence of a "creative climate" characterized by freedom and the possibility to independent work as the most important aspect, but also of other aspects such as time and support for ideas, risk-taking, challenge, playfulness and humor, trust, confidence, debates and conflicts (Hoff, 2014).

(5) Persuasion: refers to the creative individual's ability to perused others that his product is creative. Highly creative persons change the way other people think so it is of great importance that these creative persons with their creative ideas have the ability to persuade others in the area of expertise in order to be considered creative (Kaufman & Sternberg, 2010).

(6) Potential: refers to the conditions and potential that a person has to be creative and to develop their creativity. Many research in this category focuses on children's potential and everyday creativity (Kaufman & Sternberg, 2010).

Urban's Componential Model

Componential model of creativity Urban (2007) presents six aspects or components of personal activity that are necessary for creativity to occur. In regard to the variety of theoretical approaches to creativity, Urban (2007) determined two large classes that are slightly different from each other: a cognition oriented view and a personality oriented view. Accordingly, his model is built taking into consideration these two main groups and remarking the interdependency that these two groups have when creativity takes place (Urban, 2007). Furthermore, Urban (2007) emphasizes the importance of identifying which components of personality are central and responsible for creative behavior.

CHAPTER THREE

THEORIES OF CREATIVITY

Theories that emphasis on the creative process intend to comprehend the idea of the psychological instruments that happen when a man is occupied with creative thinking or creative activity. Process speculations ordinarily indicate diverse phases of processing. When looking at theories of creativity, it is additionally valuable to separate between levels of creative magnitude - little c (frequently more subjective) versus Larger C (more objective) creativity. The hypothetical ways to deal with creativity may likewise be considered regarding which angle or aspect of creativity they underscore (Rhodes, 1961; Runco, 2004b). Traditionally, these perspectives have been alluded to as the "four p's of inventiveness": **process, product, person** (or personality), and place (or press). Later forms of this structure (e.g., Runco, 2007a) have extended it to six P's, including **persuasion** (Simonton, 1990) and **potential** (Runco, 2003)' Since this alliterative system pleasantly sorts out numerous issues in the investigation of creativity, we will utilize it as another methods for looking at the extent of various theoretical points of view. Hypotheses that emphasis on the creative process plan to comprehend the idea of the psychological instruments that happen when a man is occupied with creative thinking or creative activity.

MODERN THEORIES

DEVELOPMENTAL THEORIES

Developmental theories of creativity are among the most handy. Not exclusively do they assist us with understanding the underlying foundations of creativity, as recommended by the foundation of unambiguously creative people, however they likewise regularly propose how to outline conditions so the creative possibilities of kids will be satisfied. Subsequently, developmental perspectives primarily stress the person, place, and potential parts of creativity.

Despite the fact that items are not the essential focal point of developmental theories, regardless they play an imperative, however frequently implied, part. This is on account of these theories suggest a direction that begins with more emotional types of creativity (smaller c) and forms into more substantial and develop types of creative articulation. Early developmental theories were formulated by looking at the lives and family foundations of famous creative people (Goertzel and Goertzel, 1976).

Goertzel and Goertzel (1976) proposed that specific developmental encounters were connected with creativity. For example, guardians of creative youngsters appeared to open their kids to assorted encounters and most were themselves in some ways creativity. These families were additionally portrayed by a direct measure of freedom (Albert and Runco, 1989): Parents knew about what their youngsters were doing however were not excessively prohibitive. Note this isn't just a perception without useful association with creativity. Autonomy is sensibly fixing to the creative process, and also clear in creative process of families. Ideal freedom enables kids to create self-sufficiency that would then be able to be utilized in their thinking and would enable them to devise unique thoughts.

To some degree more controlled investigations of improvement have concentrated on family structure. This isn't amazing on the grounds that family structure (e.g., birth arrange, ordinal position inside the family, age interim amongst kin, and die down - the term used to show the quantity of kin in a family) have intrigued social and conduct scientists, and regular rationalists whose work far originated before the social sciences, for quite a while. To name one exceptional example, Galton (,1869) had much to say in regards to genetic virtuoso. He revealed that firstborn kids had a Significant developmental preferred standpoint, and thus were regularly effective. Galton did not take a gander at creativity but rather centered around people with more regular accomplishments.

Research on family structure has demonstrated helpful for building theories of creativity. For example, consider the possibility that center kids have certain developmental favorable circumstances. Sound proof recommends that center youngsters are frequently defiant and progressive (Gaynor and Runco, 1998; Sulloway, 1996), likely in light of the fact that they are brought up in families where there are more seasoned, more fit kin whose development acquires them parental consideration. Center youngsters along these lines discover elective approaches to get consideration, frequently by opposing parental qualities and the present state of affairs and finding a one of a kind specialty. Defiance might be inside the setting of the family, in one's thinking, or, amid adulthood, in masterful or logical upsets.

PSYCHOMETRIC THEORIES

Psychometric theories are not built to depict the developmental foundation of creative people, nor their reasoning examples or characteristics or intentions. Or maybe, they are extraordinary in concentrating on estimation, and accordingly they advise every single other theories of creativity. In this manner, psychometric theories underline items over the other P's (have been alluded to as the "four p's of inventiveness": process, product, person (or personality), and place (or press). Later forms of this structure (e.g., Runco, 2007a) have extended it to six P's, including persuasion (Simonton, 1990) and potential (Runco, 2003), and they run from little-c to Big-C Creativity.

They don't have a specific reliance on anybody model of creativity nor are they attached to a specific theoretical system (e.g., intellectual) social clinical, and so on. Psychometric theories are concerned, in addition to other things, with the reliability and validity assessment, which are issues in all logical work on creativity.

ECONOMIC THEORIES

One of the later classifications of creativity theories draws vigorously from financial matters. This is apparently a crisp and helpful point of view mostly on the grounds that it considers extremely broad large scale level procedures and impacts. Monetary speculations additionally offer testable theories about creative endeavors. They anticipate, for example, that bigger gatherings will repress conceptualizing in light of the fact that the expenses of being extraordinary and hence original, are higher when the group of onlookers is extensive. They likewise foresee that people with large amounts of skill will be less adaptable about choices, in any event those that test their own particular perspectives, than people who have put less into their vocations or into a specific hypothesis or technique. The large scale level nature of financial and venture hypotheses includes the greater part of the P's with the exception of process, and ranges Little -c to Big-C Creativity.

Florida (2002) additionally analyzed the market for inventive practices, going so far as to characterize an creative class or portion of society. This thusly enabled him to analyze distinctive urban communities and nations as far as help for and indications of creativity. Here again the common sense of financial hypothesis is clear, in that Florida suggested that a key segment of the market for creative work is resilience. Offbeat individuals some of the time should be endured; and creative social orders complete a great job of that. Creativity is additionally, for Florida, reliant on talent and technology.

STAGE AND COMPONENTIAL PROCESS THEORIES

As noticed, various models of the creative process have been suggested that endeavor to comprehend the structure and nature of the creative process as far as stages, which can be successive or recursive, or basic componential subjective

procedures. Clearly, such models underline process over the other P' s; as far as creative magnitude, they run from smaller than expected c to Big-C Creativity.

A standout amongst the most prominent and persisting stage speculations is that of Wallas (1926; cf. Helmholtz, 1896). It starts with *a preparation* where the individual assembles data and characterizes an issue. Next comes *incubation*, which includes removing some time from an issue, at any rate deliberately. On the off chance that incubation is viable, a third stage happens: insight, or what Wallas called *illumination*. Now, an answer or thought all of a sudden makes itself known. Critically, in spite of the fact that the knowledge may appear like an "a-hal" minute and may feel like an exceptionally sudden motivation (which is the reason experiences are regularly symbolized with a light turned on). Gruber (1981b) exhibited that bits of insight as often as possible have extended chronicles. For Wallas, the last stage was confirmation. By then, the individual tests the thought or applies the arrangement.

The linearity of Wallas' model has been to a great extent undermined; accordingly, later models have recognized the probability of recursion, whereby an individual may go through the stages different occasions, in different blends. For example, the individual may endeavor to check a thought yet think that its solitary in part satisfactory, and come back to the arrangement stage and begin once again .

Amabile's (1999) componential show incorporates three features; domain-relevant skills (e.g., information about the area, specialized aptitudes), creativity-relevant skills (e.g., proper intellectual style, learning of heuristics for producing original thoughts), and **task motivation** (e.g., demeanors toward particular undertakings, view of one's intentions). For Amabile, the first of these depends intensely on intrinsic capacities and aptitudes, while the second relies upon preparing and experience. The third is a component of inherent inspiration, nonattendance of

outward limitations, and the person's ability to limit the incapacitating impacts of imperatives.

COGNITIVE THEORIES

It is hard to consider creative accomplishments or exhibitions without expecting that they have some premise in discernment. It is likewise hard to consider imaginative individuals without expecting that they have some exceptional intellectual capacities. Neither of these suspicions require be valid, yet there is some sign that distinctions in discernment can assume a noteworthy part in creativity.

Cognitive theories underscore the creative process and person: process, in accentuating the part of subjective components as a reason for creative thoughts; and person, in thinking about individual contrasts in such systems.

Cognitive theories of creativity are very shifted. Some emphasis on all inclusive capacities, like consideration or memory; others center around singular contrasts, for example, those listed by different reasoning errands. Some attention on cognizant activities (e.g., strategies) while others point to preconscious, implicit, or unexpected procedures. Some place that imagination is a sort of critical thinking, and others incorporate psychological process that are ostensibly generally autonomous of critical thinking, for example, issue finding .

One respected cognitive theories contends that creative experiences can result from acquainted procedures. Mednick (1962) depicted how ideas are anchored together, in a steady progression, and how remote partners have a tendency to be unique. Relationship among thoughts might be shaped for different reasons, for example, being practically or even acoustically related. Clearly a few people tend to move rapidly from evident partners to remote ones. In this view, more creative people have a tendency to have compliment chains of command of relationship than less creative people; as it were, more creative individuals have numerous all the more

moderately solid partners for a given idea, as opposed to just a couple, which is thought to give more prominent degree to the concurrent actuation of far-flung portrayals.

THEORIES BASED ON PROBLEM SOLVING AND EXPERTISE

A related real class of creativity theories, again drawn fundamentally from subjective cognitive psychology, stresses critical thinking procedures and master learning (e.g., Ericsson, 1999; Newell, Shaw, and Simon, 1962; Simon, '1988" '1989; Weisberg, '2005, 2006). This point of view is to a great extent theory of the creative individual and the creative "process: person, in stressing area particular skill as an essential condition for huge creative accomplishments; and process, in underscoring how customary subjective mental ideas like issue portrayals and heuristic inquiry through issue spaces clarify how individuals produce inventive answers for issues. Like the creative cognition approach, the critical thinking/mastery see expressly contends that creative ideas at last come from everyday cognitive processes, in spite of the fact that skill construct speculations frequently center with respect to Big-C Creativity, while the creative cognition approach normally tends to little-c inventiveness.

PROBLEM FINDING THEORIES

"Problem finding," another powerful perspective of creativity, can be viewed as a response against the utilization of customary critical thinking thoughts to creativity (Runco, 1994). The problem finding view holds that the conventional critical thinking view is lacking to disclose how creators come to understand that an issue exists in any case, and how they are spurred to proactively bring their emotional experience to comprehend the issue. In this view, heuristic pursuit through an issue space basically does not have any significant bearing to circumstances like making a

canvas, since there is no pre-indicated set of contrasting options to involve the problem space.

Problem finding is generally viewed as autonomous f critical thinking, and it is for the most part a hypothesis of the creativity process; it can likewise be viewed as a theory of the creative individual, accepting that something like the inclination for distinguishing intriguing issues speaks to a steady identity variable (Perkins, 1981).

As far as creative magnitude, the demonstration of problem finding can regularly be translated as a case of smaller than normal c creative (as problem finding includes the more subjective, novel bits of knowledge and by significant understandings of creators), despite the fact that there is space for more elevated amounts of creative accomplishment also (when, for example, creators can share their procedure and others come to consider it to be a novel and important route for distinguishing and investigating problems).

EVOLUTIONARY THEORIES : MODEL OF SIMONTON

Simonton model (1984, 1988, 1997, 1999,2003,2004) covers the majority of the P's of creativity: person and potential, in recognizing dispositional and developmental peculiarities related with the acknowledgment of starting creative potential into real creative accomplishments; process, in spreading out a two - step model of ideation and elaboration, in which chance mixes of thoughts play a foremost part and whose complexities are difficult to control; product, in taking note of in some cases untrustworthy introductory appraisals versus longer-term stable judgments of creative relics; put, in distinguishing social components prompting exceptional creativity; and influence, in stressing how social elements set up decisions of creative results. More than some other theories of creativity, Simonton's Darwinian view expects to comprehend the idea of genius, greatness, and Big-C accomplishments.

The basis of Simonton's Darwinian model is a two-stage mental process, including the blind generation and selective retention and elaboration of thoughts (Campbell, 1960). In this view, thoughts are consolidated in some visually impaired design, regularly beneath the limit of mindfulness; the most fascinating blends are then deliberately explained into completed creative products; these in tum are judged by other individuals.

TYPOLOGICAL THEORIES

One way to deal with understanding identities variety as a part of creators' identities, working strategies, profession directions, etc., has been to place typologies of creators, who contrast in precise ways (e.g., Epstein, 1991; Epstein, Pacini, Denes-Raj, and Heier, 1996; Gombrich, 1984; Isaksen, Lauer, and Wilson, 2003; Kaufmann, 1979; Kirton, 1976, 1989; Martinsen, 1993, 1995)

This model is a pretty much brought together theories of creativity, and it addresses the greater part of the P's, for each situation underlining singular contrasts instead of nomothetic patterns .

Galenson's (2001, 2006) emphasis has been on Big-C Creativity, however other typological speculations include different levels as well. Quite, his typology includes two altogether different levels of examination: macro level trajectories and micro-level depictions of creators' working techniques .

Galenson contends that there are two basic sorts of creators: aesthetically motivated experimentalists, or "seekers," and conceptual innovators, or "finders." The two kinds vary by way they approach the creative process, and in addition in their vocation directions and the premise of their notorieties.

For seekers, the creative process is a frustrating struggle. Often eschewing preparatory work, they typically begin without a clear idea of their goals, proceed by trial and error, labor over their decisions, and have a difficult time declaring a work

completed, using mainly perceptual criteria to do so. Over time, these creators show great continuity in their stylistic development, tend to improve steadily with age, and are ultimately known for a body of work of fairly even quality, rather than individual standout achievements. Because their approach relies on a large body of expert technical knowledge and perceptual skills that take time to acquire, seekers rarely produce outstanding works early in their careers. In contrast, finders frequently make detailed preparations and clearly know their goals at the outset. They thus typically work very efficiently and can easily decide when a project is finished. Often their careers are marked by abrupt changes of style, each marked by a few capstone works, which form the basis of their reputation. Because finders radically change a domain's rules, they can largely circumvent the normally laborious process of expertise acquisition and often make a noteworthy contribution quite early in their careers - although in principle, radical conceptual innovations can happen at any point in a creator's career.

SYSTEMS THEORIES

A portion of the broadest and most aspiring speculations of creativity take the view that creativity is best conceptualized not as a solitary element, but rather as rising up out of a mind boggling framework with interfacing subcomponents – which must all be considered for a rich, significant, and substantial comprehension of creativity.

One seminal theory is that of Gruber (1981a; Gruber & Wallace, 1999) and colleagues, who pioneered the *evolving systems* approach to creativity. This has mainly been applied to understanding the unique attributes of the creative person, via very detailed archival case studies of Darwin (Gruber, 1981a) and others (Gruber, 1996; Wallace & Gruber, 1989).

The evolving-systems approach is primarily an account of what creators *do* (Gruber & Wallace, '1999). Its emphasis is on dynamic, developmental processes that play

out in complex ways and contexts, over very different timescales. To provide a structural framework for understanding creative individuals in the midst of such complexity, Gruber introduced a number of foundational concepts. One is the notion that great creators likely use an *ensemble of metaphors* in their thinking, which together characterize a developmental process leading to creative meaning making (Gruber, 1978), rather than relying exclusively on one dominant metaphor - as, sadly, many researchers have done when trying to understand these issues.

CHAPTER FOUR

FOUNDATION THEORIES OF CREATIVITY

MURPHY'S THEORY OF CREATIVITY.

Murphy (1945) has joined notable highlights from the speculations of different essayists and included one of his very own kind parts. He attracts on Gestalt theories to clarify the marvel of knowledge (now and then called inspiration), on psychoanalytic speculations of oblivious drives, and on affiliation principles with respect to the progressive manufacturing of mental associations, summation, and separation. He fused the thoughts of Catherine Patrick, Eliot Dole Hutchinson and other people who have composed of the different stages in imaginative idea and includes his own particular and most noteworthy of all, idea of creativity.

This idea comprises of the possibility that creativity is the summation of educated action becoming out of outrageous affectability to tactile experience sought after until such an innovative drive has turned out to be constant. The special part of Murphy's hypothesis is that he lays worry upon the combined character of creative skills inside the on-going life procedure of the person.

The coordination of higher and more unpredictable aptitudes, as indicated by Murphy, results from a mix of inherited and social variables. An example of creative skills made out of full of feeling and scholarly abilities in all cases and of engine abilities in a portion of expressions of the human experience and sciences is required .

Murphy cautions that there is no alternate route to creativity, yet he proposes three particular techniques which may add to a cognizant acknowledgment of increased creativity through arranged methodology. These are the open door for people to

help decide their own particular objectives, preparing in immediacy, and a shift amongst sociality and detachment .

The second of these strategies, Moreno's (1962) suddenness preparing, Murphy feels bolsters and fortifies techniques from dynamic training in the freedom of "huge energies inside the center of the ego, which have as a rule been left to coincidental articulation. In this procedure people learn, through assuming different parts on a phase, to convey what needs be suddenly with a specific end goal to satisfy themselves as people and "uncover distinction which life had trained them to hide. Of the third system for encouraging creativity Murphy says, "at times. . . a shift amongst sociality and confinement might be the best instructive gadget.

DEWEY'S THEORY OF CREATIVITY (1959).

Many of these same ideas expressed by Murphy are to be found in the work of Dewey (1959) couched in a somewhat different language. He, too, infers that creativity rests on the reorganization of experience, that it is, a learned activity, and that it constitutes a construction in time. While Murphy speaks of "creativeness resulting from sensory drives refined and enriched through a hierarchy of more complex integrations" and Dewey writes of "expression through impulsion toward wholeness, " both are saying the same thing. "Impulsion" is defined by Dewey as ". . . a movement outward and forward of the whole organism to which special impulses are auxiliary. " He says of them, "Impulsions are the beginnings of complete experience because they proceed from need; from a hunger and demand that belongs to the organism as a whole and that can be supplied only by instituting definite relations (active relations, interactions) with the environment.

He continues, "The need that is manifest in the urgent impulsions that demand completion through what the environment - and it alone - can supply, is a dynamic acknowledgment of this dependence of the self for wholeness upon its surroundings.

Dewey, like Murphy, carefully distinguishes the ongoing quality of creativity. He says:

"The act of expression that constitutes a work of art is a construction in time, not an instantaneous emission. And this statement signifies a great deal more than that it takes time for the painter to transfer his imaginative conception to canvas and for the sculptor to complete his chipping of marble. It means that the expression of the self in and through a medium, constituting the work of art, is itself a prolonged interaction of something issuing from the self with objective conditions, a process in which both of them acquire a form and order they did not at first possess".

Dewey observes that, Persons who are conventionally set off from artists, "thinkers", scientists, do not operate by conscious wit and will to anything like the extent popularly supposed. They, too, press forward some end dimly and imprecisely prefigured, groping their way as they are lured on by the identity of an aura in which their observations and reflections swim. Only the psychology that has separated things which in reality belong together holds that scientists and philosophers think while poets and painters follow their feelings. In both, and to the same extent in the degree in which they are comparable rank, there is emotionalized thinking, and there are feelings whose substance consists of appreciated meanings of ideas. . . Those who are called artists have for their subject matter the qualities of things of direct experience; "intellectual" inquirers deal with these qualities but are not significant in their immediate presence. . . Thinking directly in terms of colors, tones, images, is a different operation technically from thinking in words.

To sum up, it might be seen that various attributes of creativity as characterized in this proposal rises up out of these thoughts of murphy and Dewey. The capacities of the individual who is creative are depicted by Murphy as affectability to a specific tangible method of experience and as involving full of feeling, scholarly, and engine aptitudes. The inspiration of the creative individual is said by Murphy to be have a great time tactile encounters and their connections and by Dewey to be an impulsion

toward wholeness. The sentiments of the creative individual are portrayed by Murphy as being enjoyment and joy in tactile experience .

The environment helpful for creativity as portrayed by Murphy comprises of one in which endorsement originates from guardians, companions and society as a rule; in which there is open door for contact with different makers; one which offers flexibility of enthusiastic experience and articulation; one in which the maker has a substantial offer in deciding his own particular seals; one in which there is an open door for unconstrained conduct and flexibility to act naturally ; and one in which there is an open door for a variation amongst sociality and separation .

The *creativity process* as portrayed by Murphy comprises of an aggregation of encounters , their mix bringing about brightening or knowledge , and a procedure of cleaning. Dewey's clarification of the *creative process* might be condensed as: (1)the utilization of direct experience ; (2)an educated affair ; (3)a development in time ; (4)a grabbing toward some faintly saw thoughts; (5)view of relations from past unconstrained acts ; (6)subliminal development ; (7)feeling going about as a magnet in the determination and association of material; (8)redesign of experience; (9)development of thoughts into cognizance where gross, unclear, turbid feeling goes up against clear shape ; (10) and the concurrent trans-definition inward and external materials where each request the others .

THEORIES OF UNCONSCIOUS PROCESSES IN CREATIVITY

As stressed in the definition of creativity of Stephen Pepper previously and alluded to directly by Dewey and obliquely by Murphy, the idea of the effortless pouring forth of ideas in high level expression is one of the central ideas of many creativity concepts. It is variously explained by different groups of writers as being of supernatural origin (Plato, Friedrich Nietzsche, and Wolfgang Goethe) or by unconscious processes (Gustav Bychowski (1951), Ernest Kriss (1955), and Anton Ehrenzweig).

Three contemporary psychoanalytic writers, Gustav Bychowski (1951), Ernst Kriss (1955), and Ehrenzweig (1953) offer additional details concerning unconscious processes in creative activity.

Bychowski (1951) assumes that extreme fluidity in the ability to concentrate on objects and to withdraw attention from them accounts for one of the chief differences between artists or creative individuals and other persons. He attributes divergent or multiple identifications to sounds, shapes, colors and odors to the presence of synesthesia in the perceiving and memory processes. The artist, he believes, is no different than others in the process of sublimation except in the scope and intensity of his sublimations. This he does by projecting intense feeling on objects in his environment.

Ehrenzweig (1953) elaborates the concept of the unconscious source of creativity. By distinguishing between surface perception and depth perception, conscious and unconscious processes, he contrasts the appreciative and the creative acts in the art process. He writes, "Creativeness may be an indivisible process in which the artist and the public each contribute their share, What the artist does is as primary process to furnish inarticulate form material from the unconscious, while the public through a secondary process rearticulates material which the artist has made thing-free or gestalt -free, The working processes of traditional artists and of modern artists are contrasted in somewhat similar fashion.

Modern painting, he says, is gestalt-free and the artist creates automatically whereas traditional painting uses partly form control and partly automatic processes. These differences are due to differences between surface and depth perception.

The creative product is portrayed by Dewey as nature changed into new connections and as something which stirs passionate reactions and new view of old implications in the eyewitness.

Theory concept:

Significant ideas from these theories of the unconscious nature of the creative process may be summarized as: the importance of the ability of the creative person to follow his intuition ; to refrain from too much self-criticism ; to be emotionally excited about his subject ; to pursue the poetic, emotional, non-rational, imaginative aspects of living as well as the logical and prosaic; and the importance of seeking new expression rather than merely repeating itself.

BUHLER THEORY "FUNCTION PLEASURE" 1927:

Finds what he calls "**function pleasure**" at the basis of both children's playing and adult creativity. He observes that "function pleasure" arises from joy in activity which involves use of muscles and sense organs and extends all the way from the simple kind found in children's play to the complex type experienced by highly creative persons.

Furthermore Buhler believes "**function pleasure**" serves a useful role in helping to perfect accomplishment and lead to increasingly more complex forms of behavior. This idea sounds very similar to that expressed by Murphy concerning creativity as learned activity growing out of pleasure in pursuit of sensory material pursued until a habit is formed.

Richard Guggenheimer (1951) believes . . great disciplinary effort is required for most productive minds before they reach a stage where they are able to swiftly launch themselves into completely spontaneous absorption in the creative business at hand. For this, great perceptive ability, freedom from inner conflict, intense concentration, and resoluteness of purpose are required.

Otto Rank proposes that the "will to form" motivates creative production. The individual urge to externalization of the personality with the purpose of immortalization of objects in abstract form, he says, is a principle inherent in the creative art form itself. The self -labeling and self -training of an artist furnishes the basis of his productivity.

SOROKIN'S THEORY OF A CLUSTER OF INDISPENSABLE FACTORS FOR CREATIVITY

Pitirim Sorokin (1925) proposed a theory of creativity that various free factors considered independently are deficient to clarify creativity, however that taken together these segments represent an awesome arrangement in the creativity of people and groups.

The factors mentioned by Sorokin are: supersensory and supranational genius, social need, cross -fertilization of cultural streams, cultural freedom, and luck.

Of the first factor, Sorokin says: Supersensory and supranational genius , resulting either from "fortunate heredity, " of which little is known at the moment, or coming from some other, unknown source. Whatever the source, a supranational and supersensory creative genius, different from a mere sensory and rational ability, is an indispensable factor in the discovery of creation of great cultural systems by persons or groups.

Of the second indispensable factor in the cluster of ingredients necessary for creativity Sorokin writes: The social need for a new system, whether scientific, technological, military, religious, ethical, artistic or other [seems indispensable]. Without such a need being felt, a given group or person does not set out to do the requisite creative work. The nature of the urgent need also determines the nature of the great cultural system that is to be discovered or created by the creative members of the group. Mountaineers do not try to discover ingenious means for oceanic navigation. Groups not menaced militarily do not invent ingenious military organization and tactics.

Of the way in which cross -fertilization of cultural streams, his third factor in creativity, operates Sorokin explains: A given original culture enriches itself by using the material of another civilization, especially practical techniques confined to any specific civilization. These neutral elements do not affect the specific individuality of any given civilization and do not threaten to erase or deface its type. Other, non-neutral elements of an alien civilization - such as religious, philosophical, social,

humanistic, ethical, and artistic systems - can also be ingested, but only as fertilizing material that will be patterned according to the type of the borrowing culture. Any original civilization is thus a highly selective organism: it takes only that which fits it and rejects all that does not harmonize with it.

ROGER'S THEORY OF POSITIVE CREATIVITY

Carl Rogers (1953), the author of non-order psychotherapy, in a provisional hypothesis of creativity, recognizes positive or useful, and negative or ruinous, creativity and defines various properties and conditions in charge of the task of these two sorts of creativity.

Consequently, Rogers defines the creative process without social distinctions of "good" and "bad" creativity, group acceptance, or degree of less or more novelty; but insists that the process result in some kind of observable product of a novel character which is due to the individuality of the creator and the materials with which he works.

To sum up, according to Rogers' theory the abilities of the person exhibiting constructive creativeness consist of: "openness " to awareness, an internal locus of evaluation, being able to toy with elements and concepts, and the power of selectivity His motivation comes from a desire for self-realization and self-enhancement. His feelings are those of discovery, aloneness, and the desire to communicate or share his creative endeavor.

The environment conducive to constructive creativity consists of a climate of psychological safety brought about by acceptance of the individual as of unconditional worth, absence of external evaluation , and practice of understanding empathy as well as an atmosphere of psychological freedom due to opportunity for free symbolic expression.

The creative process, according to Rogers' theory, is the same in both constructive and destructive creativity and is impossible to describe.

The creative product, in this theory, has a novel character due to the interaction of the individuality of the creator with the materials or media of expression.

WHITE HEAD'S THEORY OF CREATIVE DURATION

As indicated by Alfred North Whitehead (1953), in creativity what is needed is a valuation for the vast assortment of striking qualities accomplished by a life form in its appropriate condition. When one sees about the sun and about the air and about the revolution of the earth, one may at present miss the brilliance of the dusk. There is not a viable replacement for the immediate impression of the solid reality with a high light tossed on what is applicable to its value.

Whitehead notes that the creative process, in particular, involves two very different kinds of activity. The first is the free and unrestricted flow of thought and fancy, kind of a romance of the imagination in which ideas are born. The second aspect involves disciplining the mind to begin elaborating, developing, consolidating and refining a nascent idea to a mature realization. Thus creativity, the bringing together of diversity in novel unity, the creation of order out of chaos, requires not only unencumbered divergence, but also a disciplined and patient nurturance, ie. , hard work

CHAPTER FIVE

CREATIVITY PROMOTERS AND BARRIERS

Fostering Creativity

With a specific end goal to foster creativity and innovation in formal schooling at that point, activity and contention is required at a few levels associatively .

To finance schools enough and pay educators in excess of a living pay, to lessen working hours and increment expert help, to prepare instructors in a reflexive and recursive way are on the whole essential elements for change .

To adjust educator preparing and optional instruction educational modules archives and syllabuses in manners which leave space and time for play, test and hazard taking which are as yet esteemed in most essential educational module, to esteem and insert developmental evaluations and decenter testing, to grow new and collective undertakings and appraisals – these are largely steps the correct way .

To persuade guardians, prevailing press and an expansive swathe of instructor coaches of the legitimacy of imaginative and creative educating and learning approaches is a more troublesome recommendation. In any case, each fight must start some place, and as our specialists let us know, a significant number of them have been battling on this front for a considerable length of time.

Banaji, Cranmer & Perrotta (2013), mentioned a few of the enablers to innovative teaching and best practices in creative learning; the researchers found that the valuing of teachers and the teaching profession through the payment of incremental and sufficient salaries, a combination of theoretical and practice-based teacher-training, continuing professional development and increased autonomy over their time, over assessment methods and over the curriculum was the most crucial enabler for everyday practices of innovative teaching and creative learning.

In tandem, a skills-based approach to the curriculum rather than an overloading of content was suggested to have worked wonders in a series of cases. Banaji et al(2013) added, over three quarters of our interviewees also made reference to what they termed the significance of a 'a supportive wider culture of creativity', which for them was primarily about empowering teachers by giving them the time and skills to teach autonomously without too much curtailment or testing; but also entails the making of references to creativity much more explicit; and the engaging of both practitioners and the wider public in discussions around this topic via national and local media as well as active consultations.

The Banaji et al (2013) stated that valuing of independence, debate, divergent thinking, irony and eccentricity both amongst teaching staff and students were among suggestions for making such a culture more resilient, while the training and recruitment of school and curriculum leaderships with an interest in and understanding of the time and motivation for creativity and innovation was seen as a top priority.

In cases where both the culture and the leadership are sensitized to the value of innovation and creativity, we encountered some of the very best practices at a national or local level. Amongst these, Banaji and their collogues (2013) demonstrated that, the assessment and rewarding of collective cross-curricular projects taught by several teachers across extended periods of time and presented to parents at regular intervals (Denmark, Scotland); innovative places and spaces of learning such as open-air schools (Estonia); widespread creative competitions in Mathematics and Science involving children from many different age-groups and school districts (Austria, Luxembourg) and the respectful valuing of teacher agency and expertise leading to strong and inspiring relationships with school students (Finland, Sweden) really stood out for us. However, in order to spread and sustain such significant enablers and good practices, both research evidence and political

will is required; and an engagement with the scale and scope of the barriers is crucial.

Barriers to creativity

Researchers have identified several categories that can suppress creativity in the class room that include; (1) convergent teaching practices; (2) teachers' attitudes and beliefs about creativity; (3) the motivational environment; and (4) students' own creativity –related beliefs (Beghetto, 2013).

Banaji et al (2013) stated that Long term and settled in boundaries emerging from political and financial structures – absence of subsidizing, poor pay for educators, functionalist summative testing, instructor or school target administrations, customary transmission strategies for learning, simple employments of computerized advancements and unquestionably – are, be that as it may, some way or another less demanding to consider disassembling and moving past than those which dwell in philosophical or ideological attitudes. Such outlooks are to be found, for example, in the conviction that instructors are just not ready to advance without computerized advances or that imagination is something which is just of worry to a world class minority of to a great degree capable understudies .

They are likewise, obviously, ideologically in charge of maintaining the most noticeably awful practices in the previous rundown of foundational obstructions – strikingly the emphasis on appraisal of understudies as people for unmistakable, un-intuitive, repetition learning or reproducible information based errands.

barriers resemble limitations, which hinder the execution of innovativeness abilities. Innovativeness abilities might be influenced and decreased by different characteristics which incorporate the person's individual identity, condition, circumstance, inspiration, psychological improvement (Wong and Pang, 2003). These limitations/barriers vary in light of the conditions and substance, for example, business, institute, economy, craftsmanship, science, and association (Adam, 1999;

Wong and Pang, 2003). For the time being, and finances, insufficient upward correspondence, deficient descending correspondence, physical condition, insufficient contact with specialized, exercises, hierarchical structure, absence of specialized study, generally safe taking, absence of inventive procedures and preparing, these are altogether distinguished as organizational barriers of creativity (Puccio and Cabra, 2010). Where, Davis (1999) finds other barriers such as, emotional barriers, perceptual barriers.

Furthermore, Adam (1999) discusses, in his book, the barriers of creativity and provides a solution to them. He discussed perceptual barriers, emotional barriers, cultural and environmental barriers, intellectual and expressive barriers, alternate thinking languages. Then he mentioned the kinds of blockbusters for the aforementioned blocks. To him everybody has conceptual barriers, though they are not aware of them, but the level of magnitude and intensity may vary from case to case. Many literatures measure the magnitude of creativity and barrier with small-c and capital-C (Davis, 1999). The following five categories of barriers are identified by Davis (1999): (1) learning and habit, (2) rules and traditions, (3) perceptual barriers, (4) cultural barriers, and (5) emotional barriers-will help distinguish barriers to creativity in different but overlapping categories. Like Adam, (1999) some scholars argue that everyone is creative by birth, but the external agents destroy it.

Hilal et al (2013) suggest that barriers related to task achievement are the most common barriers that hinder students' creative ability. The second most important set of barriers to creativity was found to be related to compliance need, followed by barriers related to abstract ability, environmental circumstances, and self-concept. Then least crucial set of barriers was found to be related to systematic analysis.

CHAPTER SIX

THEORETICAL IMPLICATIONS FOR PRACTICE AT SCHOOLS

Several implications for classroom practice which endeavors to cultivate creativity and creative articulation would appear to take after from these theories.

An instructor might just intentionally set out to figure out which methods of tactile experience claim most firmly to specific understudies and look for techniques for binds visual experience to these different methods of experience. Casual exchange taken after by a demand for a composed articulation may fill in as a strategy for anchoring the required data .

Endeavors to assemble a classroom climate where individual understudies give visit and solid support to each other and contact with inventive laborers from different fields, for example, music, show, writing and move ought to take after as a result of these speculations.

An educator set on cultivating imagination among understudies ought to give an atmosphere of flexibility and rich passionate experience and urge understudies to advance their enthusiastic lives outside the classroom.

The contribution of understudies in strongly close to home objectives takes after as a ramifications of these speculations. This, converted into classroom practice, may mean joint choices by bunches for ventures including a few people and the quest for singular objectives in ventures attempted alone. It doesn't really take after that the instructor remains by inertly with no voice in objective setting, yet suggests rather that his activity is one of fortifying liberally and helping understudies find new connections which prompt the defining of new objectives.

It is clear that in all cases understudies must be urged to set objectives and pick endeavors that have exceptional individual criticalness for them if there is to be that level of individual contribution required for maintained exertion and high creativity .

An open door for nothing and simple social contacts in the classroom with formal and casual trade of thoughts and also times of tranquil and continuous reasoning is proposed by Murphy's perception on the estimation of a shift amongst sociality and seclusion .

Maybe the most critical of these thoughts is that of creativity being a development in time, or the ongoing-ness of the creative process.

The ramifications of this imperative idea is that past achievements be used by the understudy in defining progressively more mind boggling objectives for himself .

The last implications of these theories (Murphy & Deweys' theories)concerns states of mind to be taken toward the craftsmanship item itself. The gathering in checking on its work ought to approach itself for proof of progressing development in articulation and whether the workmanship item under thought brings out enthusiastic responses and new impression of previous truth.

Where, Sorokin's theory for several reasons seems to have significance for an investigation of creativity and an attempt to foster conditions in the classroom conducive to it. Although this theory concerns the role of genius at work in the development of a civilization or culture, the fact that it suggests intuition as lying behind almost all knowing and discovery signifies an implication for the creativeness of all people, not just the genius, Sorokin's linkage of "intuition" and "inspiration" with "extra- sensory perception" and "mysticism" rather than with unconscious processes. Where material learned previously suddenly comes to consciousness as explained by many other writers offers another explanation, different from the "scientific" explanation and more similar to the "supernatural" theories of creativity. The implication here is that students should develop a habit of following their "feelings".

The factors of social need, luck, cross -fertilization of cultural streams, and freedom from censorship and regimentation each in their own way seem to hold significance for procedures which might enhance creativity in the classroom.

The social need factor suggests the urgency of capitalizing on deeply felt student motivation, i.e. attempting to help individual students find projects to be undertaken for which they feel a deeply personal necessity. The factor of cross -fertilization of cultural streams suggests the necessity of stimulating creativity through a wide range of visual materials from both historic and contemporary sources.

Also implied from this concept is the possibility of the legitimacy of one student consciously borrowing and adapting ideas of fellow classmates. The necessity of freedom from censorship and regimentation as voiced by Sorokin supports the argument of a number of other writers to be reviewed later that psychological freedom is a basic ingredient in the nurturing environment for creativity.

The need of the individual to be his own censor is stressed. An implication coming from the factor of luck is taking advantage of the accidental and suggests development of the habit of looking for interesting visual fragments in natural forms and accidental arrangements, noting them through sketch, photograph, or collection of actual objects and keeping them for the day when they may be used.

It would seem that one implication for classroom practice might include methods of guidance whereby ample stimulus material is provided from which the student might be allowed to set his goals for accomplishment and rate of achievement with frequent requests that he re-evaluate his goals and progress. This might more nearly place the locus of evaluation within him and at the same time insure the fact that some evaluation takes place. Perhaps even here the use of techniques for re-fleeting feeling expressed by students might provide the safeguard against over-strain engendered by too-insistent concern for constant student self-evaluation.

The creative person apparently can handle freedom even though and in spite of the fact that it may involve freedom to be afraid. Whether the student with little practice in creativity can handle fear as well as the more experienced person with a greater backlog of success to his credit is highly problematic. It would seem otherwise, that the non-art major in particular should be helped to find as much

success as possible to alleviate fear of beginning. In this case efforts should be made to help him find significant ideas for expression, means of visualizing them, technical information for their execution, leading questions for their evaluation, and ready enthusiasm for their approval. It is doubtful whether reflecting the student's feeling of fear of beginning helps him sufficiently to make the effort and quite possible that presentation of simplified alternatives might be more useful. In any case, refraining from negative criticism and from doing all his thinking for him are important contributions from Rogers' theory for classroom practice in fostering creativity.

Another implication growing out of Rogers' theory comes from his suggestion that one of the necessary pre-requisites for a creative performance is the ability to toy with elements and concepts.

This idea suggests the necessity of providing experiences in the early phases of a student's exposure to creative activities in fluid media so that ideas may be readily captured without the necessity of too much forethought.

The medium itself under the influence of different tools and ways of handling them may suggest ideas of a fairly spontaneous nature in working with the former types of activities which an inexperienced student could not foresee in the latter less fluid materials which require planning ahead.

In similar fashion, the use of cut-out shapes, string, and bits of colored paper from magazine advertisements which may be pushed about then juggled while an idea for a painting is being crystallized furnishes opportunity for refraining from a too-ready tendency to closure on the part of inexperienced students who frequently tend to execute incomplete and poverty-stricken ideas out of inertia, lack of ability to visualize, and fear. Constructions in three-dimensions should likewise probably be attempted in early situations from the assembly of pre-formed shapes such as rectangular and cylindrical boxes, oddly-formed bits of wood, and bent scrap wire rather than from flat sheets, rods, sticks, and unformed wire since partially formed material may be juggled more readily and tends to suggest more ideas and a three-

dimensional structural sense than completely unformed material which requires more complex visualization and planning.

The Whitehead view of creativity as it relates to education has among other names been called integrative education. Integrative education derives its impetus from two basic postulates. The first was discovered through psychological research into the nature of the individuals construction of his view of the world. This research has pointed out the mind tends to display an organizing activity which results in an attempt to make a unified picture out of all of the separate bits of information and experiences encountered. "This organizing activity is displayed rather consistently in the situations the learner encounters, thus giving evidence that he has a mind-set of attitude which causes him to seek to organize material. "

The second postulate may only be a reflection of the mind-set mentioned above, for it is based on the supposition that there are basic unities and commonalities within all knowledge and processes that we are able to experience and understand. Possibly the best example of this basic theme of unity according to Whitehead, is to be found in the sciences. Near the turn of this century as a result of Darwin's thinking much of the plethora of seemingly unrelated detail in the biological sciences was related into a basic unified scheme. This unity has been carried much further with the advent of biochemistry and biophysics. The same general kinds of relationships were also discovered through the work and thinking of Planck (Quantum Mechanics) and Einstein (the Theory of Relativity) in the field of physics. Jung's Archetypes may be viewed as other specific realizations of the universal attributes of man.

Extending the discussion of the universal elements of man toward a view of man unified with the universe we are able to approach Whitehead's suggestion that "there is only one subject matter for education, and that is Life in all its manifestations. Instead of a single unity, we offer children - Algebra, from which nothing follows; Geometry, from which nothing follows; Science, from which nothing follows; History, from which nothing follows; a couple of Languages, never mastered;

and lastly, most dreary of all, Literature, represented by plays of Shakespeare with philosophical notes and short analyses of plot, and character to be in substance committed to memory. The best that can be said of it is that it is a rapid table of contents which a deity might run over in his mind while he was thinking of creating a world, and has not yet determined how to put it together.

It would seem that Whitehead is suggesting that we view Life as a continuum of knowledge and experiences, all the parts of which are parts of a greater whole of unity. Science and the rise of a dependence on deductive reasoning have previously been referred to as the major factors which have succeeded in destroying much that formed the basis of our psychological moorings. To state it more directly we see as seemingly irreconcilable and incompatible the following opposites; science and religion, physics and metaphysics, deductive reasoning and aesthetic experience, rational and irrational thought, objective and subjective reasoning, and a-posteriori and a-priori knowledge.

Some of the above mentioned comparisons are irreconcilable by definition, other opposites are so because of the limits of the definitions, thus much of the conflict can be eliminated through the development of better definitions which will result from a deeper understanding of the knowledge involved. Attempts toward this understanding might indeed seem presumptuous, however, without the attempts nothing can be gained.

Theoretical implications from authors' previous studies

Practical implication from Farrajallah and Al-arjani study (2012a)

Training the teachers of Mathematics on the various strategies of active learning and creative mode for its positive impact of attaining them with the different teaching skills.

Identifying the modern strategies for active learning, and empowering Mathematical teachers with creative process and connecting it with their teaching environment, in order to achieve the impact in their practical life.

Encouraging teachers on creativity in teaching and adopting modern strategies such as active learning and the different techniques it includes (cooperative learning and brain storming, problem solving) and to leave the traditional methods that totally neglects the role of learner in education process and makes him just a receiver for information.

Providing a class environment that contributes in the students' interacting and involving them all in the activities that increases their achievement and develop their skill of critical thinking and creativity.

Focusing upon the organization of the educational environment of Mathematic classes where the learning is being done in an atmosphere of excitement and entertainment, through formulating an effective Mathematical problems that touches the students reality and contributes in improving the students - achievement and their trends towards Mathematics.

Designing Mathematical books according to active learning strategies and the modern learning/teaching Method.

Publishing educational publications in all fields of study to tell them about active learning, the ways of applying it, it's advantageous, and the role of both learner and teacher.

Designing an active learning website, where it presents active learning strategies with detailed explanation for each strategy: what is it about, examples for each strategy, the way of implying the strategy in the different education level.

Practical implications from Farrajallah and Al-arjani study (2012b)

Increase the attention to infrastructure and equipment to create an appropriate conditions for teaching and creative thinking. Hold training courses for mathematics teachers on how to use the computers on the interactive creative learning and computerized programs. Providing incentives provisions for the teachers who use the computerized interactive learning. Providing incentives provisions for the students who participate in the computerized interactive creative learning. High

light the importance of the computerized interactive and creative learning through workshops and study days. Use the computerized interactive and creative learning in various levels at schools. Enabling prospective students who will be a teacher on how to use the computerized interactive learning with more creativity.

CHAPTER SEVEN

SOME RECENT STUDIES ON THE RESEARCH FINDINGS OF CREATIVITY

The literature review in recent times discussed creativity in several fields concerning the magnitude of creativity and critical thinking.

Bloom & Dole (2018) provided a special issue of Global Education Review, dedicated to the theme of creativity, looks at creativity from various angles and lenses that are particularly relevant to education, from the neuroscience on what influences creativity and global views on creativity to specific programs that target the development of creativity. Their Efforts guided toward nurturing creativity in public schools, higher education and teacher education are represented.

Zou & Jin (2018) proposed that the cultivation of children's creativity has always been a hot field in international educational research and teaching practice. The development and cultivation of children's creativity is an important trend and specific educational goal of the national educational reform in the past half century. It can provide an extraordinary opportunity and condition for the development of preschool children's quality and the expression of natural creativity, for the formation of social values and collectivist moral concepts, and for the formation of personality and self-respect characteristic.

In the process of shaping children's creativity during preschool teaching, creative design focuses on activating ideas, enlightening wisdom, early development of young children's brain, training children's creativity, and training children's space and visual perception. Therefore, their knowledge of life is fully mobilized, so that our artistic education connotation further expands its depth and breadth, and we can give children a free imagination space and environment.

Fazaie & Ashayeri (2018) found that teaching music to children helps them to understand various concepts, accurately perceive and feel different problems and

challenges, and create new ideas to solve the problems. Generally, when it is intended to realize creativity in children through teaching music by Orff method, we must attempt to use practicable activities in a proper way that are consistent with the curriculum setting of the schools along with other educational methods and teaching textbooks. This provides an entertaining setting for the kids that not only flourish their creativity but also improve their performance and motivation toward learning

Stolaki & Economide (2018) found that the intervention was overall effective in stimulating creativity. There was a statistically significant increase in fluency, flexibility, elaboration and originality, as measured by divergent thinking tests. Total student creativity calculated with the use of principal component analysis showed a significant positive link to academic achievement and ICT knowledge. Students with almost zero Facebook usage exhibited the highest levels of creativity followed closely by their peers with the highest Facebook usage. Creativity enhancement was not related to Facebook usage or ICT knowledge.

Al Bado, (2017) The study aimed at revealing the relationship between intelligent learning and creative thinking and its tools which are most widely used by the mathematics teachers in the schools of intelligent learning. The researcher applied a test for creative thinking and a measure to identify the most intelligent learning tools to be used. Of the most prominent results of the study is that there is a positive relationship between intelligent learning and creative thinking and that of the most used tools are colored pencils followed by the Internet.

Rabie, (2017): A study that aimed to determine the effectiveness of a program proposed in the teaching of creative thinking to fourth grade students. The researcher applied Turans test for creative thinking, and of the most oustanding results is that that there are significant statistical differences between the pre and post scales of the creative thinking, which indicates the effectiveness of the proposed program.

Al Zayyat, et al. (2017): The study aimed at detecting the relationship between the components of working memory and creative thinking in pre-school children. The main finding of the study is that all components of working memory are related to creative thinking indicators.

Kaware'a (2017) This study was designed to identify the effect of the use of the STEM approach in the development of conceptual understanding and creative thinking in mathematics among the ninth grade students. The researcher used two tools: a test for conceptual understanding and a test for creative thinking, and the results showed that there is a significant statistical difference between the mean scores of the experimental group and their peers in the control group in the conceptual understanding tests and the creative thinking, in favor of the experimental group.

Mohammed (2016) The aimed to detect the effectiveness of a program proposed in the teaching of Geometry for preparatory stage using the fractal geometry in the development of creative thinking among the students of that stage. The researcher applied an achievement test in plain geometry and a test of creative thinking as study tools. The main results of the study indicate that there are significant statistical differences between the experimental and control groups in the achievement test and the test of creative thinking in favor of the experimental group.

Agha (2016): The study aimed at building a program proposed in light of international standards for the development of creative thinking and solving life problems in mathematics for high school Outstanding students. The results of the study show the effectiveness of the proposed program in the development of creative thinking skills (fluency, flexibility, originality, sensitivity to problems) and the skills of solving life problems in Mathematics among 11th graders.

Ashour (2015) This study aimed to build a program that is based on the theory of TRIZ in the development of creative thinking and communication skills among the sixth grade students. The key results of the study indicate that there were significant

statistical differences between the mean scores of the experimental and control group in both test; this difference is in favor of the experimental group.

Mushtaha (2015) A study that aimed at determining the effectiveness of employing the Augmented reality technique in developing the skills of creative thinking and trends towards science among ninth grade students in Gaza. For the study tools, the researcher used the test of creative thinking and the measure of the trend towards science. The results showed significant statistical differences between experimental and control groups in both measures; both differences were in favor of the experimental group.

Siyam (2013) This study aimed to detecting the effectiveness of a program in the light of TRIZ theory of the development of creative thinking on the course of technology for the seventh grade. The results found that there is a significant statistical difference between the experimental and control group in the test of creative thinking skills, in favor of the experimental group.

Bahar & Maker (2011) A study designed to investigate the relationship between creative ability in mathematics and mathematical achievement among Indian students in America. The researchers used a test to assess creative ability in mathematics and a mathematical achievement test as study tools. The results of the study showed a correlation between mathematical achievement and mathematical creativity.

To sum up, there is a global attitudes towards creative thinking development and training. The importance of creativity shed light on developmental and educational processes where it is complementary for educators. Where, the studies stressed the importance of creative thinking skills including but not limited to; fluency, flexibility, originality, sensitivity to problems.

CHAPTER EIGHT

Evidence from Experimental study

An experimental study conducted to examine the Impact of Employing the 'Six Thinking Hats' Strategy on the Development of Creative Thinking Skills and Trends Towards Mathematics Among Sixth Grade High-Achieving Students in Mathematics

In light of the interest in the teaching of thinking and the development of skills of high achievers, it is necessary for the teacher to use modern methods and strategies that develop creative thinking, including the strategy of the six thinking hats proposed by De Bono, which is a strategy that includes six types of thinking for the individual assigned with different colors, of which each color symbolizes a different type of thinking. The strategy of the six hats aims to simplify thinking and increase its effectiveness, allowing the learner to move from one mode of thinking to another (Nofal, 2009: 202).

The Six Thinking Strategy is one of the most significant educational strategies in the field for improving and teaching thinking and developing its various skills, making the teachers and learners more active and effective, by which de Bono concluded that:

- The Western society's way of thinking is limited to technical quality only which is based on debates, by which each individual attempts to predominate the other, which makes each idea faced by an opposite one.
- When the individual thinks, they normally employ all different types of thinking at the same time, which leads to confusion, misunderstanding and lack of concern and rationality, and results in subjective conclusions.

For this, De Bono designed the Six Thinking Hats strategy to help individuals think rationally and realistically, making them more productive (Kharrazah, 2016: 579).

The Six Thinking Hats strategy aims to enable students to use at the same time one pattern of thinking by linking the color of each hat with a way that matches the nature and quality of its thinking:

The white hat is a symbol of neutrality, representing neutral thinking; the red hat is a symbol of expression of emotions and feelings; the black one symbolizes negativity of things; the yellow one is a symbol of optimism and constructive thinking and brightness; while, the green hat symbolizes creativity and generation of new ideas; and finally the blue one represents organization of thinking and reaching learning outcomes. (Habib, 2013: 181).

All of the above emphasize the need to utilize the Six Thinking Hats strategy in developing the skills of creative thinking and trends towards mathematics among sixth grade students who are high achievers in mathematics, as the strategy enables the presentation of the educational material in an exciting educational and scientific way, which attracts students towards creative thinking and raises their motivation towards learning.

The researcher sensed the problem of this study and the need for addressing it based on the following:

- The importance of developing the skills of creative thinking and trends towards mathematics, and the right of every student, especially high-achieving students, to have the opportunity to develop their creativity skills to the maximum of their abilities.
- The need to respond to some of the previous studies that recommended the development of creative thinking in mathematics, such as the studies of Rabie (2017), Ashour (2015), Mushtaha (2015), and Siam (2013).

In light of the foregoing, there is an urgent need to carry out such a study, which aims to answer the following main question:

What is the impact of the employment of De Bono's 'Six Thinking Hats' Strategy on the development of creative thinking skills and trends towards mathematics among sixth grade high achieving students in mathematics?

To answer this question, the following sub-questions have to be answered:

1. What creative thinking skills should be developed among sixth grade students who are high achievers in mathematics?
2. What is the impact of the employment of the 'Six Thinking Hats' strategy on the development of creative thinking among sixth grade students who are high achievers in mathematics?
3. What is the impact of the employment of the 'Six Thinking Hats' strategy on the development of trends towards mathematics among sixth grade students who are high achievers in mathematics?

Study Hypotheses:

The study aims to verify the validity of the following hypothesis:

1. There are no significant statistical differences ($\alpha \leq 0.05$) between the mean scores of the high-achieving students in the pre-and-post tests of creative thinking skills.

2. There are no significant statistical differences ($\alpha \leq 0.05$) between the mean scores of the high-achieving students in the pre and post scale of trends towards mathematics.

Significance of the study

The study is expected to contribute to the following:

1- This study may be useful for mathematics teachers in helping them develop teaching and evaluation methods and in presenting educational activities of mathematical lessons in new ways.

2- It may be useful for mathematics supervisors in training new teachers on using the 'Six Thinking Hats' strategy in teaching.

3- This study provides some tools which can benefit researchers in the preparation of similar studies, such as the test of creative thinking and the scale of trends towards mathematics.
4- The results of this study benefits the specialists responsible for preparing the Palestinian curriculum in the presentation and organization of concepts, skills and geometric generalizations for fourth grade students, in a way that develops their thinking and geometric achievement.
5- The current study may open new avenues for researchers to conduct future studies in the use of the 'Six Thinking Hats' strategy in the educational process, at different stages of teaching and in various educational courses.

Limitations of the study:

This study is limited to the following:

- **Objective limit**: The study was limited to determining the impact of employing the 'Six Thinking Hats' strategy on the development of creative thinking skills and trends towards mathematics among sixth grade students who are high achievers in mathematics
- **Institutional Limit:** Schools of the Ministry of Education in Gaza.
- **Spatial limit**: Sabha Al Harazeen Boys Primary School.
- **Human limit:** A purposive sample of sixth graders who are high achievers in mathematics.
- **Time limit:** First semester of the academic year 2017-2018.

Operational definitions of the study:

- **Six Thinking Hats Strategy:** A set of procedural steps in light of De Bono's theory, in which the teacher follows on the development of creative thinking skills and trend towards mathematics among sixth grade students; these colors

include the white color (information and facts), red (emotions and feelings), black (negative aspects), yellow (positive aspects), blue (assessing things and prioritizing), green (new ideas).

- **High Achieving Students:** Sixth grade students in Gaza Governorate who have obtained 90%+ in mathematics and possess high cognitive skills and abilities in mathematics.
- **Creative Thinking:** A mental process that aims to solve a mathematical problem to reach authentic results based on fluency, flexibility and originality and is measured by the scores of students in the creative thinking test.
    - **Fluency:** The student's ability to generate the greatest number of correct solutions for the mathematical problem, measured by the scores obtained by students on the measure of fluency in the test of creative thinking.
    - **Flexibility**: The student's ability to generate a number of ideas to solve the mathematical issue, measured by the grades obtained by students on the measure of flexibility in the test of creative thinking.
    - **Originality:** The student's ability to solve the mathematical problem is a non-repetitive solution, measured by the degree to which the students are able to measure the skill of originality/uniqueness in the test of creative thinking.
- **The Trend towards Mathematics:** An acquired psychological state that results due to the experiences undertaken by the learner when employing the 'Six Thinking Hats' strategy, and is measured by the degree to which the learner responds to the phrases in the scales of the trend towards mathematics.

Methodology

The researcher of this study used the quasi-experimental approach, using the design of a single group with a pre-post measurement. The population of the study consisted of high achieving sixth grade students in mathematics for the academic

year (2016- 2017). As for the sample of the study, Sabha Al Harazeen Primary Boys School was selected in a targeted way, due to the existence of a cooperative and motivating educational faculty. The sample was also chosen in a targeted way to include (33) students, as follows:

- Selection of high achieving students with a general average (90% or higher) in the first semester of the academic year 2017/2018, during which this research study was conducted.
- Among the high achieving students selected, only those who were of the age of 10-years-or-less were chosen.
- From the students who met the previous criteria, only those who had not failed in any of the previous years were selected.
- Finally, from the students who passed all the above criteria, only those who fell within the highest quartile among their colleagues were chosen.

With respect to the research instruments used to achieve the objective of the study, the researcher used a test for creative thinking skills and a scale for students' trends towards mathematics, as explained below:

1. **Test of Creative Thinking Skills:** It was prepared based on the following steps:
   a. ***Determining the test purpose***: This test was designed to measure the impact of the employment of the 'Six Thinking Hats') strategy on the development of creative thinking skills among sixth grade students who are high achievers in mathematics.
   b. ***Determining the creative thinking skills***: The researcher reviewed the literature on the issue of creative thinking skills, such as the studies of Al Bado (2017, Rabie (2017), Al Zayyat et. al (2017), Kaware'a (2017) and Mohammed (2016). He also analyzed the content of the second unit entitled "Geometry and Measurement" of the sixth grade mathematics book. Furthermore, the

researcher surveyed the opinions of a sample of specialists in education through personal interviews (Delphi method), where he proposed a list of creative thinking skills needed for sixth grade students, consisting of the (3) main skills: fluency, flexibility, and originality.

c. ***The initial form of the test:*** The initial form of the test consisted of (18) essay questions.

d. ***Test Scoring:*** test was scored after the sample answered its questions, in which the scores were determined as follows:

1. **Fluency:** A score is given for each correct answer after deleting duplicate answers.
2. **Flexibility:** A degree is given to each entrance or idea of a solution with the elimination of duplicate ideas.
3. **Originality:** The researchers adopted the criterion (Khair Allah, 1981: 13) to estimate the degree of originality as shown in the following table:

Frequency of the idea	1-9%	10%	20%	30%	40%	50%	60%	70%	80%	90%
Score	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	1

Table (1) illustrates the distribution of test scores:

Paragraph	Creative Thinking Skills			Total
	Fluency	**Flexibility**	**Originality**	
1	3	3	30	**36**
2	4	4	40	**48**
3	-	2	-	**2**
4	4	4	40	**48**
5	3	3	30	**36**
6	2	2	20	**24**
7	2	2	20	**24**

8	3	3	30	**36**
9	3	3	30	**36**
10	-	1	10	**11**
11	-	2	20	**22**
12	2	2	20	**24**
13	3	3	30	**36**
14	-	2	-	**2**
15	6	6	60	**72**
16	4	-	-	**4**
17	5	-	-	**5**
18	4	-	-	**4**
Total	48	42	380	**470**

Thus, the score obtained by the student is limited to (0 and 470).

e. ***Exploratory experimentation of the test***: After the preparation of the initial test, it was applied on an exploratory sample of (30) sixth-grade students outside the study sample, for the purpose of calculating the difficulty and discrimination indexes of the test paragraphs, testing the validity and reliability of the test, and determining how long it takes to answer the test when applied to the study's actual sample.

f. ***Analysis of the paragraphs of the test:*** The results of students' answers on the creative thinking skills test were analyzed in order to identify the degree of difficulty and discrimination index for each paragraph of the test, where the researcher found that the difficulty index for each paragraph ranged from (0.43-0.77), which indicated graduated levels of difficulty. In addition to that, the discrimination index ranged from (0.38- 0.75) to distinguish between the responses of the upper and lower categories, where metrology accepts a discrimination index when it reaches more than (0.20) (Kilani et al., 448: 2008). Based on the above, the researcher kept all of the test paragraphs.

g. ***Validity of the test of creative thinking skills:*** The validity of the test was tested through presenting it to a group of (10) specialized university teachers and (8) educational supervisors, to be guided by their views on the appropriateness of the paragraphs of the test for sixth graders and to confirm the scientific and linguistic appropriateness of the vocabulary used in it. As a result, suggested modifications were taken into consideration. In addition, the internal consistency of the test was ascertained using Pearson correlation between the scores of each paragraph of the test and the total score, in which the researcher found that all values of Pearson correlation were statistically significant at significance level ($\alpha = 0.01$), which indicated that the test is strongly valid.

h. ***Reliability of the test of creative thinking skills:*** To test the reliability of the test of creative thinking skills, the researcher used Kuder–Richardson Formula 21 and found that the reliability coefficient is (0.847), which is a highly reliable and statistically significant coefficient.

i. ***Determining the test duration:*** The time needed to answer the test of the creative thinking skills was determined by calculating the mean time it takes for the first and last student to finish the test; it was found to be (70 minutes).

j. ***The final form of the test of creative thinking skills*****:** Based on the results of the arbitration and exploratory experimentation of the test and doing the necessary modifications, the number of test paragraphs after adjustment was (18) essay questions, ready to be applied in its final form.

2. Scale for Students' Trends towards Mathematics

The researchers prepared a scale for the trends towards mathematics in order to be used to identify the attitudes of sixth grade students, who are high achievers in mathematics, towards mathematics, before and after the implementation of the 'Six Thinking Hats' strategy. The scale, in its final form, included 40 paragraphs that

measure three dimensions, which are: the trends towards the appreciation of the importance and value of mathematics (12), enjoying the learning of mathematics (14), and interest in mathematics (14). The scale was prepared based on the following steps:

a. ***Determine the scale purpose***: This scale was designed to measure trends towards mathematics among sixth grade students before and after the application of the 'Six Thinking Hats' strategy.
b. ***Determining the areas of the scale***: The areas of the scale were three: appreciation of the importance and value of mathematics, enjoyment of mathematics learning, interest in mathematics.
c. ***Phrasing the scale's paragraphs***: The phrases of the scale were formulated in a procedural form, by which the number of phrases in its initial form was (45) phrases divided into four fields.
d. ***The scaling and correction of the scale:*** Student responses were formulated according to the Quintet Likert scale (strongly agree "five points", Agree "four points", neutral "three points", Disagree "two points", and strongly disagree and has "one point") for positive phrases, and vice versa for negative phrases
e. ***The validity of the Scale:*** the validity of the instrument was tested through:
    - ***Validity of the arbitrators:*** The scale was presented to a group of arbitrators from specialists in education, curriculum and teaching methods in the Palestinian universities, to be guided by their views on the appropriateness of the paragraphs of the scale, as well as to ensure the validity and clarity of its language.
    - ***Internal consistency***: Internal consistency was ascertained using Pearson correlation between the scores of each area of the scale and the total score, and also by applying the instrument on an exploratory sample of

(30) students outside the study sample, and were as follows (0.854, 0.884, 0.773) respectively, which indicated that the scale is strongly valid.

f. ***The reliability of the scale:*** The reliability of the scale was calculated using Cronbach's alpha coefficient to measure the reliability of each area and the phrases of the scale as a whole. The reliability coefficients were as follows (0.901, 0.907, 0.845, 0.936), which indicated that the scale has a high degree of consistency of its vocabulary.

Analysis and Discussion of Results

The Statistical Package for Social Sciences (SPSS) was used to perform the required analysis, in which the (T-test) for two independent samples was used to study the differences between the variables of the study, in addition to calculating the size of the impact of the employment of 'Six Thinking Hats' strategy through calculating ETA square ($\eta 2$).

Based on the study questions and hypotheses, the following results were obtained:

- **Results of the first question:**

  What creative thinking skills should be developed among sixth grade high achieving students in mathematics?

  To answer this question, the researchers prepared a list of creative thinking skills by reviewing the research literature and by analyzing the content of the second unit of the sixth grade math book entitled "Geometry and Measurement", in addition to a sample survey of opinions of specialists in education. In light of this, the list of creative thinking skills necessary for sixth grade students, consisted of the following (3) skills:

  - Fluency: The student's ability to generate the greatest number of correct solutions for the mathematical problem, measured by the scores obtained by students on the measure of fluency in the test of creative thinking.

- Flexibility: The student's ability to generate a number of ideas to solve the mathematical issue, measured by the grades obtained by students on the measure of flexibility in the test of creative thinking.
- Originality: The student's ability to solve the mathematical problem is a non-repetitive solution, measured by the degree to which the students are able to measure the skill of originality in the test of creative thinking.

➢ **Results of the second question:**

What is the impact of the employment of the 'Six Thinking Hats' strategy on the development of creative thinking among sixth grade high achieving students in mathematics?

To answer this question, the first hypothesis of the study was formulated, stating that there are no significant statistical differences ($\alpha \leq 0.05$) between the mean scores of the Outstanding students in the pre and posttests of creative thinking skills. To test this hypothesis, T-test was used for two independent samples; the results were as illustrated in Table (2).

Table (2) shows the results of T-test to compare the mean scores of high achieving students in the pre and post tests of creative thinking skills

Variable	Experimental Group	Number	Mean	Std. deviation	Calculated T-Value	Sig	p-value
Fluency	Pre	33	8.79	3.95	-27.06	0.00	Statistically insignificant
	Post	33	30.85	6.42			
Flexibility	Pre	33	6.97	3.26	-25.74	0.00	Statistically insignificant
	Post	33	29.67	6.51			
Originality	Pre	33	25.94	12.83	-23.11	0.00	Statistically insignificant
	Post	33	263.33	63.68			
Overall Test	Pre	33	41.70	19.32	-24.32	0.00	Statistically insignificant
	Post	33	323.85	75.51			

Limits of statistical significance begin at the level ($\alpha = 0.05$), d.f. (32) when the tabulated T-value is (2.00)
Limits of statistical significance begin at the level ($\alpha = 0.01$), d.f. (32) when the tabulated T-value is (2.66)

It is clear from the above table that the calculated T-value equals to (27.06, 25.74, 23.11, 24.32), respectively which is greater than the tabulated T-value (2.66), at the degree of freedom (32) and the level of statistical significance (α = 0.01). This indicates the existence of significant statistical differences between the mean scores of the high achieving students in the pre and post tests of creative thinking skills; these differences are in favor of the post test. This result is consistent with several previous studies, such as the study of Rabie (2017), Kaware'a (2017), and Agha (2016).

Regarding the size of the impact of the employment of the 'Six Thinking Hats' strategy on the development of creative thinking skills among sixth graders, ETA square (η2) was calculated to make sure that the size of the T-test resulting differences are real differences caused due to the study variables, and are not coincidental. The following table illustrates this :

Table (3) shows the size of the impact of the t-test of the differences between the scores of high achieving students in the pre and post tests of creative thinking skills

Variable	Calculated T-Value	Value of ETA square (η2)	d value	Size of impact
Fluency	-27.06	0.958	4.784	Large
Flexibility	-25.74	0.954	4.550	Large
Originality	-23.11	0.943	4.085	Large
Overall Test	-24.32	0.949	4.299	Large

It is clear from the above table that the value of ETA square equals to (0.958, 0.954, 0.943, 0.949) respectively, which indicates a large impact, since Afaneh (2000: 42) indicates that the size of impact is considered large if the value of ETA square is greater than or equal to (0.14), as is the size of the impact is considered supplementary to the statistical significance, and does not replace it. The success of

'Six Thinking Hats' strategy to improve the creative thinking skills among primary sixth-graders may be due to the following reasons:

- Employing the 'Six Thinking Hats' strategy stimulates competition among students, effectively contributing to their motivation, raising their level of ambition and their continuing desire to accomplish other activities; which has had a significant impact on their increased acquisition of creative thinking skills.
- The adoption of the 'Six Thinking Hats' strategy in student activities, makes the student the focus of the educational process, and thus eliminates the boredom of students during the educational situation, which motivates the students to be participative, effective and thoughtful.
- Using this strategy has helped to diversify activities and questions that develop creative thinking skills.
- This strategy gave a prominent role for the learners in class participation by wearing the six hats, which deepened their ideas and gave them opportunities for creativity and practicing different and varied ways of answering.
- This strategy was based on the motivation of students to research and inquire, which led to the stimulation of their ideas and to the generation of a large number of questions, and this developed their ability to think of solutions in all directions, and solve the problems they face in more than one way.
- Employing the 'Six Thinking Hats' Strategy made the learners free from the routine of the teaching process, and gave them a new learning experience.

➢ **Results of the third question:**

What is the impact of the employment of the 'Six Thinking Hats' strategy on the development of trends towards mathematics among Sixth Grade students highly achieving in mathematics?

To answer this question, the second hypothesis of the study was formulated, stating that there are no significant statistical differences ($\alpha \leq 0.05$) between the mean scores of the high achieving students in the pre and post scale of trends

towards mathematics. To test this hypothesis, T-test was used for two independent samples; the results were as illustrated in Table (4).

Table (4) shows the results of T-test to compare the mean scores of highly achieving students in the pre and post scale of trends towards mathematics

Variable	Experimental Group	Number	Mean	Std. deviation	Calculated T-Value	Sig	p-value
Appreciation of the importance and value of mathematics	Pre	33	2.20	0.59	-21.36	0.00	Statistically insignificant
	Post	33	4.65	0.30			
enjoying the learning of mathematics	Pre	33	2.08	0.65	-20.93	0.00	Statistically insignificant
	Post	33	4.69	0.29			
interest in mathematics	Pre	33	2.02	0.63	-20.72	0.00	Statistically insignificant
	Post	33	4.60	0.35			
Overall Questionnaire	Pre	33	2.10	0.60	-22.00	0.00	Statistically insignificant
	Post	33	4.64	0.29			

Limits of statistical significance begin at the level (α = 0.05), d.f. (32) when the tabulated T-value is (2.00)
Limits of statistical significance begin at the level (α = 0.01), d.f. (32) when the tabulated T-value is (2.66)

It is clear from the above table that the calculated T-value equals to (21.36, 20.93, 20.72, 22.00) respectively, which is greater than the tabulated T-value (2.66), at the degree of freedom (32) and the level of statistical significance (α = 0.01). This indicates the existence of significant statistical differences between the mean scores of the highly achieving students in the pre and post scale of trends towards mathematics; these differences were in favor of the post scale.

Regarding the size of the impact of the employment of the 'Six Thinking Hats' Strategy on the development of trends towards mathematics among sixth graders, ETA square ($\eta 2$) was calculated to make sure that the size of the T-test resulting

differences are real differences caused by the study variables, and are not coincidental. The following table illustrates this :

Table (5) shows the size of the impact of the t-test of the differences between the scores of highly achieving students in the pre and post scale of trends towards mathematics

Variable	Calculated T-Value	Value of ETA square (η2)	d value	Size of impact
Appreciation of the importance and value of mathematics	21.36	0.894	2.907	Large
enjoying the learning of mathematics	20.93	0.890	2.848	Large
interest in mathematics	20.72	0.888	2.820	Large
Overall Questionnaire	22.00	0.900	2.994	Large

It is clear from the above table that the value of ETA square equals to (0.894, 0.890, 0.888, 0.900) respectively, which indicates a large impact, since Afaneh (2000: 42) indicates that the size of impact is considered large if the value of ETA square is greater than or equal to (0.14), as is the size of the impact is considered supplementary to the statistical significance, and does not replace it. The success of the 'Six Thinking Hats' strategy to improve the trends towards mathematics among primary sixth-graders may be due to the following reasons:

- The presentation adopted by the 'Six Thinking Hats' strategy, which included the use of sensory examples that are close to the students, lively activities, exciting equations, and constant movement, provided an opportunity to stimulate students' motivation to participate and to extract their potential, which led to the correlation of more students with mathematics.
- Increased students' participation had a positive impact on their trends towards learning mathematics.
- The 'Six Thinking Hats' strategy made students love mathematics by engaging them in the presentation of lessons.

- The 'Six Thinking Hats' strategy took into account individual differences among students, by giving them the opportunity to wear the different hats.
- The strategy increased the motivation of students toward learning and achievement through competition among students on wearing the hats.
- Interaction between students during the lessons makes students more friendly with their peers and more interested in the presented lessons.
- Setting a mutual goal, as per the 'Six Thinking Hats' strategy, by making students bear the responsibility for their learning, helped create positive trends towards mathematics and its subjects.

Study Recommendations:

In light of the research study's findings, the following recommendations can be made:

1. Those responsible for the development of mathematics curricula at the elementary level/ primary stage need to focus on preparing activities and exercises that enable students to exercise creative thinking skills, and not just be limited to activities and exercises that focus on memorization of mathematical information and knowledge.
2. There is a need to train mathematics in-service teachers, through courses, workshops, and other teaching methods, on the use of modern teaching strategies such as the 'Six Thinking Hats' Strategy, as to positively develop learners' creative thinking skills and trends towards mathematics.
3. There is a need to include in the teaching of mathematics topics in which the 'Six Thinking Hats' strategy can be incorporated, as well as other different strategies that help students develop creative thinking skills and positive trends towards mathematics.
4. There is a need for the teacher's math guidebook prepared by the Ministry of Education, to include models of how to present some lessons using the 'Six

Thinking Hats' strategy for the development of creative thinking skills and trends towards mathematics.

5. Classes for developing the creativity and innovative skills of high achieving students need to be held.
6. Conducting similar studies at various educational stages, and testing the impact of the 'Six Thinking Hats' strategy on different learning outcomes, is necessary.

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