People's Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research

University Mohamed Kheider of Biskra

Faculty of Letters and Languages

Department of Foreign Languages

Field of English

Enhancing Tertiary Students' Creative Thinking Through Educational Puzzles

The Case of Third Year LMD Students at Biskra University

A Dissertation Submitted to the Department of Foreign Languages in Partial Fulfillment of the Requirements for the Master's Degree in Sciences of the Language

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JUNE 2016

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June 2016

Dedication

I DEDICATE THIS WORK:

In the memory of my family bodies shield and souls shelter,

To the candle that burned to illuminate our paths,

To our warm home,

To my father.

In the memory of my grandmother, and my friend.

Those I lost and shall never forget.

To my precious mother.

To my brothers and sisters.

To my loyal companion and future wife.

And to all my friends.

Acknowledgments

All praise to Allah, the Almighty, for the blessing and mercy leading me to finish this research work.

I would love to express my sincere thanks and gratitude to **my father**, for his time, efforts, and patience. Thank you so much. May Allah hold your soul in his mercy and grant you with his paradise.

To whom I will eternally be thankful and beholden, **my mother**, for all her patience, devotion, encouragement and prayers. May Allah bless you.

All thanks to my big brother **Mohyeddine**, my little **Mohamad**, and my sisters **Lamia, Monira, Ilham, and Manar**, for always being supportive. Thank you guys.

I am deeply grateful to my teacher and supervisor **Mr. Bechar Maàmar** for all the support and patience. Thank you.

I also would like to thank **Dr Segueni Lamri**, and **Mr. El-Hamel Lamdjad**, as teachers, and their willingness to help.

My gratitude also goes to **Mrs Hassina Nachoua** for her support and patience.

Special thanks go to my incredibly wonderful friends **Rehim Meriem, Ms. Haddad Mimouna, Nadia Bensaleh** for their prayers, love, and support. I am blessed to have you in my life. **Douida Brahim and Bechar Ahmed Amin**, along with all my friends and classmates for their kindness, help, and those unforgettable moments we had together, I wish all the best.

Abstract

The purpose of this study is to enhance EFL students' creative thinking through the use of educational puzzles. Creative thinking is a highly importance thinking skill that requires risk taking, imagination, approaching problems differently, and generating multiple ideas. We hypothesised thatvia the use of educational puzzles, as instructional tool, will improve students' creative thinking skills. To achieve the objectives of the study, a descriptive qualitative method was followed. It aims at describing two variables: educational puzzles as the independent variable and creative thinking skills as the dependent variable. Our main research instruments to collect data were classroom observation and classroom discussion, on the students. The sample of the research is 29 third year LMD students, at the department of foreign languages, field of English, University of Biskra. After analyzing the obtained data of the present research, it revealed that educational puzzles represent an effective, practical teaching technique. It can positively affect and develop students' creative thinking skills. In fact, students showed positive attitudes towards applying them. Finally, on the basis of our findings, some recommendations and pedagogical implications are suggested and we hope that they may be of help to teachers in employing educational puzzles in the classroom.

Keywords: creativity, creative thinking, educational puzzles, fun, effective, assessment, tertiary students, education.

List of Abbreviations

EFL: English as a Foreign Language

TTCT: Torrance Test of Creative Thinking

PLA: Puzzle-based Learning Approach

APA: American Psychology Association

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General Introduction

General Introduction

Introduction

The world we are living in has come to a complete new era of evolution. The era of the twenty-first century where the balance of power is built upon holding voluminous data and information, where science and technology decide the faith of cultures and nations to be great leaders or obedient followers. The time that demands more than the usual understandings and abilities groups or individuals have. This reality has added a weight on people's shoulders and put them through new thinking trials as requiring specific skills and policies.

The need for meeting those challenges, the twenty-first century's nature has added, shifts the interest of knowledge, which has been imparted to tertiary students as they set their first steps into the groves of Academe, from the common related plethora of information to higher order thinking skills. The latter term is elucidated by the systematic ways of thinking and reasoning that enable students to absorb new ideas, examine and interpret information, apply knowledge and solve unconventional problems (Rozakis, 1998). Scholars and researchers have been enriching the knowledge archive with massive amounts of data, collected through researches and studies, about the different types of higher order thinking skills.

A noteworthy higher order thinking skill is creative thinking, which resembles the divergent way of thinking when solving problems or dealing with new situations with new unstructured strategies. It has arrested a universal attention, many studies of scientists, curricula designers and scholars in different fields highlighted its importance as a learning and performing skill that pervades all the aspects of life. They also proposed and developed approaches and tools for fostering it.

One suggested tool that responds the creativity enhancement request, and believed to be effective in many dimensions, is the use of puzzles. Puzzles are problem-like games that

demand specific knowledge, problem solving and thinking skills. Educational puzzles, or puzzles that are used for educational purposes, trigger and support problem-solving skills and creative thinking. A review through the nature of both items, creative thinking and the demands of educational puzzles, can detect a common ground between them. This synchronization of grounding highlights a probable utility of educational puzzles in enhancing the creative thinking skills.

Statement of the Problem

The creative mind is the soul of a nation and tertiary students are its hope. When young minds are honed to think creatively, new possibilities arise in the horizon widening the scope of research and progression. However, the observer of the current situation in the system of higher education in Algeria can easily diagnose the lack of creative thinking among students through the lack of diversity in ideas whether be it in writing or in speaking, the repetition of the same old topics in presentations and also the discussion of matters which are often mundane, tedious and uninspiring. These traits do not certainly belong to any educational faculty that is based on the acquisition and use of higher order thinking skills. Moreover, creative thinking skills are increasing in demand for job applications all over the world. Hence, the case of our students is becoming more of a crisis since they will be the administrators and educators of the coming generations.

Significance of the Study

This study is anticipated to be of great importance to syllabus designers, researchers, teachers and students. As for syllabus designers, it addresses basic issues such as the purpose of higher education and its role in the nation's progress academically and socially. Such issues emerge from the teachers' unceasing expectations from tertiary students that are often unsatisfied. Thus, increasing the need for implementing teaching creative thinking skills at the Algerian schools and universities. As for researchers, it adds to the previous findings concerning the Puzzle-based Approach and its pedagogical implications in the case of EFL

students. As for teachers, it draws their focus on how to present adult learners with such skills in the scope of learner-based approach while facing challenges like time shortage and lack of materials. Finally, students become familiar with an educational tool that can be used with or without the teacher's guidance, hence; allowing autonomous learning.

Aims of the Study

The aims throughout this investigation are:

- Introduce creative thinking to the English language learning community.
- Determine the utility of educational puzzles as pedagogical support for teaching creative thinking.

Research Questions

This investigation attempted to address the following questions:

- Does the use of educational puzzles help in fostering students' creative thinking?
- What are the underlying advantages of using puzzles purposefully in EFL classrooms?

Research Hypotheses

The main hypotheses underlying this research were the following:

- If teachers use educational puzzles as part of classroom activities, tertiary students' creative thinking skills are to develop.

Research Methodology

To answer the research questions and to test the two hypotheses it proposed, the qualitative approach was followed. The researcher conducted an intervention on 3rd year students of English at Mohammed Kheider University of Biskra. The intervention consisted of puzzles solving sessions through worksheets, as well as classroom observation and classroom discussion in order to test and guide students' creative thinking skills development. The study is descriptive-interpretive in method. As on the descriptive level, the attempt was to describe students' creative thinking skills development through solving the puzzles and

participating in the classroom discussions. At the interpretive level, the attempts were to understand the ways in which students' thinking have changed, analyze their attitudes towards puzzles and examine how their creative thinking skills were shifting.

Research Tools

In order to have significant results, the researcher opted for a twice in a week puzzle intervention for seven sessions. The main data collection instruments were educational puzzles worksheets consisting of four to five different puzzles targeting the major elements of creative thinking. Also, a check-list on students' behavior and attitudes was taken as a part of classroom observation. A classroom discussion was provoked at each session in both while-solving and post-solving phases.

Population and Sampling

The population of the Branch of English Studies at License level at Mohammed Kheider University of Biskra is estimated at 1500 students. Third year students represent 24.3% (365students) of the population. This study; however, targeted only one group, group 1 of third year English LMD students consisting of 29 students. The group was chosen conveniently as their teacher of 'written expression' module gave the researcher the permission to use most of the instructional time to perform the intervention. This sample represents 8.49 % of the third year population.

Limitations of the Study

The limitations of this research were mainly limitations of time for both the researcher and the students. The intervention took place for seven sessions only which did not allow for more puzzle-based learning. The presence rate also varied from one session to another due to personal issues. As well, many students were urged to leave 10 minutes earlier than the end of the session on Wednesdays because they had to catch their buses. Moreover, the return rate of

worksheets was less than expected in some sessions. Finally, as the researcher paid for all expenses, the research only targeted a representative sample.

Organization of the Dissertation

This dissertation is divided into three main parts. The first part is devoted to present an introduction of the study, statement of the problem and aims of the study, in addition to the main hypothesis, research questions and research methodology.

Moreover, the second part is the theoretical that consists of two chapters. The first chapter presents: conceptualization and definition of creative thinking, historical overview, roadblocks, assessment, and its relevance to education and EF Learning. While the second chapter deals with educational puzzles nature, importance, criteria, the Puzzle-based Learning, and educational puzzles examples.

Finally, the third part is the third chapter which represents the field work. It includes research description, data collection, data analysis and findings of the research intervention. At the end of this chapter we suggest some pedagogical recommendations for using the suggested approach more effectively in EFL English classrooms.

Chapter One

Creative Thinking Nature

Creative Thinking Nature

Introduction

In the realm of ideas, countable theories and interpretations have made their way up to be considered spectacular and outstanding. This acknowledgement is coined by the specific nature of those thoughts; as being rare, original, unusual, and imaginative, comparing to other existing models of thinking. Those thoughts could be transformed to make uncommon products, or applied common interesting fields, seeking better results. The term used to label this infrequent thinking is creativity.

The discussion of creativity has been an opened arena, for different and contradictory researchers' opinions and estimations. Scholars and researchers have tackled various aspects of creativity or creative thinking; such as its nature, measurement, and teaching and learning it. The subject of creativity is an ongoing debate, which inflamed the most in the recent few years because of the changing in thoughts the world is witnessing.

Definition of Creativity-Related Terms

In order to reach a closer look on the nature of beast (creativity), a need of defining the set of related terms is raised. Those terms are usually presented when defining creative thinking notion, process, and aspects. They are generally used in the creativity field to refer to certain levels of elements and components. The terms, that will be mentioned, are not the all that is in the field, but the most prominent ones.

Thinking. It is usually perceived as a mental process by which humans are able to weigh ideas, understand the world around them, identify their inner selves, and come to effective results that guide them to better lives. The Merriam-Webster Dictionary defines thinking as 'the action of using your mind to produce ideas, decisions, memories, etc.'. The Concise Oxford English Dictionary (11th Edition) defines the verb to think as having a particular opinion, belief, or idea about someone or something and using one's mind actively

to form connected ideas. On the other hand, Thinking is defined as having a particular mental attitude as in someone's ideas and opinions. It is also using thought or rational judgment.

Lower Order Thinking. Refers basically to the ability of students to recall content of subject matters. Lower order thinking is defined as "mastering facts (such as being able to describe the parts of the water cycle) or completing a task with specific steps (such as being able to solve a two-variable equation)". (Teaching Higher-Order Thinking, 2011, p. 53)

Higher Order Thinking. Means handling a situation that you have not encountered before and is generally recognized as some combination of; uncertainty about what is known, self-regulation, and imposition of meaning. (Teaching Higher-Order Thinking, 2011, p. 54) Higher order thinking is a more complex system of judging the content for its credibility and usefulness, and applying the learnt methods and techniques into real-life situations that demand problem solving.

Critical Thinking. It is the process of discriminating and judging over conceivable reasoning, or it is also the assessments and value of judgements. (Forster, 2004)

Note: the following terms' definitions are taken from a collection-book of different academic articles entitled '*Creativity Anoiko 2011*'. The document has been retrieved from the link: https://oiko.files.wordpress.com/2011/03/2011_wiki_anoiko_creativity1.pdf

Convergent Thinking. First introduced by Guilford as the contradictory term of divergent thinking. It refers generally to the ability of giving the accurate response to regular and non-requiring creativity questions, such as school tasks and multiple choice intelligence tests.

Divergent Thinking. Refers to the process of generating creative ideas through exploring a verity of possible solutions. It arises as a spontaneous, unrestricted phenomenon, that resulted by generating different unorganized ideas.

Lateral thinking. Describes the process of solving problems following an indirect and creative approach, through non-immediate unclear reasoning, and containing thoughts that

cannot be obtained through logic ways. The *lateral thinking* term was coined by Edward de Bono in the book *New Think: The Use of Lateral Thinking* published in 1967.

Intelligence. It is a term used to describe the human mind. It also refers to the set of abstract thought, understanding, communication, reasoning, learning, planning, and problem solving skills.

Problem solving. Describes the mental process of finding out what caused a problem and figuring out ways to fix it. It is considered as complex intellectual function and higher-order cognitive process that entails the changing and control of more repetitive or fundamental skills.

Innovation. It is the process of refining an existing product or service. The term can be traced back to the Latin word "innovational", the noun of action from "Innovare" which means to renew or change.

The fore mentioned terms and concepts are the major concepts used in the creativity field. Most of them will be used repeatedly throughout this work. Their use purposes will shift from referring to description and comparison of creative thinking notion.

Conceptualizing and Defining Creativity

Apropos to the importance the notion of creativity has had in all fields of human life, a countless number of theorists and researchers have entered the arena of discussion about creativity nature and use. They gave massive amounts of insights and different interpretations, trying to define and conceptualize the term of creativity. As a result of the scholars' tendency towards identifying creativity, according to their areas of research and expertise, finding an all-encompassing definition appears to be difficult if not impossible.

The term creativity can be traced back to the Latin word "creates" which holds the meaning of bringing into existence. It has been assumed that creativity, in a colloquial definition, refers to an activity that results in producing something new, or in imagining new possibilities that were not conceived of before (Levin, 2008). It is: "putting things together in

new ways (either conceptually or artistically), observing things others might miss, constructing something novel, using unusual or unconventional imagery that nevertheless works to make an interesting point, and the like."(Brookhart, 2010, p. 124). Creativity: "in all domains, including science, technology, medicine, the arts, and day-to-day living, emerges from the basic mental operations of conceptually blending dissimilar subjects" (Michalko, 2011, p. 16). And because it can be seen as, a whole brain process and a combination of convergent and divergent thinking, creative thinking involves generating multiple ideas and then making selection of the more useful, effective, or appropriate ideas in order to have a workable solution to the problem.(Yaqoob, 2007)

Creativity Boundless Nature.

Creativity seems to be not only a strictly limited quality of those few intelligent or brilliant individuals, but rather it is the shared process of seeking to improve and upgrade the daily life situations we encounter. Brian Tracy in his article 'A Guide for Creative Thinking' asserted that creativity is simply a process of "improvement": "You don't have to be a rocket scientist or an artist in order to be creative, all you have to do is develop the ability to improve your situation, wherever you are and whatever you are doing." (p.1). Improvement means making something better. Tracy said that it is only 10 percent new or different version of a situation. He puts the estimation that, each year the average person has about four ideas for improvement, when driving to and from work, so the problem does not lay on having ideas for accomplishment, but in failing to act on those ideas and dismissing them by thinking that they cannot be valuable.

Rowan Gibson also thinks that we all have and can improve our creativity. In his book The Four Lenses of Innovation he wrote: "every human being has the cognitive ability or the capacity for creative thinking. We are actually born with it, and we all demonstrate it in our early childhood, so none of us can claim that creativity doesn't come naturally to us..., the reality is that all of us can improve our creative thinking skills and dispositions" (p.80). In his

claim we demonstrate creativity in the daily life episode, but unconsciously, for instance "when engaging in a hobby, or solving puzzles, or doing some practical tasks around the house or in the garden". (p.80)

Underlying Skills and Attitudes of Creative Thinking.

The process of creativity is a sum of other attitudes and processes, which characterized creative minds. In a paper of the DCU Student Learning Resources compiled by Ann Coughlan (2007-2008, p4), creative thinking said to be about applying imagination to finding solutions to a learning task through a variety of approaches, that differ it from other thinking skills. It is the free and playful thinking where there are no logical constraints that forbid making mistakes, risk taking and daydreaming when trying to find solutions, resolve issues and/ or solve problems.

Thinking about the solution demands pondering upon it, i.e. it necessitates reflection. One must think about the problem or situation at hand many times and from all the possible angles and perspectives. The first answer might drive the stream of thought astray. Accordingly, careful thinking is an important step towards reaching good and well-reflected results.

Restriction and guidance in creative thinking, in order for one to stay inside the box might be helpful in some cases, however, open mindedness is much needed in creativity. Letting one`s thoughts flow in all directions is better and more helpful than stopping them at first light. Multiple answers give chance to productiveness which is a key factor in the creative process.

Thinking of new ideas which has never been thought of before is the core of creativity. Sometimes the ideas that, at first thought, seem impossible, far-fetched or unrealistic are the ones which make perfect solutions. Consequently, early judgment in creativity is deemed bad. The neglected ideas may have potential of success if only they are treated with patience. This

does not mean that solutions, which are based on good judgment, practical ideas and rational understanding, do not have a stand in the creativity process.

The patterns which appear on the outside to be messy, faulty, or irrelevant are actually the very seeds of the creative thought. Doodling, writing on cardboards or rough papers, and daydreaming are the tricks which capture inspirational thoughts. Creativity does not need too many rules, but rather it needs space and freedom. Also, creativity is a process of trial and error. In order to reach creative solutions, numerous mistakes may be made and learned from. In other words, the path to creativity is like an open-ended question; there are no wrong or right answer, and the solutions are hiding somewhere in between.

A Historical Overview of Creativity

Long before the words "creativeness" or "creativity" entered the English language vocabulary (back to the 18th and 19th century), or before psychology became an independent science, creativity was out there, progressing humans' daily life and making it easier to live. The creativity reputation started a long ago with its products and inventions. The serious attempts to reconsider its very nature came after the appearance of those inventors and creative individuals, such as Galileo Galilee and Leonardo da Vinci, with their outstanding ideas and inventions.

At the first half of the 20th century and the beginning of the second half, creativity was kept in the shadows of psychology research with a limited interest and focus on studying it thoroughly.(Sternberg & Lubart, 1999). Conversely to the current times, creativity is considered to be a highly needed element, and it is studied the most.

One the earliest concerns about creativity were by the British sociologist and social scientist Graham Wallis. In his 1926 book "The Art of Thought", Wallis proposed his model of the creative process that consists four "stages of control" which are: preparation (the question or the problem is investigated consciously and systematically); incubation (the unintentional period of abstention from conscious thought about the problem when ideas are

connecting); illumination (when the creative idea appears in a sudden “flash” of inspiration, following a series of subconscious trains of association); and verification (the validity of the new idea is tested, and the idea is reduced to exact form)(Karakas, 2010). Wallis’s model was based upon the notion that creativity is a subconscious process. In 1940s and 1950s, as Pope (2005) noted, creativity term was used for specific meanings in specific fields to meet a set of technological, military and population challenges at the time.

The reason behind the absence of considerable intention in using and explaining creativity is illustrated by sawyer (2012). In his book "Explaining Creativity: The Science of Human Innovation" Sawyer noted that as a result of the behaviorism school domination since 1920s, psychologists tended to study only behaviors that they could see and perceive. As a result, they did not focus on the unseen element of creativity.

The 1950s considered to be the birth period of creativity research. J.P. Guilford, then the president of the American Psychology Association, who is named as "the father of creativity" put the starting stone of research on creativity. In his APA Presidential Address, Guilford shed the light on creativity and conjured it up to be very important subject of study, challenging psychologists to examine it closely. He reported that in psychological abstracts only less than 0, 2% of entries, up to 1950, focused on creativity.(Sternberg & Lubart, 1999). As an echo response to Guilford's call, some psychologists directed their attention to studying the creativity phenomenon, and an interest in the research field of creativity had known a few but noticeable growths. Through different views and various thinking angles, people tackled the notion of creativity and the interest in studying it has increased.

An explanation to that is presented also by Sawyer: "the conditions were ripe for creativity to flourish in America on account of three developments. First, there were concerns that despite the economic boom of the 1950s, the regimented economy was resulting in an America full of uncreative, identical conformists. Secondly, a group of former military psychologists had established research institutes to study creative individuals. Finally, the

government had started to award research grants to psychologists to identify creative talent early in life, to educate for creativity, and to design more creative workplaces"(Chan, Researching Creativity and Creativity Research, 2013, p. 23). As Sawyer mentioned, research institutes were founded to explore more the notion of creativity, but that was not enough.

An analysis done by Sternberg on the number of references to creativity in psychological abstracts from 1975 to 1994, served as one of several indicators of the volume of work on creativity, showed that the development of research on creativity was deficient, and creativity was relatively a marginal topic of psychology. That analysis used the terms: creativity, divergent thinking, and creative measurement as database keywords in searching the computerized Psych Lit database of journal articles whose content primarily concerned the subject of creativity. Entries that contained the word stem creativ- were also added, but excluded because they were found irrelevant. The results showed that in a period of 20 years, only 0, 5% of articles indexed in psychological abstracts, were concerned creativity. In addition, a look at introductory textbooks as another index, found that creativity was barely covered.(Sternberg & Lubart, 1999). That represents and explains to what extent creativity was neglected and improperly studied.

One foot ahead was made then, when independent journals devoted to creativity study were founded; The Journal of Creativity Behavior in 1967 and focuses on enhancement and education for creativity, and The Creativity Research Journal in 1988 which focuses on creativity research. Also, the APA sponsored a conference on creativity in the APA Monitor in August 1995. Then, creativity became an important element in psychology that demands serious attention, thus considerable researchers and theorists came to the picture who aimed to understand and define the old-new phenomenon, providing different views and definitions that enriched the research field. From that time to the present, creativity research has known major leaps and drawbacks that in general have widen the scope of its notion and diverted its progress line towards many fields and disciplines.

Major Road-blocks of Creativity Study.

Under the belief that creativity has been the psychology's orphan, i.e. an important subject that has been neglected by the psychological studies, R. J. Sternberg and T. L. Lubart listed what they called "major road-blocks" as six factors that prevented the proper recognition and acknowledgement of creativity by the psychological community. The road-blocks are:

> (a) the origins of the study of creativity in a tradition of mysticism and spirituality, which seems indifferent or even possibly counter to the scientific spirit; (b) the impression conveyed by pragmatic, commercial approaches to creativity that its study lacks a basis in psychological theory or verification through psychological research; (c) early work on creativity that was theoretically and methodologically apart from the mainstream of theoretical and empirical psychology, resulting in creativity sometimes being seen as peripheral to the central concerns of the field of psychology as a whole; (d) problems with the definition of and criteria for creativity that seemed to render the phenomenon either elusive or trivial; (e) approaches that have tended to view creativity as an extraordinary result of ordinary structures or processes, so that it has not always seemed necessary to have any separate study of creativity; (f) uni-disciplinary approaches to creativity that have tended to view a part of creativity as the whole phenomenon, often resulting in what we believe is a narrow vision of creativity and a perception that creativity is not as encompassing as it truly is. (Sternberg & Lubart, 1999, p. 4)

Sternberg and Lubart mentioned six elements that hindered the study on creativity from developing appropriately like other psychology subjects. Each of the aforementioned factors seemed to be linked with a specific phase in the creativity development life span, i.e. the successive approaches of creativity study. Sternberg and Lubart rang the bell of what they called "a serious under-investment" of a vital element in the field of psychology which is creativity.

Approaches to the Study of Creativity

As one component in the field of psychology, creativity witnessed various attempts to understand it properly. Those attempts are approaches derived from theories that utilized a sum up of thoughts and views; seek to gain the approximate comprehension to creativity. The following paradigms are the major highlights in the creativity research field.

Mystical Approaches.

Back to the firsts ages, humans believed in magic and holly spirits. They tended to turn every unexplainable phenomenon, which they cannot understand at first trials, to myths or spiritual entities that have mysteries roots. Creativity witnessed that faith, and it was seen as mystical and divine mania or at least a characteristic for the chosen ones.

Sternberg and Lubart (1999) put: "The creative person was seen as an empty vessel that a divine being would fill with inspiration. The individual would then pour out the inspired ideas, forming an otherworldly product'' (p.5). Also, Danah Henriksen (2011) asserted: "creativity was conceived of as a somewhat mystical or divine trait. This notion of creative ability as inspiration, or even madness, imparted by the gods, was a part of the philosophy of the ancient Greeks and Romans'' (p.12). Plato was among the firsts who adopted and believed in this conception, or what is known as the Muse (the source of revelation). This belief presumed the spiritual nature of creativity and asserted that it is a phenomenon which cannot be studied scientifically.(Henriksen, 2011)

Sternberg and Lubart mentioned what Plato believed to be the Muse dictation, like when a poet creates epic poems or another to create a choral song. This mystical view can be seen in Rudyard Kipling's (1937-1985) "Daemen" term that lives in the writer's pen. The concise Oxford English Dictionary (Eleventh Edition), define the term 'Daemen' as an ancient Greeks belief of a divinity or supernatural being of a nature between gods and humans, i.e. an inner or attendant spirit or inspiring force, and it is the archaic spelling of the word demon which is used nowadays to describe an evil spirit or devil. Sternberg and Lubart quoted

Kipling: "My Daemon was with me in the Jungle Books, Kim, and both Puck books, and good care I took to walk delicately, lest he should withdraw… When your Daemon is in charge, do not think consciously. Drift, wait, and obey"(p.5).

The conception of relating creativity to supernatural acts and phenomena drifted its study away, for a long time, from the proper and closer scientific diagnoses. It dressed it with a vague up normal status that misleads its research. Until today, some people still consider creative thinking, that stands behind outstanding results and findings, as unique unconsciousness activities.

Pragmatic Approaches.

After many years of misconception and misunderstanding that creativity has suffered. When the mystical view was the only approach that discussed creativity, even as in-researchable subject. The time has come for another approach to take the lead.

The pragmatic approach was the one. It came as a solution to understanding creativity better than before. The adopters of the pragmatic approach put their focus on developing creativity and understanding it, but they neglected testing the validity of their thoughts about it.(Sternberg & Lubart, 1999) As one of the foremost followers of this approach, Edward de Bono who is with the practice of creativity not with theory has had commercial success with working on lateral thinking and other creativity aspects. De Bono in his books suggested tools that focus on provoking the aspects of ideas rather than judging them. In his book "Six Thinking Hats", de Bono differs between the thinking aspects by having individuals metaphorically wear different colors of hats, for instance; "as a white hat for data-based thinking, a red hat for intuitive thinking, a black hat for critical thinking, and a green hat for generative thinking, in order to stimulate seeing things from different points of view'' (Sternberg & Lubart, 1999, p. 5). The table below explains more the six hats colors representations and functions. Those are tools used to motivate individuals to look at things differently from other angles, and as a result think divergently and creatively.

Hat	Color represents	Function of Hat
	Neutral, Objective	Objective Facts & Figures
	Emotional, Angry	Emotions & Feelings
	Serious, Somber	Cautious & Careful
	Sunny, Positive	Optimistic, Hope & Positive Thinking
	Growth, Fertility	Creativity, Ideas & Lateral Thinking
	Cool, Sky Above	Control & Organization of Thinking

Table 1: Edward de Bono's six thinking hats (Mathew, 2009)

De Bono brought to light the six thinking hats as hypothetical tools, individuals use as thinking boxes, moving their thought style or nature from one box to another to feat the situations they face. Every single hat describes and represents different attitudes and functions people tend to follow.

Hat Target. The target is neutral and objective. The white hat takes care of objective facts and numbers.

Hat Red. The red one suggests wrath, (to see red), fury and emotions. Red hat gives the emotional point of view.

Hat Black. The black is sad and negative. The black hat covers negative aspects, why something cannot be done.

Hat Yellow. The yellow is glad and positive. The yellow hat is optimist and covers the hope and the positive thought.

Hat Green. The green one is turf, vegetation and fertile growth, abundant. The green hat indicates new creativity and ideas.

Hat Blue. The blue one is cold, and is also the color of the sky, that is in favor of upon everything. The blue hat takes care of the control and the organization of process of the thought, and the use of the other hats.(Bono, 1988)

Every hat color means a thinking mood in different situations. De Bono used colors to make the distinction between the types of thinking humans enter through when dealing with their daily settings.

Proponents to this approach developed several tools and techniques to stimulate individuals' creative thinking. Sternberg and Lubart mentioned some of those who belong to this enterprise, criticizing their approach as making people associate creativity with commercializing, and lacking serious psychological basis and empirical attempts to validate the results they presented. Some of them are: Osborn (1953) with the brainstorming technique that is gathering as many solutions as possible in a constructive, not critical or inhibitory atmosphere, in order to solve problems creatively; Gordon (1961) by the synectics method that basically involves analogies in order to stimulate creative thinking; Adams (1974-1986) and von Oech (1983) who suggested that people can be creative when they identify and remove the false notions about creativity, such as the existence of one right answer to a given problem, von Oech also proposed that in order to enhance the creative productivity there is a need for adopting the explorer, artist, judge, and warrior roles in dealing with the situations ahead.(Sternberg & Lubart, 1999)

The pragmatic approach was an absolute commercial view towards creativity, and it did tackle creativity immaturely from a deficient angle that had inappropriate impacts on the evolution of creativity study.

The Psychodynamic Approaches.

The psychodynamic term is an English adjective that is derived from psychodynamics which is the branch of psychology that is concerned with the interrelation of the unconscious

and conscious mental and emotional forces that determine personality and motivation. (The Concise English Dictionary-Eleventh Edition)

In the twentieth century, the Psychodynamic was the first theoretical attempt to the study of creativity. It defined the phenomenon of creative thinking as the outcome of the conscious actuality and the unconscious pushes tension. Freud (1908-1959) defined creativity as the representation of the unconscious wishes publicly through acceptable forms. This definition is an example of S. Freud thought about humans' behaviors. Vernon (1970) illustrated that conception by examples of unconscious wishes such as power, riches, fame, honor or love, and famous inventors such as Leonardo da Vinci as modal to support this approach. (Sternberg & Lubart, 1999)

Later, concepts of adaptive regression and elaboration were added to this approach as two successive processes of creativity. Adaptive regression refers to: "the intrusion of unmodulated thoughts in consciousness. Unmodulated thoughts can occur during active problem solving, but often occur during sleep, intoxication from drugs, fantasies or daydreams, or psychoses."(Sternberg & Lubart, 1999, p. 6). It is about what happens to a creative mind when it is invaded by the unusual uncontrolled group of ideas. Elaboration refers to: "the reworking and transformation of primary process material through reality-oriented, ego-controlled thinking."(Sternberg & Lubart, 1999, p. 6). It is the first turnover of the group of ideas that were given birth by the adaptive regression process, to the type of thinking that is shaped by the ego and reality.

Kubie (1958) as cited in (Sternberg & Lubart, 1999, p. 6), claimed that the source of creativity is the preconscious "which falls between conscious reality and the encrypted unconscious", because creativity ideas are flexible and obscure but interpretable. As a new but relevant definition to creativity, Kubie named the preconscious the birthplace for creative thinking, based on the malleable wild nature of that type of thinking. He opposed Freud, who believed that creativity is a tension offspring, by claiming that conflicts on the encrypted

unconscious may damage creativity, instead of enhancing it, by leading to fixated repetitive ideas.

However, the addition that the psychodynamic approach made. At the level of insights and perceptions, to the field of creativity scientific study, it did not receive the appropriate attention for the development it merits. That lack of attention took place as result of the domination certain psychological schools, such as structuralism, functionalism, and behaviorism, which were not dedicating any serious resources to the creativity study. The psychodynamic approach was criticized for its reliance only on case studies of famous inventors and outstanding creative individuals, which is methodologically difficult to measure the theoretical paradigms the approach offered.(Sternberg & Lubart, 1999)

The psychodynamic approach to the study of creativity proposed the first theoretical view in the creativity history. It offered serious thoughts and ideas as an attempt to analyze the creative thinking process. Some of those thoughts are currently affirmed and acknowledged by different psychological studies.

The Psychometric Approaches.

The psychometric term means in the English language the supposed ability to discover facts about an event or person by touching inanimate objects associated with them, it is also used as another term for psychometrics; which is the science of measuring mental capacities and processes. (The Concise English Dictionary-Eleventh Edition)

In his APA Address, Guilford mentioned that in the psychological field there is a difficulty of researching and measuring the creativity of those genius ones; such as Michelangelo or Einstein. Instead, it could be studied with a psychometric approach in everyday subjects using paper-pencil tasks; such as the Unusual Uses Test. The latter is a task that is based on asking the examinee to think of all the uses (usual and unusual) of a certain object; which is commonly used in everyday life. The more unusual uses were offered the more the examinee is creative. Basically those tasks measure the divergent thinking that an

individual has, which became the main instrument for measuring creativity as researchers continued on adopting Guilford's proposal. Based on Guilford's work, E. P. Torrance (1974) developed the Torrance Test of Creative Thinking. The TTCT entails a diversity of verbal and figural tasks that encompass divergent thinking and problem solving skills. It can be scored for the skills of fluency, flexibility, originality, and elaboration. Fluency is the total number of relevant responses to a given task, flexibility is the total of varieties in dimensions those responses follow, originality is the novelty of those responses and how rare are they, elaboration is the total of details the responses offer and the extent of clarity they possess.(Sternberg & Lubart, 1999)

The psychometric approach expedited the course of research on creativity by offering an assessment stratagem that measures the everyday people creative thinking skills empirically. But, those instruments, especially the brief paper-pencil tasks, were criticized as being trivial, inadequate, and lacking actual drawings or writing samples by the examinees that may show his creativity better. The criticism of the approach reached the aspects of fluency, flexibility, originality, and elaboration as inappropriate scoring criteria. Tools and criteria for terming and scoring creativity have been questionable topics on the study of the creativity phenomenon in terms of reliability and the most suitable ones that should be used.(Sternberg & Lubart, 1999)

One the foremost paradigms, to the scientific study on the creative thinking process, that made a closer look into its aspects and measurement is the psychometric approach. Although it had been firmly criticized, the psychometric approach did not just make the process of measuring creativity possible by offering countable tests, but it also made studying it among ordinary people possible. The psychometric tests like the TTCT are used up today, as reliable instruments, to measure people’s creative thinking and to detect the talented ones.

The Cognitive Approach.

The creativity faith has known many turns because of the aforementioned approaches in its study. Those paradigms approached the creativity phenomenon from different angles and tackled its notion from various perspectives according to the group of thoughts they belonged to and represented.

The cognitive approach sought to decipher the mental representations and processes behind creativity and understand them better. Human based and computer simulation studies are conducted to apprehend the processes consisting creative thinking. Finke (1995) and his colleagues developed the Geneplore model that is comprised of generative and exploratory phases as two main processes of creative thinking. The generative phase is where mental representations of pre-inventive structures are assembled; they have properties that raise creativity discoveries. The exploratory phase is where creative thoughts and inventions flourish and born based on those properties. "The processes of retrieval, association, synthesis, transformation, analogical transfer, and categorical reduction (i.e. mentally reducing objects or elements to more primitive categorical descriptions)" (Sternberg & Lubart, 1999, p. 7) are included in the phases of creativity invention. The cognitive approach representatives proposed these phases as a model that explains the creative thinking process. Sternberg and Lubart (1999) explained a tentative test that is typically based on the model where:

> "Subjects will be shown parts of objects, such as a circle, a cube, a parallelogram, and a cylinder. On a given trial, three parts will be named, and subjects will be asked to imagine combining the parts to produce a practical object or device. For example, subjects might imagine a tool, a weapon, or a piece of furniture. The objects thus produced are then rated by judges for their practicality and originality."(Sternberg & Lubart, 1999, p. 8)

Finke (1990) used those tests to measure creative thinking among ordinary people. Weisberg (1986-1993) sees creativity as the extraordinary products of ordinary cognitive processes. To prove his suggestion, Weisberg used: “case studies of eminent creators and laboratory research, such as studies with Dunckers (1945) candle problem, which requires subjects to attach a candle to a wall using only objects available in a picture (candle, box of tacks, and book of matches), Weisberg attempts to show that the insights depend on subjects using conventional cognitive processes (such as analogical transfer) applied to knowledge already stored in memory.”(Sternberg & Lubart, 1999, p. 8)

The cognitive approach representatives also used computer simulation studies to produce creative thoughts, by imitating humans’ processes. Sternberg and Lubart (1999) explained thoroughly those studies including the pioneers who conducted them:

> “Langley, Simon, Bradshaw, and Zytkow (1987), for example, developed a set of programs that rediscover basic scientific laws. These computational models rely on heuristics -problem-solving guidelines-for searching a data set or conceptual space and finding hidden relationships between input variables. The initial program, called BACON, uses heuristics such as "If the value of two numerical terms increase together, consider their ratio" to search data for patterns. One of BACONs accomplishments has been to examine observational data available to Kepler on the orbits of planets and to rediscover Kepler's third law of planetary motion. Further programs have extended the search heuristics, the ability to transform data sets, and the ability to reason with qualitative data and scientific concepts. There are also models concerning an artistic domain. For example, Johnson-Laird (1988) developed a jazz improvisation program in which novel deviations from the basic jazz chord sequences are guided by harmonic constraints (or tacit principles of jazz) and random choice when several allowable directions for the improvisation exist.”(Sternberg & Lubart, 1999, p. 8)

Those studies are based on computer simulation as referential devices to harvest creative thoughts similar to those that might be invented by creative individuals. The evolvement of those studies is an ongoing process, and the results are proving their validity.

The cognitive approach offered noticeable insights into the study of creativity, which helped moving the creativity research wheel toward new areas. It has been criticized for ignoring the personality and social elements that involved in molding people's creativity.

The Social-Personality Approach.

As any other subject of the psychology study field, creativity discussion has known many perspectives and views divisions. This plethora of study angles was a result of successive approaches through years of investigations, and sometimes a result of parallel approaches that happened to evolve simultaneously.

The Social-Personality approach developed concurrently with the cognitive approach. Its focus was on: "personality variables, motivational variables, and the socio-cultural environment as sources of creativity" (Sternberg & Lubart, 1999, p. 8). It suggested that creative people have specific personality traits and habits that allow them to be creative. Proponents of that claim, such as MacKinnon (1965), Barron (1968-1969), Gough (1979), Amabile (1983), and Eysenck (1993) identified the traits behind creative thinking skills after countable co relational studies and ordinary samplings. The cited personality traits include: "independence of judgment, self-confidence, attraction to complexity, aesthetic orientation, and risk taking" (Sternberg & Lubart, 1999, p. 8), those are not all what researchers revealed but the dominant ones.

Humanists such as Maslow (1968) and Rogers (1976) believed that creativity is a result of the interaction between an individual and his environment.(Henriksen, 2011). Maslow as cited in (Al-Silami, July 2010, p. 32) noted: "(my) feeling is that the concept of creativeness and the concept of the healthy, self-actualizing, fully-human person, seem to be coming closer and closer together, and may perhaps turn out to be the same thing". He

asserted on self-actualization as an important personal trait that determines the creativity process. Rogers thought that the individual's environment is one vital condition to the creative thinking emergence, which can either, motivates it or destroys it before even being hatched. Motivation for creativity, as one of the personal and social elements, took its chance in describing creativity through the studies of Amabile and her colleagues. They conducted: "studies using motivational training and other techniques have manipulated motivation and observed effects on creative performance tasks, such as writing poems and making collages" (Sternberg & Lubart, 1999, p. 9). Those studies in addition to recent ones, affirmed the significance of intrinsic motivation and its role in the creativity occurrence among individuals.

Through the social-personality approach and studies, valuable insights have been added to the body of creativity research. However, this approach has been criticized for minimizing the role of cognitive elements in the creative thinking process.(Sternberg & Lubart, 1999)A quick analysis to those paradigms results that each one of them approached creativity from one specific facet, neglecting or downplaying the others. The analysis also shows the interdisciplinary nature of creativity. To responds what creativity nature demands, multidisciplinary approaches should be developed. In order to bridge that gap, theorists have recently begun to formulate confluence approaches to the study of creativity.(Sternberg & Lubart, 1999)

The Confluence Approaches.

The Concise Oxford English Dictionary (11th edition) defined the word confluence as a noun for an act or process of merging things together.

Those approaches are a result of researchers understanding that creativity is a broad field of study, which needs the merging of different views and paradigms to be learned. Theorists such as Sternberg who combined in his examination both lay persons and experts samples. As it is noted in Sternberg and Lubart (1999):

> “People's implicit theories contain a combination of cognitive and personality elements, such as "connects ideas," "sees similarities and differences," "has flexibility," "has aesthetic taste," "is unorthodox," "is motivated," "is inquisitive," and "questions societal norms." At the level of explicit theories, Amabile (1983) describes creativity as the confluence of intrinsic motivation, domain-relevant knowledge and abilities, and creativity-relevant skills. The creativity-relevant skills include; (a) a cognitive style that involves coping with complexities and breaking one's mental set during problem solving, (b) knowledge of heuristics for generating novel ideas, such as trying a counterintuitive approach, and (c) a work style characterized by concentrated effort, an ability to set aside problems, and high energy.” (p.10)

Sternberg and Lubart differed between implicit and explicit approaches that merged paradigms, which tackled creativity differently before. The implicit ones assembled features of personality and cognition to shape a description to the process of creativity as being a curious, flexible, unorthodox, aesthetic process of connecting similar and different ideas motivated by questioning the societal norms. The explicit ones; such as the work of Teresa Amabile and her colleagues who brought together the aspects of motivation, knowledge and ability, and creativity skills, which are in sum a mixture of social and cognitive elements, to mold an identity to the creative thinking process.

Other examples of confluence approaches can be seen in Gruber and his colleagues (1981, 1988) model of developmental evolving-systems; that defined creativity as the result of deviations an individual has faced which were accrued by the person’s purpose, i.e. the interrelated drives that lead and cultivate his behavior, the developmental changes in his knowledge system and thoughts, the affect or mood system which is identified by the stimulus of pleasure and obstruction on the started tasks. Csikszentmihalyi (1988, 1996) selected another systems path by associating creativity with the interaction or the tension between the individual, domain, and field. The individual, through cognitive processes, personality traits,

and motivation, brought to life reconstructed domain or developed information. The field is the group of individuals who govern or stimulate a domain where new ideas are selected and assessed. The domain is the culturally shaped system that is in charge of maintaining the creative products and passing them on to the following individuals and generations.(Sternberg & Lubart, 1999)

The most known confluence theory about creativity is the investment theory by Sternberg and Lubart (1991, 1992, 1995, 1996), which sees creative individuals as those who want and can "buy low and sell high" in the realm of ideas. Creativity is the amelioration or the refinement of the unknown or criticized, but potentially valuable, thoughts and ideas to new rare inventions. The investment theory defined creativity as a process that demands a confluence of six different and interconnected accoutrements which are; intellectual abilities, knowledge, styles of thinking, personality, motivation, and environment. The following intellectual abilities merge to serve the creativity process; "(a) the synthetic ability to see problems in new ways and to escape the bounds of conventional thinking, (b) the analytic ability to recognize which of one's ideas are worth pursuing and which are not, and (c) the practical-contextual ability to know how to persuade others of- to sell other people on -the value of one's ideas."(Sternberg & Lubart, 1999, p. 11). Knowledge about the specific field is important to creativity occurrence, but it also can prevent it when shaping and restricting the individual's mind within the specific field. Creativity needs also a legislative style of thinking, i.e. to think in novel ways of what a person usually selects, in addition to think globally as well as locally or to think in sum and in details simultaneously.

Personality traits such as; self-efficacy, the will to overcome obstacles, risk taking, and ambiguity tolerance, are vital to preparing a person's creative ability. Another important element to creativity is motivation; one must have intrinsic support like loving the work in hand to make the creative change. The last piece in the puzzle is the accurate environment that

surrounds the creative person, which should be fertile for the creativity seeds to be grown properly.(Sternberg & Lubart, 1999)

The relationship between those components of the investment theory can vary from the overlapping of one component on another, to tension or interaction between them, all to serve creativity and set the suitable atmosphere for its products to blossom. The investment theory is one prominent acceptable interpretation of creativity.

Confluence theories still emerge in the field of creativity, and the discussion about its definition, validity and methods of gaining the best of it, has not been closed yet. Empirical studies and evolutionary thoughts are up to day enriching the realm of research on creativity. The latter remains arguably undefined but under the spot light of the research world.

Creativity Assessment

The process of creativity, or creative thinking, resembles a thinking skill which is of a paramount importance in the educational and real life spheres. In an attempt to detect it, in an early stage, among groups and individuals, measurement techniques appeal the interest of those who belong to the creativity research field. The psychometric approach led the creative thinking measurement evolution. Researchers hypothesized techniques and develop tests, to measure and assess the creativity process, but they remain insufficient. Only few tests were developed because of the difficulty of formulating a test for a debatable undefined process. The most prominent acknowledged tests are Guilford's divergent thinking test and Torrance Test of Creative Thinking.

Guilford's Test.

In 1950, through his APA Presidential Address, Guilford highlighted the necessity of measuring creativity among individuals through testing tasks. He suggested the paper-and-pencil tasks, as psychometric tools, to assess subjects' creative thinking skills. Those tests actually assess the divergent thinking aspect, and since the latter refers to creativity, it became a way of measuring creativity itself. One of Guilford's proposed tests was the Unusual Uses

Test. Subjects of this test are asked to think of the maximum usual and unusual uses of a given object, which exists in the everyday life and for limited common purposes. For instance, a brick and the examinee that can come up with creative unusual ideas of using it, is considered to be a creative thinker.

Guilford's proposal received noticeable acceptance among researchers, and his tests were widely adopted. Divergent thinking tasks also witnessed the same welcoming, when acknowledged to be valuable instruments that measure creative thinking. Those tests were an appropriate means of rating individuals through one standard scale of creativity.(Sternberg & Lubart, 1999)

Torrance Test.

Standing on Guilford's theory and practice, E Paul Torrance constructed a new creativity test. In 1974, he coined the Torrance Tests of Creative Thinking, or the TTCT. It is a collection of moderately simple tasks, which can be figural or verbal or both. The tests include divergent thinking and problem-solving skills. They are scored in respect of the four elements of fluency, flexibility, originality, and elaboration. The latter refers to the amount of complex and complete answers the examinee gives. Originality stands for the rarity or uncommonness of answers. Flexibility means the statistical variability of idea categories in the answers. Fluency is the quantity of the given relevant answers. The Torrance series contain a set of subtests such as:

- Asking questions: based on a drawing of a scene, the examinee is asked to write all the questions he or she can think of.
- Product improvement: The examinee is asked to list or write down ideas of how to change a sad toy to one that children can have more fun playing with.
- Unusual uses: The examinee writes down, as much as he or she can, unusual uses of a cardboard box.

- Circles: based on a number of simple circles, the examinee develops different drawings and titles them.

The TTCT is world wild used test of creativity.(Sternberg & Lubart, 1999)

Creativity assessment is still a debatable field of contributions and interpretations. Many researchers have been giving different theories and maxims, all to better measurement of creativity. The unsettled battle of making an all-agreeable test for creative thinking is a result of the absence of an all-encompassing definition of creativity. Though, Guilford's and Torrance's tests are widely acknowledged and used as assessing instruments.

Creativity and Education

It is acknowledged that creativity has pervaded every aspect of human life, in terms of insights, applications, and products. One substantial aspect of life is education, which signifies the continuity of humans' knowledge and development. Creativity receives a respectful attention of education representatives; such as scholars, curricula designers, teachers and students. Consequently, theories, contributes, studies and strategies were developed to integrate creative thinking in the different educational settings.

Education for Creative Thinking.

Though, the resistance it is receiving, the loss of synchronization, and the unforeseen challenges, the attempt of replacing the education practices to more creativity supportive systems is noticeably progressing. The awareness of the emerging priority of creative thinking is expanding. The Japan National Commission on Education Reform stressed the lack of creativity nurture and production, by its universities, that the nation progress demands. The Education Ministry for the Republic of China asks for colleges' reforms that educate and reward students for creativity rather than rote memory. Also, business leaders across the United States and Europe have been recommended similar transformations.(Storm & Storm, 2002)

Robert D. Storm and Paris S. Storm (2002) asserted that changing the rules, that guide the education policy and teaching practice, is highly required in order to enhance students' creativity. They also presented some rules, addressing teachers, parents, and community leaders, who can help reaching the goal of restoring the educational value of creativity. The rules addressed community leaders, teachers, and parents, and based evident interpretations and empirical studies. The recommended rules include:

- Teacher training should assign higher priority to encouraging creative thinking: because of the great influence teacher attitudes have on students thinking performance, teacher training should trigger the teachers' recognition of thinking skills and understanding of how they can be nurtured in their classrooms.
- Cooperative teams should become a source motivation for creative thinking: during work groups, divergent ideas, i.e. creativity directed, are commonly neglected. Consequently, creative students tend to solve problems individually rather than cooperating with others. Teaming up by individuals is more needed by creativity, thus teachers should assign peer group activities, where each team member can contribute and solve problems by joining efforts with his classmates. This can raise students' awareness of cooperative work and accepting others unusual thoughts.
- Students should acquire the ability to fairly evaluative peer and self-performance: in business and management, a paramount importance is given to peer-evaluation as a significant tool of improvement, because employees give more interest to their peers' criticism and suggestions. In classrooms, peers' evaluation is more valuable source of progress information, than the individual judgment of teacher. Through peer work, students can also evaluate their own performance, by developing suitable criteria while reflecting upon personal contributions and by allowing the observation of peers comparing to self-impressions. Teachers should highlight the peer and self-evaluation for better performance.

- Combining media tools and teacher instructional skills by allowing students to contribute with their media experiences.
- Detecting boredom and motivating the creativity setting by inviting students' educational opinions.
- Applying alternative learning activities to avoid routines by the integration of visual aids and the discussion of students' opinions.
- Encouraging students to take initiative when they finish their assignments before the schedule time, such as silent tasks.
- Providing students opportunities to improve their creativity through freedom and frequent evaluation.
- Stimulate curiosity and asking questions to make students recognize their value in the learning process.

Those are the authors' rules for better creativity educational atmosphere. Numerous contributions are made, by different scholars across the globe; seek the serious change in educational systems to fit the creative thinking needs. The international educational interest about creativity is witnessing a considerable growth in its various fields and contexts.

Creative thinking and the English Language teaching.

As one important field of education, the English language teaching is also concerned with the creativity notion. Specialists have been suggesting different techniques and procedures to integrate creativity in the English language learning domains. English as a foreign language is a domain that received various attempts of detecting and learning the creative thinking skills in its classrooms. Numerous studies have been conducted, highlighting the relevance of creative thinking in EFL classes and proposing rules and regulations for better learning results.

Aiming at having creative thinking EFL classes, it is recommended that instructors eliminate rigid malfunctioning approaches and attitudes, such as severe inflexible way of

teaching and students limited freedom, and replace them with fun, flexible, free atmosphere (Rahimi & Hematiyan, 2012). In the book of 'Teaching Creativity for the common core classroom', insights to foster creativity in the English language classroom are given such as: (a) the value of intrinsic motivation as it is closely associated with creativity; (b) rewards and foreseen evaluations tend to reduce creativity; (c) when giving students' feedback, the following items should be respected:

- Teacher critical evaluation should be on the assigned students' specific work not on the students' general skills.
- The teacher emphasis, when praising the work, should be on the students' effort rather than any underlying skill.(Beghetto, Kaufman, & Baer, 2015)

EFL students' creativity and their language proficiency are positively related, the first enhance students' production of questions and coordination and vary "may help account for variation in how English L2 learners interact with each other during problem-solving tasks (e.g., asking for information, coordinating information across turns and speakers, clarifying their interlocutors' utterances)" (Mcdonough, Crawford, & Mackey, 2015, p. 189).

Attempting at developing activities that enhance EFL students' thinking skills and language, scholars such as Puchta and Williams (2012) counted the following 13categories of activities: "making comparisons, categorizing, sequencing, focusing attention, memorizing, exploring space, exploring time, exploring numbers, creating associations, analyzing cause and effect, making decisions, solving problems, creative thinking". Thammineni (2012) innovated several activities for English classroom practice such as: task-based activities, contests, language games, video or movie sharing, media literacy translation, and Computer Assisted Language Learning (CALL) programs**.** (Cimermanova, 2015, p. 1972)

There is a great wealth of thoughts and interventions in the English as foreign language scope. Those thoughts and interventions acknowledged the mutual assistances creativity and English learning gain from each other. It is worth noted that international

curricula professionals and designers are making considerable changes to their approaches. In order to synchronize them with the creativity revolution.

Conclusion

In conclusion, creative thinking is of a paramount importance to every human life aspect, especially education. Creative thinking skills hold a respected significance among intellectual skills and abilities that individuals are interested to acquire and develop. However, an absence of integrating the creativity notion in the Algerian educational system is being noticed, throughout its different levels, and creative thinking skills are not properly introduced.

After mentioning and discussing the different areas of creativity, that comprise its conceptualizations and definitions, history and development road-blocks, approaches and paradigms, assessment tools, and its correlation with education and language learning, it is worth mentioning that creative thinking is vital and a key skill for enhancing one's overall abilities. In the academia world, both students and teachers acknowledge the importance and absence of creativity in the EFL classroom, and seek to integrate it properly. This goal can be reached when following a variety of effective methods and techniques, which lead to enhancing the creative thinking skills.

Chapter Two

Educational Puzzles

Educational Puzzles

Introduction

One of the major distinctions between humans and animals, is that the human being has a mind that allows him to think and discriminate the right from wrong and the accurate from the inaccurate. The human's mind led him to learn new notions, grasp countless abilities, and to discover unknown spheres of the world inside his being and outside it. These evolutionary numerous activities are in sum the pillars that constructs the humanity knowledge, which has been imparted to every new generation through educational systems and learning techniques. Various systems and techniques have been followed and used to extract the exact tools that make the learning procedure more effective, pleasurable, and flexible.

One used tool, that is effective in transmitting the information, fun method to adhere the intended material to the recipient's mind, and flexible technique to use in different situations for different purposes, is educational puzzles. The latter has a good reputation in the learning world generally and in the academia world especially, for its gained profits and the opportunities it offers to both the teachers and learners.

The current chapter will be addressing the identity of educational puzzles through a historical over view, definitions of puzzles in the English language, and their main types. The chapter highlights the importance of puzzles in the different contexts of human interests, in addition to the criteria of educational puzzles. This chapter also comprises a probe on the Puzzle-based Learning Approach; its nature, purposes andinterests, and reputation. At last, some examples of educational puzzles are listed along with their solutions.

Educational Puzzles Nature

Puzzles are acknowledged as a valuable educational tool by those who belong to the different fields of education, such as science, art, and language teaching. They are also recognized by the groups and individuals ranked in the educational system, like discussion

makers, curriculum designers, teachers and learners of different aspects of knowledge. Puzzles have an epic history and various types and uses, but their first objective was not educationally directed but as an entertainment tool that brought fun to change the unpleasant atmosphere and challenge the participants mind and thinking.

Brief History of Puzzles.

As it is introduced earlier, the first intention of puzzles creation was to entertain the participants in a new way, that motivates their brains to make new connections and contest them trying to figure out the right answer. That contest was held in a challenging context limited by time and preconditioned stimuli. The puzzles use also held a mathematical purpose as a new interest that humans began to grow.

Puzzles are one of the human's ancestors' inventions. Their history can be traced back to the Sumerian texts from 2500 BC, and to the Egyptians era, when mathematics was first invented grounding on puzzle type problems. An Egyptian papyrus named the Rhind, written in around 1850 BC, shows the concern Egyptians gave to puzzles. The Rhind puzzle is about; seven houses contain seven cats, each cat kills seven mice, each mouse had eaten seven ears of grain, each ear of grain would have produced seven heads of wheat, what is the total of all of these?

The Chinese also have a claim in the puzzles invention, their first known puzzles are from around 2200 BC, which are the puzzles of magic squares. The Chinese named them lo-shu, and they involve using all the numbers 1, 2, 3, ..., n (n is representing the last number in the sequence) to fill the squares of an n × n board so that each row, each column and both main diagonals sum to the same number.

One of the most known puzzles, is the puzzle of the farmer and his three items (a wolf, a goat, and cabbage), the farmer wants to move the items to the other side of a river using a small boat, which can lift only one item beside the farmer each single trip. If the farmer moves, the cabbage the wolf would eat the goat and if he moves the wolf the goat would eat

the cabbage. What the farmer should do? This puzzle was published as one of a volume that included fifty puzzles, in the eighth century by the English scholar named Alcuin, and it is still broadly used. This puzzle was recently mentioned and acknowledged by the professor Zbigniew Michalewicz, at the Adelaide Convention Center IPOS'12 summit held in February 2012. Michalewicz is the inventor of the Puzzle-Based Learning Approach.

Great mathematicians, such as Fibonacci's Liber Abaci in 1202; Archimedes in his book The Sand reckoner where he gives the Cattle Problem; and the Arabic Mathematician ibn Khallikan who, in 1256, poses the problem of the grains of wheat, 1 on the first square of the chess board, 2 on the second, 4 on the third, 8 on the fourth etc. they invented different kinds of puzzles with different aims and intentions. (O'Connor & Robertson, 1996)

In the current time, countless puzzles are used in every aspect of humans' life, such as education, mathematics, computer sciences, and entertainments, as a flavor to each domain recipe. They are the results of great scholars creative thinking, such as Martin Gardner, Edward F Meyer, Zbigniew Michalewicz and others.

Puzzles Definitions.

There is a lack in definitions of puzzles in the academia world, as a result of their common nature as tools used in the everyday life and creatively for educational purposes, in addition to the unclear difference between a puzzle and real problem. Puzzles are in the main: "domain-free challenges that require very little formal progress in other areas of study to be enjoyable and exacting while still approachable"(Meyer III, Falkner, Sooriamurthi, & Michalewicz, 2014, p. 17). An accurate linguistic definition to the puzzle term can be derived from the most reliable dictionaries of the English language, which are the Oxford dictionary, the Cambridge dictionary, and the Merriam-Webster dictionary.

The Oxford dictionary definition.

The Concise Oxford English Dictionary (Eleventh Edition), defines the word puzzle as: a game, toy, or problem designed to test ingenuity or knowledge. the linked expressions

are defined as follows; jigsaw puzzle is a puzzle consisting of picture printed cardboard or wood and cut into numerous interlocking shapes that have to be fitted together; Chinese puzzle is an intricate puzzle consisting of many interlocking pieces; and crossword puzzle is a puzzle consisting of a grid of squares and blanks into which words crossing vertically and horizontally are written according to clues.

The Cambridge dictionary definition.

The Cambridge Advanced Learner's Dictionary (Third Edition) gives the word puzzle the definition: a game or toy in which you have to fit separate pieces together, or a problem or question which you have to answer by using your skill or knowledge. It also defines the related expressions of; Chinese puzzle as a game where you have to solve the problem of fitting many different pieces together, especially boxes inside other boxes; crossword puzzle as a game in which you write words which are the answers to questions in a pattern of black and white squares; and jigsaw puzzle as a picture stuck onto wood or cardboard and cut into pieces of different shapes which must be joined together correctly to form the picture again.

The Merriam-Webster dictionary definition.

The Merriam-Webster's Learner's Dictionary defines the word puzzle as a question or problem that requires thought, skill, or cleverness to be answered or solved.it defines the correspondent expressions of jigsaw puzzle as a puzzle consisting of small irregularly cut pieces that are to be fitted together to form a picture, Chinese puzzle as an intricate or ingenious puzzle, and crossword puzzle as a puzzle in which words are filled into a pattern of numbered squares in answer to correspondingly numbered clues and in such a way that the words read across and down.

The three English pillar dictionaries seem to be similar in defining the concept of puzzle as a type of question or a problem that demands to be solved through the incorporation of mental capacities, such as thinking, and knowledge. A puzzle is: "problem that is perplexing and either has a solution requiring considerable ingenuity, perhaps a lateral

thinking solution, or possibly results in an unexpected, even a counter-intuitive or apparently paradoxical, solution"(Badger, Sangwin, Ventura-Medina, & Thomas, 2012, p. 4). It is also a game that challenges the individual reasoning and thinking skills.

Types of Puzzles.

Puzzles have a verity of types that serves a verity of goals, and triggered specific thinking abilities and skills. They have been classified according to different criteria, and standardized in respect of many contexts. Criteria and standards vary in their interpretations of how puzzles should be classified. They differ puzzles in terms of simplicity to complexity, linguistic nature to mathematic nature, generality to specificity, and other categorizations that refer to other interpretations which are so many to be included. (Meyer III, Falkner, Sooriamurthi, & Michalewicz, 2014)

A common and simple itemization of the notion of puzzles can put them in a taxonomy of four sets, each set with a specific nature and use. In sum, this taxonomy targets the classroom use of puzzles, i.e. an educational purpose. The four following types are not radically different, but they serve different learning goals.

Icebreakers.

As the name shows, the icebreakers are designed to melt the ice between recipients (students mainly) and get them to be accustomed with each other. They are special with a challenging nature that targeted the maximum contribution of participants. Icebreakers also break the icy relationship between the presenter for instance a teacher, and his students, which is a dynamic element in the teaching and learning structure.

Warm-ups.

Warm-ups are educational puzzles designed to take the students into a specific higher level of mindset, where their mental receiving devices are ready to learn and grasp the planned set of information. In other words, they rehearse the students in a particular technique

or way of thinking. A good warm-up enhances the readiness of students, and put them into the appropriate level of thinking to look at more complicated puzzles in the same vein.

General puzzles.

these type of puzzles vary in their level of difficulty, comparing to the earlier ones, and they can be used as fundamental course puzzles. They target a sum of particular problem-solving techniques and thinking skills, but the assumption of needing an advanced learning in specific discipline is not absolutely accurate. General puzzles can be solved by general knowledge of various disciplines. This feature allows teachers to use them for different purposes.

Discipline-specific puzzles.

The last type in the four-types taxonomy is the discipline-specific puzzles. They are puzzles which were designed to fit the needs, thoughts dimensions, and the related set of knowledge of a specific discipline. This puzzles category includes mathematical puzzles, as prominent examples, which assume a high-school or college mathematic knowledge. In addition to those puzzles where you have to state prerequisite knowledge from a course above middle school, in order to solve them.

The above categorization of puzzles types was proposed by the professional scholar Edwin F Meyer III and his colleagues, in their book of 2014 entitled ‘Guide to Teaching Puzzle-based learning’. It is used, as understanding tool, for those who want to integrate educational puzzles in their classrooms and courses. The whole mentioned book is a complete guide to the interested teachers and instructors.

Educational Puzzles Importance

As a human invention, puzzles have been proven their utility and validity as entertainment tools or as challenging games that are used by all categories of people, such as children, adults, and professionals. In addition to that, puzzles have booked a considerable place in both educational and scientific spheres. Luminary individuals in different fields of

science and education, have shed the light on the significance of using puzzles, in the mentioned fields, as basic courses instrument or additional aids for more advantageous learning process.

In medicine, different designs of puzzles and games have been integrated as aids to traditional teaching methods. That resulted from the acknowledgment of the value of puzzles in the process of acquiring and applying cognitive, affective, and psychomotor knowledge and skills. Crosswords puzzles are beneficial in term of near transfer material, and more beneficial for the review and assessment processes. In addition to other active learning methods, crossword puzzles have been included in medical courses as an endeavor to enhance understanding, learning, and retention. In a learning atmosphere that allowed discussion and fitting sense of humor, and in an anticipation of fostering students' capacity of recalling necessary concepts, crossword puzzles were presented as quick valid procedure that strengthens critical concepts and important vocabulary. The puzzles afforded students with the chance of thinking critically, cooperate with each other, recalling the main concepts and discussing them using the associated important vocabulary. (Saxena, Nesbitt, Pahwa, & Mills, 2009). Sexena and his colleagues also proposed that: "The judicious use of crossword puzzles in a collaborative, friendly competitive environment is a useful adjunct to the repertoire of active learning strategies" (p.1462). They confirmed the utility of puzzles in the majority of learning process aspects.

In a YouTube video presented by The Great Courses website; the professor Richard Restack, from the George Washington University School of Medicine and Health Sciences, asserted the role of puzzles as a formula that leads to solving problems and creative solutions. Puzzles solving and exposure makes the person: (a) concentrate and mull over problems; (b) question initial assumptions; (c) restate and reframe problems; (d) shift his mental perspective; (e) integrate brain function by uniting the activity of his right and left

hemispheres. Puzzles keep the brain young and agile by their challenging nature, that forces the brain to make new moves and connections.

Puzzles can also be used with children, they offer a plenty of educational help for young learners, such as “visual perception, eye-hand co-ordination, social development, and the development of specific mathematical concepts”, in addition to the targeted problem solving strategies(Fleer, 1990, p. 73). Others stated: “Our teaching experience strongly suggests that embedding puzzles in the curriculum enhances students’ learning by developing their general problem-solving and independent learning skills.”(Badger, Sangwin, Ventura-Medina, & Thomas, 2012, p. 1)

Other reasons that illustrate the importance of puzzles in the educational realm are presented by Michalewicz, the inventor of Puzzle-Based Learning approach, and his colleagues. They suggested that puzzles can serve as educational aids or diversion to the main presented courses. Puzzles can afford respite in a difficult course, and withdraw students’ boredom in a simpler course. They are useful in rising the students’ awareness about the future problems they will face after graduating. An appropriate puzzle course can help students “realize that they are capable of much more than they think, help them to frame problems in a useful way, and remind them of ways to deal with the kind of situations they will encounter later on in life”(Meyer III, Falkner, Sooriamurthi, & Michalewicz, 2014, p. 17).

Puzzles used in educational areas, or educational puzzles, represents an effective learning tool in different domains with different levels. They also represent an alternative teaching technique, that is preferable by teachers and learners. Teachers support the use of puzzles in the classroom as supplements to the methods they originally follow in the teaching process. That support was a result of puzzles easy handling nature and flexibility, and because they do not oppose any traditional way of teaching most teachers select and afraid of change. Students, or learners in general, also show acceptance to the use of puzzles in their learning

environments. Students grasp more effectively when they are interested in the presented course, and their interest raised in case they are motivated by the varied nature of the course. Puzzles are tools to change the rigid atmosphere that characterized usually the courses, and make it more enjoyable and competitive.

The aforementioned arguments represent a sample image of the utility educational puzzles hold. They also highlight the resourceful experience, noticeable number of groups and individuals have witnessed, by applying various formats of puzzles in their educational environments. This can illuminate the validity and usage of puzzles in learning curriculums, to those who are frustrated from integrating the educational puzzles, or underestimating their worthy noted outcomes.

Educational Puzzles Criteria

The scholars; Zbigniew Michalewicz and Matthew Michalewicz, in their book 'Puzzle-Based Learning: An introduction to critical thinking, mathematics, and problem solving' (2008), stated that puzzles should satisfy four criteria before being called 'educational' and integrated in the educational domain. Educational puzzles respect the four elements of: generality, simplicity, eureka factor, and entertainment factor. The independence factor is added lately, that is why it is mentioned separately.

Generality.

Itis the first criterion, educational puzzles should elucidate, in their content, the list of universal problem solving skills and basics. Learning to solve problems needs exposure to real problems, and by solving the puzzles they develop the needed abilities. Generality factor assures the involvement of general basic skills to students, when solving the puzzles.

Simplicity.

It means that educational puzzles should be easy to the instructor and the students. Concerning the instructor, the puzzles should be easy to state, so he can explain them to students and make them understand. Concerning the students, the puzzles should be easy to

remember, which raises the chance of remembering the solution method, i.e. the universal solving problem principles triggered by the puzzles.

Eureka factor.

The eureka moment describes the solution state a problem-solver witnessed unexpectedly after thinking and approaching the solution for a long time and from different angles. It happens suddenly and unintendedly, as a flash of light that crosses the darkness of usual thoughts and approaches. Educational puzzles should allow that by being frustrating and motivating in nature. They also should have elementary solutions that are not obvious to the solver.

Entertainment factor.

Educational puzzles should hold the sense of fun and entertainment. The problem solver should be interested and motivated when searching for the puzzle solution. This can be a result of the simple, frustrating, eureka allowing nature of puzzles, in addition to the entertainment environment the educational puzzles are presented in.

After the frequent applications and the development, the Puzzle-based Learning approach has known, a fifth criterion has been added to indicate the educational puzzles nature, and define them properly, for the better use in teaching and learning atmospheres. The fifth one is independence.

Independence.

The educational puzzles are not tied specifically to a certain problem solving field. They are not constrained by the nature of domain are presented in. For instance, in an English language classroom, the teacher is free when choosing the puzzle subject; such as history or basic mathematics (Falkner, Sooriamurthi, & Michalewicz, Teaching Puzzle-based Learning: Development of Basic Concepts, 2012).

Educational puzzles can play a major role in attracting students to courses, that they usually lose interest in (Falkner, Sooriamurthi, & Michalewicz, Teaching Puzzle-based

Learning: Development of Basic Concepts, 2012). The five fore mentioned criteria identify, in sum, the educational puzzles form for those who hold interest in using them as basic or supplementing tools in domains of teaching and learning. They form a guide for the appropriate use of different types of puzzles in the educational context.

Puzzle-Based Learning Approach

From the starting point up till now, educational curricula, systems, associations, and all other formulae of education have been holding the attempt of imparting knowledge from more knowledgeable entities to less knowledgeable individuals. This knowledge is, in sum, a massive amounts of information that cultivates the individuals and facilitates his life. The latter demands the individual to acquire and develop a range of thinking skills and capabilities, to overcome numerous problems and situations he faces during his life experience.

The skills an individual needs varies from critical thinking, to creative thinking skills and problem solving skills, and the skills educational prescriptions provide are constrained to logic thinking, memorizing, and recalling. A look on those skills shows a gap between what is offered and what is needed. This gap enlarged when students face real life problems, and they fail to solve them after applying the materials they learned in school or college courses and textbooks. For instance, in a job interview, students discover the ill preparation they have to address a real life problem. In an attempt to bridge that gap, the Puzzle-based learning approach was developed, in addition to other learning approaches that seek the same goal, and applied with positive results and outcomes.

What is Puzzle-based Learning Approach.

The term of Puzzle-Based Learning, that is used to name the approach, is taken from the term mentioned by Michalewicz & Michalewicz, in the book of ‘Puzzle-Based Learning: An introduction to critical thinking, mathematics, and problem solving’ published in 2008 (Badger, Sangwin, Ventura-Medina, & Thomas, 2012). And as it is mentioned before, it is an

approach that represents a serious attempt to address and bridge the educational gap. The Puzzle-based Learning approach “aims at encouraging students to think about how to frame and solve unstructured problems - those that are not encountered at the end of some textbook chapter”(ÖZTÜRK, GÖK, & TAKIMCIGİL, 2013, p. 49).

It aims pedagogically at increasing “students’ analytical awareness and general problem-solving skills by employing puzzles, which are educational, engaging, and thought provoking” (Michalewicz, Falkner, & Sooriamurthi, Puzzle-Based Learning: An Introduction to Critical Thinking and Problem Solving, 2011, p. 6). The entertaining engaging nature of puzzles permit them to be used as means to the Puzzle-based Learning “pedagogical end of fostering general domain-independent reasoning and critical thinking skills that can lay a foundation for problem solving in future course work”(Michalewicz, Falkner, & Sooriamurthi, Puzzle-Based Learning: An Introduction to Critical Thinking and Problem Solving, 2011, p. 7).

Puzzles have been used by teachers for teaching purposes for decades, and the Puzzle-based Learning approach has roots that extends to more than sixty years ago. Historical researches stated that the first mathematical puzzles are the ones found in the Sumerian texts, which is from circa and aged back to 2500 BC. Though, approximately the more significant trace of the Puzzle-based Learning approach can be illustrated by the works of the English scholar Alcuin, who was born around 732 AD. One of his main works is the volume entitled ‘Problems to Sharpen the Young’, encompassed about fifty puzzles. After about 1,200 years later, samples of Alcuin’s work are used in educational textbooks to educate students and boost their thinking skills. The ‘river crossing problem’ embodies a vivid example of Alcuin’s puzzles current use in various fields of education and science. (Falkner, Sooriamurthi, & Michalewicz, 2010).

Recently and before the termed approach was coined, formal and informal similar attempts that introduced puzzles in education have appeared in various places. Examples of

those trials were works of different instructors, such as; Michalewicz and Fogel in ‘How to solve it: modern heuristics’ (2000); puzzle-based problem solving for-credit courses have been presented by Ed Meyer at the Baldwin Wallace University (Ohio, USA) since 2002; and Levitin and Levitin’s ‘Algorithmic puzzles’ (2011). The Puzzle-based Learning has been offered, in various countries and contexts, as widespread novel seminar since 2009 to a verity of audiences from various levels and expertise. (Meyer III, Falkner, Sooriamurthi, & Michalewicz, 2014)

The Puzzle-based Learning approach refers to a foundational approach that aims at improving students thinking skills, and triggers the mental stamina and persistence at solving problems. It centers the interest on unstructured, unrestricted-knowledge context or domain, and frequently entertaining problems, which are branded as puzzles. This approach proposed a set of rules for solving puzzles and problems, which simplifies the task of teaching it. The rules correspond:

a. Understanding the given problem appropriately, in addition to the total basic terms and expressions that used to define it.

b. the incomplete reliance on intuition, because it may be deceivable; solid scheming is more reliable.

c. Modeling the given problem through variables, restraints, and objectives identification.

The Puzzle-based Learning approach wishes to lead students to thinking accurately about the way they should frame and solve unstructured descriptive problems. Setting the goal of stimulating students, and raising their problem solving skills and mathematical awareness by conferring a diversity of puzzles and their solution techniques and strategies. (Meyer III, Falkner, Sooriamurthi, & Michalewicz, 2014)

Puzzle-based Learning Approach Reputation.

Throughout the past years, the Puzzle-based Learning approach was applied in several educational settings, through variety of versions and formats. The approach authors have taught, long courses for a full semester, puzzle-based learning subjects. They also presented themed seminars, conferences, and workshops in numerous educational and professional environments around the globe.

Audiences with different careers; such as organizers, instructors and teachers, business leaders, and especially students have expressed great enthusiasm about the subject (Meyer III, Falkner, Sooriamurthi, & Michalewicz, 2014). Known universities and institutions in various places; such as the United States, the United Kingdom, Mexico, Argentina, New Zealand, Australia, South Korea, Japan, China, Poland, Sweden, Germany, Spain, Italy, France and the Middle-East (Qatar and Abu Dhabi), have held and welcomed workshops of the new emerging approach (Michalewicz, Falkner, & Sooriamurthi, Puzzle-Based Learning: An Introduction to Critical Thinking and Problem Solving, 2011; Michalewicz & Michalewicz, Puzzle-Based Learning: An introduction to critical thinking, mathematics, and problem solving, 2008).

The respectable reputation the Puzzle-based Learning is gaining, is not a matter of coincidence. It largely resulted from the solid ground, of the enjoyable and effective nature of puzzles, the approach is standing on. In addition to the invention motives of bridging the educational gap, and restoring the trustful status of validity that teaching systems held.

Though it is a new born item-approach in the educational gallery, the Puzzle-based Learning has held a remarkable place among other learning approaches, as an enjoyable substitution methodology to bridge the educational gap. The gap that arises as a result of the ongoing dissimilarity between what the scholastic systems offer and teach to students, and what real life problems demand from them, in terms of skills and capacities. Integrating this approach to the language learning sphere, for instance; the English language learning

profession, may solve plenty of difficulties and refresh the teaching learning atmosphere. It helps students by triggering the reasoning and remembering skills, concerning vocabulary and new concepts, and also critical and creative thinking skills, which strengthen their feedback and assessment rate.

Educational Puzzles Examples

To elucidate the meaning and construction of puzzles better, the educational puzzles archive offers a voluminous number of samples and examples of puzzles that can be used in multiple educational settings for multiple purposes. They are also appropriate for the reasonable entertainment use. The offered puzzles are suitable to enhance recipients' problem solving skills, thinking skills, and retention of the input information.

The Puzzles.

The following puzzles depict a sample of educational puzzles that can be integrated in the English learning context. They hold different values that allow them to join other second language teaching techniques. The puzzles are the crossing river problem, the M-heart-8 sequence, the man of the seventh floor, and the four nuts.

The river crossing problem.

The first puzzle is the "river crossing problem", which is one puzzle of the English scholar Alcuin's 'Problems to Sharpen the Young' volume. The puzzle tells:

A man has to take a wolf, a goat, and some cabbage across a river. His rowboat has enough room for the man plus either the wolf or the goat or the cabbage. If he takes the cabbage with him, the wolf will eat the goat. If he takes the wolf, the goat will eat the cabbage. Only when the man is present are the goat and the cabbage safe from their enemies. All the same, the man carries wolf, goat, and cabbage across the river. How has he done it? (Falkner, Sooriamurthi, & Michalewicz, Teaching Puzzle-based Learning: Development of Basic Concepts, 2012)

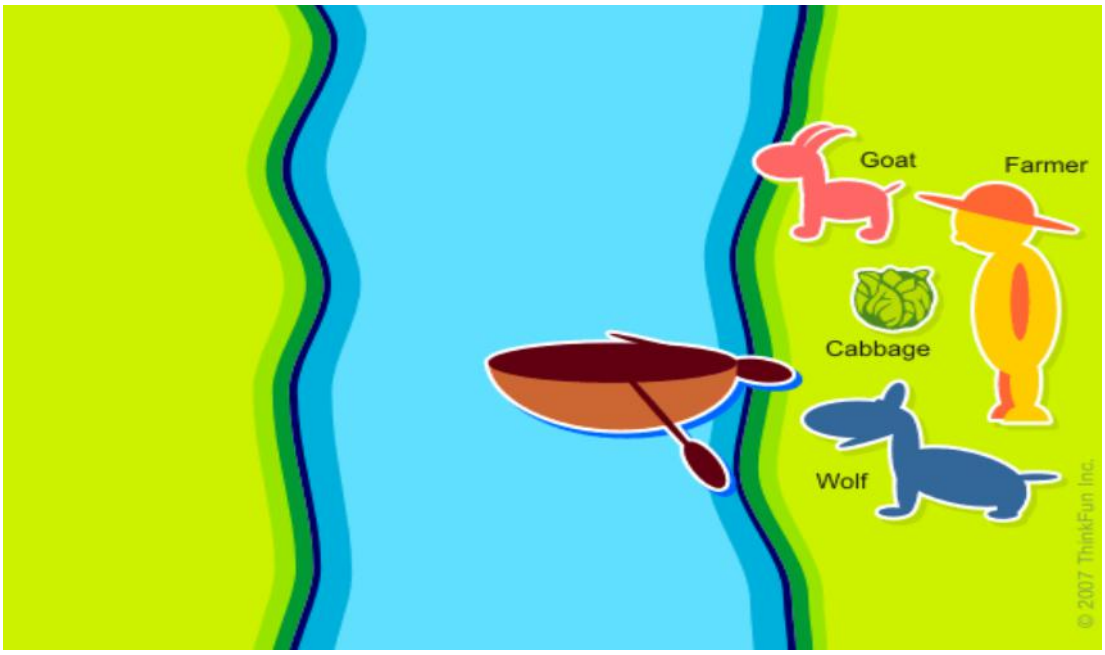


Figure 1: The river crossing problem.

The M-heart-8 sequence.

The second puzzle is known as the M-heart-8 sequence. This puzzle is a famous one in the English culture, because of its integration in one of the Fox Network's cartoon series "The Simpsons" episodes. Where, much was made of a character's failure to crack the puzzle, though others around her could simply find the solution. The puzzle appeared also in the book/film "The Oxford Murders".

The puzzle tells:

The following sequence of seven symbols is "meaningful" in the sense that it is not random:

Figure 2: The M-heart-8 sequence puzzle(Meyer III, Falkner, Sooriamurthi, & Michalewicz, 2014)

What is the next symbol in the sequence?

(Meyer III, Falkner, Sooriamurthi, & Michalewicz, 2014)

The man of the seventh floor.

The two following puzzles were presented by Edward de Bono's 'Six Thinking Hats' as lateral thinking puzzles, but they applicable to the current use. The man of the seventh floor puzzle tells:

A man lives on the tenth floor of a building. Every day he takes the elevator to go down to the ground floor to go to work. When he returns he takes the elevator to the seventh floor and walks up the stairs to reach his apartment on the tenth floor. He hates walking so why does he do it? Clue: on rainy days he goes up in the elevator to the tenth floor.

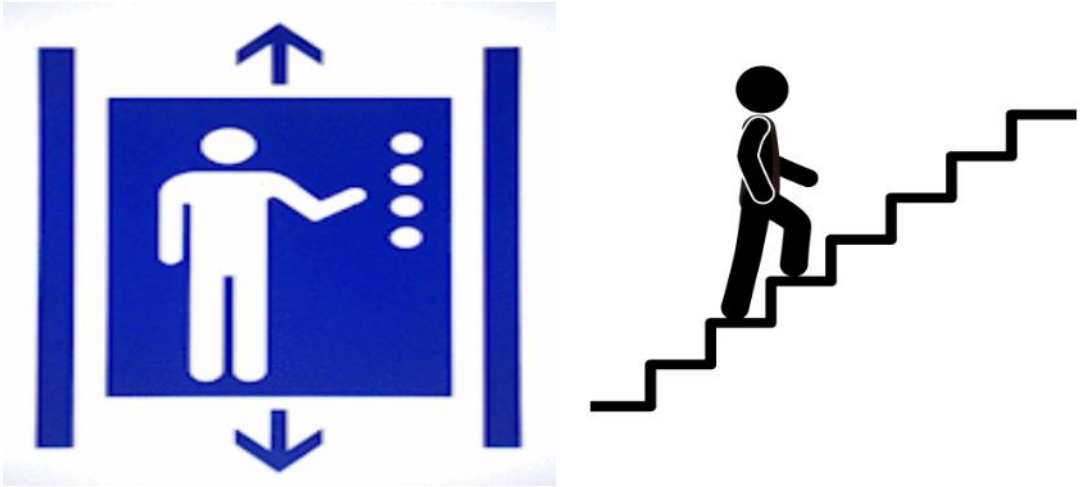


Figure 3: The man of the seventh floor puzzle

The four nuts.

This puzzle tells: A man is replacing a wheel on his car, when he accidentally drops the four nuts used to hold the wheel on the car, and they fall into a deep drain, irretrievably lost. A passing girl offers him a solution which enables him to drive home. What is it?

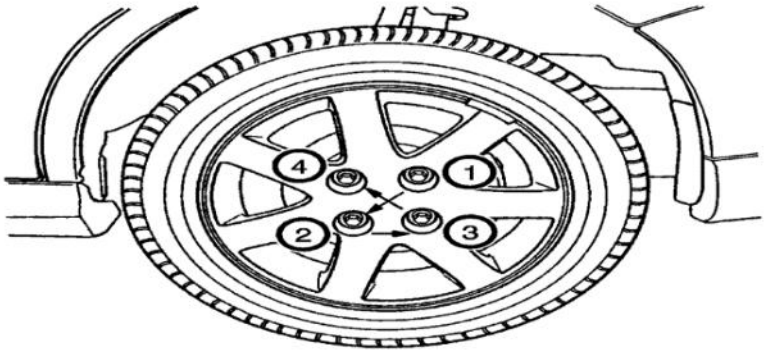


Figure 4: The four nuts puzzle.

The Solutions.

The puzzles' solutions are considered to be easy by some peoples, while others faced different degrees of difficulty in solving them. Those puzzles can be solved using mental capacities; such as: basic problem solving skills, prediction, critical and creative thinking, and imagination. They can also be solved by a sudden flashy answer or the eureka factor.

The river crossing problem's solution.

The man could succeed in moving the wolf, goat, and cabbage following a simple structure. He first moves the goat to the other side of the river, leaving the wolf and cabbage behind. Then he returns and takes the wolf to the other side, and retrieves the goat in return. He puts the goat on the shore and takes the cabbage to beside the wolf. Then he returns and brings the goat last.

The M-heart-8 sequence's solution.

The next sequence would be the symbol below, which is formed by the 8 number and its reflection. The given sequence is formed by pairs of 1, 2, 3, 4, 5, 6, 7 alongside their mirror reflections.

Figure 5: The M-heart-8 sequence's solution**.**

The man of the seventh floor's solution.

The man is dwarf and can only reach the elevator button for the seventh floor. On rainy days he uses his umbrella.

The four nuts.

He uses one nut from each of the other three wheels and fix the problem.

The set of the four mentioned puzzles, generally respect the educational puzzles criteria; that are: generality, simplicity, eureka factor, entertainment factor, and independency. They also can be classified, under more than one category, in the aforementioned categories; which are: Icebreakers, warm-ups, general puzzles, and discipline-specific puzzles. Regarding the current discipline context, all the cited educational puzzles serve the English language learning specific domain and its interests.

Conclusion

The educational field is full of approaches, methods, and techniques, that seek in sum the betterment of teaching and learning process. Using a verity of techniques in classroom teaching is of a paramount importance, because it retains the complexity of information and suits the diversity of stimuli types students respond to, such as verbal and visual (Davis, Shepherd, & Zwiefelhofer, 2009). Varying and changing the teaching techniques can also eliminate boredom and motivate students, by making them more interested in acquiring more information. The diversity of methods guarantees the involvement of all types of students;

such as shy, passive, active, bookworms, talented, and untalented learners. It also guarantees the involvement of teachers themselves, who become lazy and unmotivated when applying the unchanged repetitive methods and techniques.

An interesting technique, that have confirmed its utility and effectiveness, is the use of games. Games represent an alternative teaching and learning method, that can be used as supplements to the classroom main applied method, without discomfiting the teacherswith radical method change. They add flavor of freedom and flexibility to the classroom environment, by allowing students the chance of; adjusting how they learn best, work alone and on groups, and being creative while having fun and study. (Davis, Shepherd, & Zwiefelhofer, 2009)

The term ‘games’ generally refers to puzzles, which are the prominent used games in the teaching and learning grounds. Educational puzzles, as it is mentioned above, are operative techniques that can add significance, curiosity, and entertainment to the learning course. They help instructors in conveying various amount of information to students through a short an exciting way. The above reviewing information stressed the efficacy of educational puzzles as engaging, thought-provoking, and different subjects’ illustrative tools (Meyer III, Falkner, Sooriamurthi, & Michalewicz, 2014). The world wild practice and recognition of techniques based upon educational puzzles use, left no doubt for them to be neglected.

Chapter Three

Field Work

Field Work

Introduction

This chapter is devoted to discussing the results of the research. Thanks to the research tools that we adopted and refined over time, we have been able to collect verifiable data that corroborate our hypothesis and address the main questions. Besides educational puzzles worksheets and classroom observation that took over a period of seven sessions, we have interviewed, i.e., unstructured interview, to fathom students' creative thinking enhancement through puzzles.

We will start first by describing the procedure of the intervention and explain its steps and tools. Second, we will describe the results of gathered data numerically, and then discuss them and interpret their meanings. Moreover, the noted data from classroom observation and discussion will be further examined and interpreted.

Description of the Procedure of the Intervention

The procedure of this intervention consisted of two phases. The first phase was meeting the teacher of the written expression module along with the students-participants, while the second consisted of the sessions of puzzles solving. In the first session, the researcher met the students in order to introduce the research and its goals, as well as gaining their agreement on being part of it. First, the concepts of creativity, higher order thinking skills, were explained to them along with the difference between convergent and divergent thinking. Then, they were asked if they believe that they should enhance their creative thinking skills as tertiary students. The response was positive by all students; they expressed their interest and eager in becoming more creative individuals and students. The idea of using educational puzzles to reach that goal was introduced briefly after that, and the students demonstrated their enthusiasm for the upcoming sessions.

After gaining the students-participants agreement on being part of the research, a time-table was designed for the sessions that were allowed to have by the teacher of the

module. As a result of the lack of instructional time of the session for the research's intervention, the number of sessions was seven. This number serves overall plan of the research. The number of puzzles was raised per session, and the allocated time was used in the most efficient way in order to fill any possible gap.

The intervention was thus concluded within seven sessions. Each session was about an hour to an hour and a half long. All sessions took place in Bettaibi Complex (a language complex which is part of the faculty of Arabic Literature and Foreign Languages) in the University of Mohamed Kheidher of Biskra on Sundays at 8:00 and Wednesdays at 9:40. During each session, the students were asked to solve four or five different educational puzzles on a printed worksheet. A classroom observation on their attitudes and behavior was completed through a check-list, and a discussion was provoked during the correction by the end of the session.

It is worth considering that each session consisted of three phases: an introductory phase, a puzzle-solving phase, and a correction phase.

The Introductory Phase.

The objective of this phase was to warm up the students and make them feel relaxed prior to starting. We explained to them the type of puzzles of the session and the general guidelines they have to respect while answering.

The general guide lines are:

- Fill in the asked information.
- Follow your instructor lead.
- Try to focus and think outside your box.
- Use the paper as draft for your trials.
- Use the allocated time to each puzzle.

The Puzzle-solving Phase.

The puzzles sheets were distributed to the students-participants. Then, each puzzle was explained. Each puzzle timing was counted using a mobile phone timer. As soon as the time was finished, the sheets were retrieved from them. Checking on students took place in the classroom while the students were answering to take notes on their attitudes, behaviors, and reactions and to prevent them from sharing their ideas with their classmates.

The checklist of classroom observation.

The checklist included these elements of observation:

- Interest.
- Boredom.
- Engagement in answering.
- Discussion between classmates.
- Confusion.
- Use of allocated time.
- Use of helping devices such as calculators and smart phones.

Rate of asking questions for further explanations:

- The gender-effect on solving the puzzles.
- Other notes on attitudes and behavior.

The Discussion Phase.

After retrieving all the puzzles sheets, we gave students the solution of each puzzle. In some sessions, the students were involved in explaining and correcting the puzzles. After that, we discussed with them some issues such as the level of easiness or difficulty they believed the puzzles to be, the problems they faced, and their responses and reactions.

The Questions of Discussions were:

- Did you solve all puzzles?

- Did you enjoy the puzzles?
- Which puzzle(s) did you find to be easy and which did you find to be difficult?
- Was the allocated time enough for you to solve the puzzles?
- Which puzzle(s) required more time than the time you were allocated?
- Now after you have the keys to the puzzles, in case you were not able to solve the puzzle, do you think you were close to doing so?
- What are the problems you have faced in solving the puzzles?

Description and Interpretation of the Results

In this section, each session will be described along with introducing the given puzzles. At first, the numerical data will be analyzed following the assessment scale. Then, the description and interpretation of the results will be stated. Finally, the results of classroom observation and classroom discussion will be reported.

The intervention consisted of seven successive sessions of puzzle-solving. Each session included four purposely-selected, accordingly-organized educational puzzles. In order to test and enhance the students-participants creative thinking skills, the puzzles focused on the four major acknowledged features of creativity: fluency, flexibility, originality, and elaboration.

- **Fluency:** which refers to the quantity of the given relevant answers.
- **Flexibility:** which refers to the variability of idea categories in the answers.
- **Originality:** which refers to the rarity or uncommonness of answers.
- **Elaboration:** which refers to the complexity and completeness of answers.

The Assessment Scale.

The assessment scale consisted of testing and grading four principle elements of creative thinking: fluency, flexibility, originality, and elaboration.

Fluency.

If the puzzle demands multiple solutions, participants who provided at least three relevant solutions were considered to be fluent in thoughts. If the puzzle demands only one solution, the fluent participant is who gave more than one trial.

Flexibility.

If the puzzle has varied answers, participants who gave at least three different solutions were considered to be flexible in thoughts. If it has not, two different attempts ore more given by the participant made him flexible in thoughts.

Originality.

Participants who provided one original solution or more were considered to be original in thoughts. If the puzzle demands one solution, originality means the right answer.

Elaboration.

Participants who were able to further elaborate their solutions as in adding details, titles and/ or explanations, were considered to be elaborative in thoughts.

The First Session.

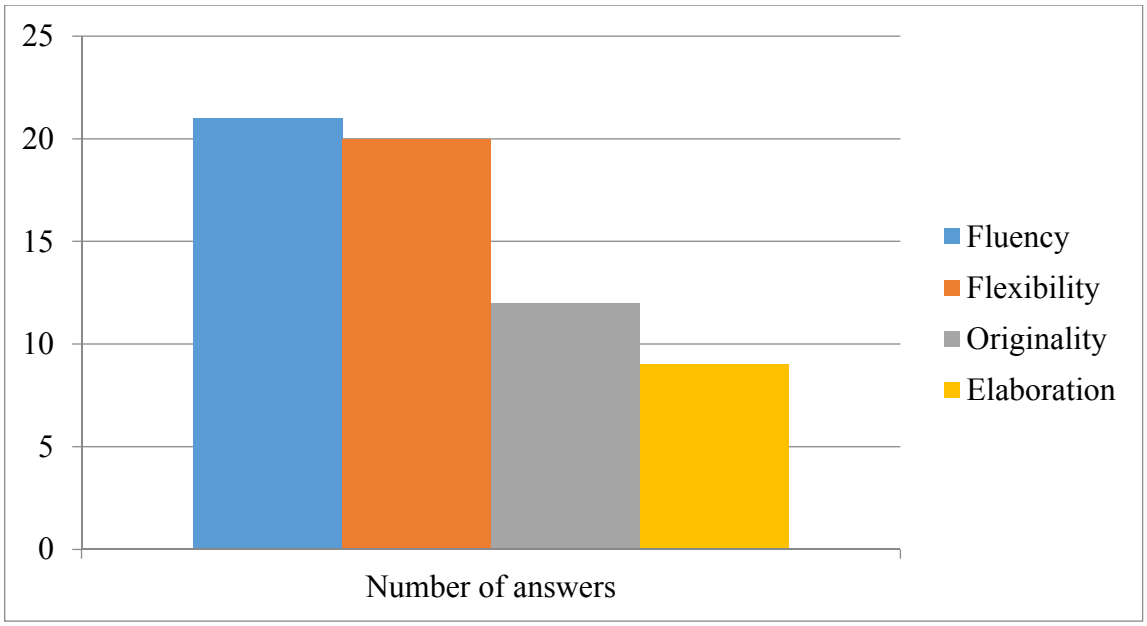
During the first session, we focused primarily on setting a relaxed mood among the students-participants. We explained that the purpose behind these puzzles is not to test or grade them, but rather to improve their abilities of thinking creatively. After ensuring that the students were comfortable and at ease, we explained to them the assessment scale for the given activities. At last, we told them that a timer will be used to ensure that they only use the allocated time. It is worth mentioning that the number of the students-participants who were present in this session was 29. The puzzles which were used in this session are extracted from the TTCT.

Activity 1.

Try to improve this stuffed toy rabbit so that it will be more fun to play with. You have 3 minutes.

Figure 6: Puzzle 1 of session 1

This activity triggers the participant's ability to develop and play with ideas.



Graph1: Answers of puzzle 1 of session 1

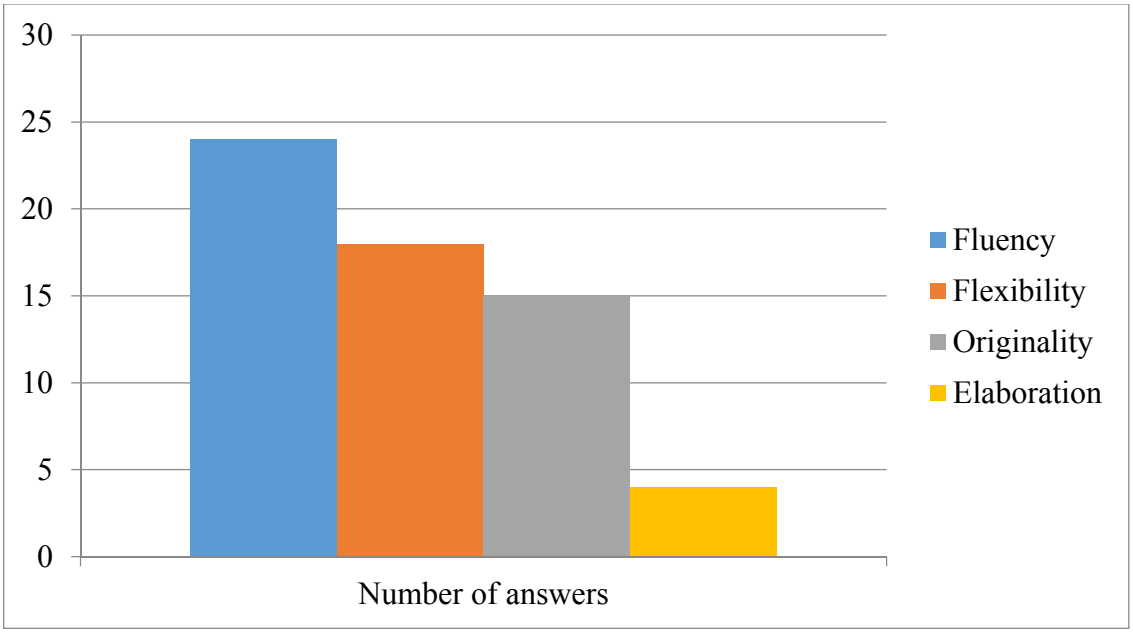
The majority of participants (21), estimated at 72.4%, provided fluent answers. Followed by 20 participants, estimated at 68.9 %, whose answers were flexible. As for participants who gave original answers, they were 12, estimated at 41.3%. At last, participants who succeeded at providing elaborate answers were 9, estimated at 31%.

Activity 2

Just suppose that you are magician. What might be some things that would happen as a result? You have 3 minutes

Figure 7: Illustrative figure of puzzle 2 of session 1

This activity is a test for 'playing with ideas and consequences' capacity and imagination.



Graph 2: Number of answers of puzzle 2 of session 1

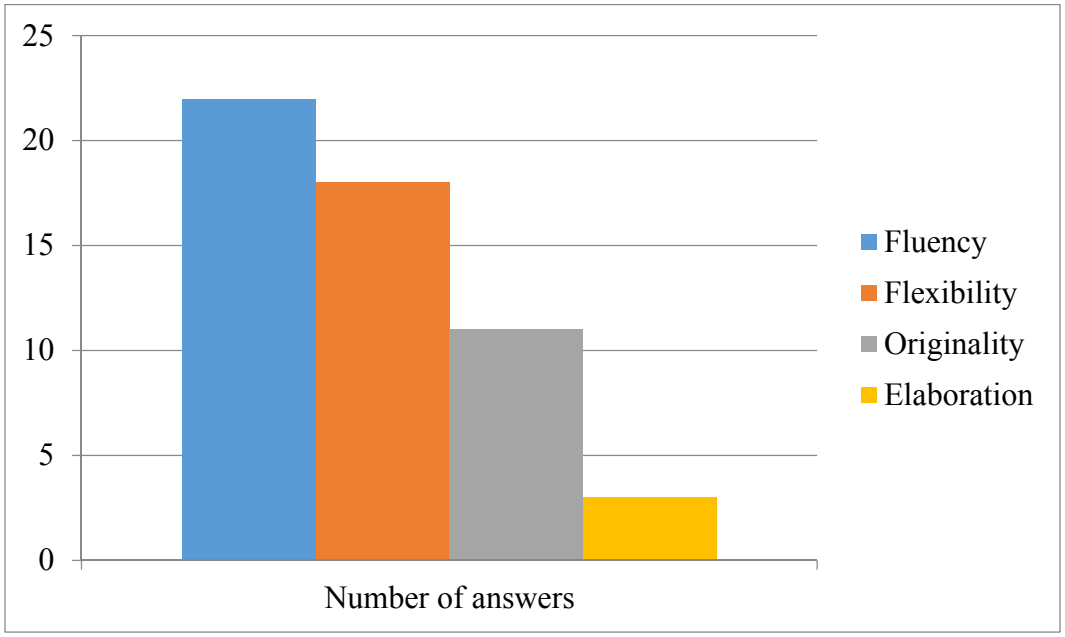
The majority of participants (24), estimated at 82.7% provided fluent answers. Followed by 18 participants, estimated at 62%, who succeeded at providing flexible answers. The participants who gave original answers were 15, estimated at 51.7%. At last, only 4 participants, estimated at 13.7%, succeeded to provide elaborate answers.

Activity 3

What is the maximum number of unusual uses of your pencil? You have 3 minutes.

Figure 8: Illustrative figure of puzzle 3 of session 1

This activity tests the participant's ability to think originally.



Graph 3: Number of answers of puzzle 3 of session 1

The majority of participants (22), estimated at 75.8%, succeeded at providing fluent answers. Followed by 18 participants, estimated at 62% who provided flexible answers. Eleven participants, estimated at 37.9%, gave original answers. Only three participants, estimated at 10.3%, gave elaborate answers.

Activity 4

Add lines to the incomplete figures below to make pictures out of them. Try to tell complete stories with your pictures. Give your pictures titles. You have 3 minutes.

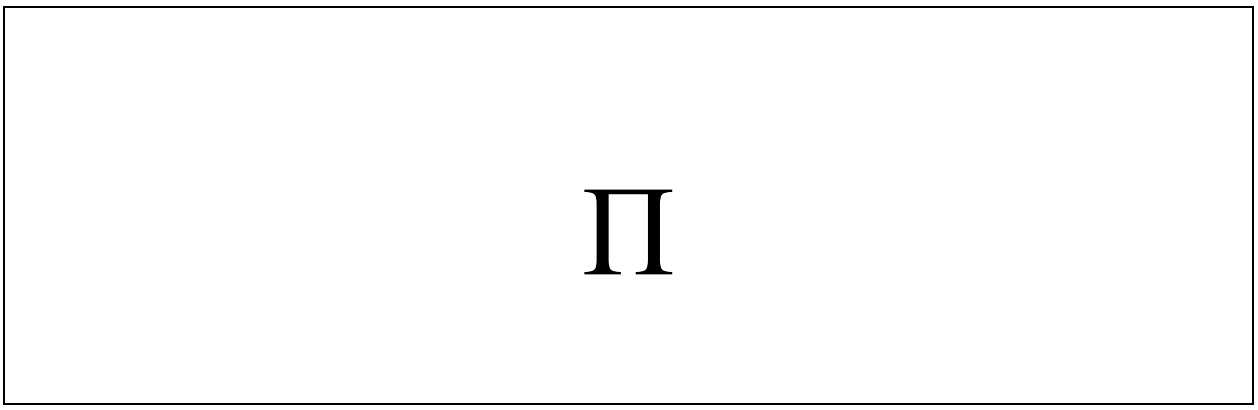
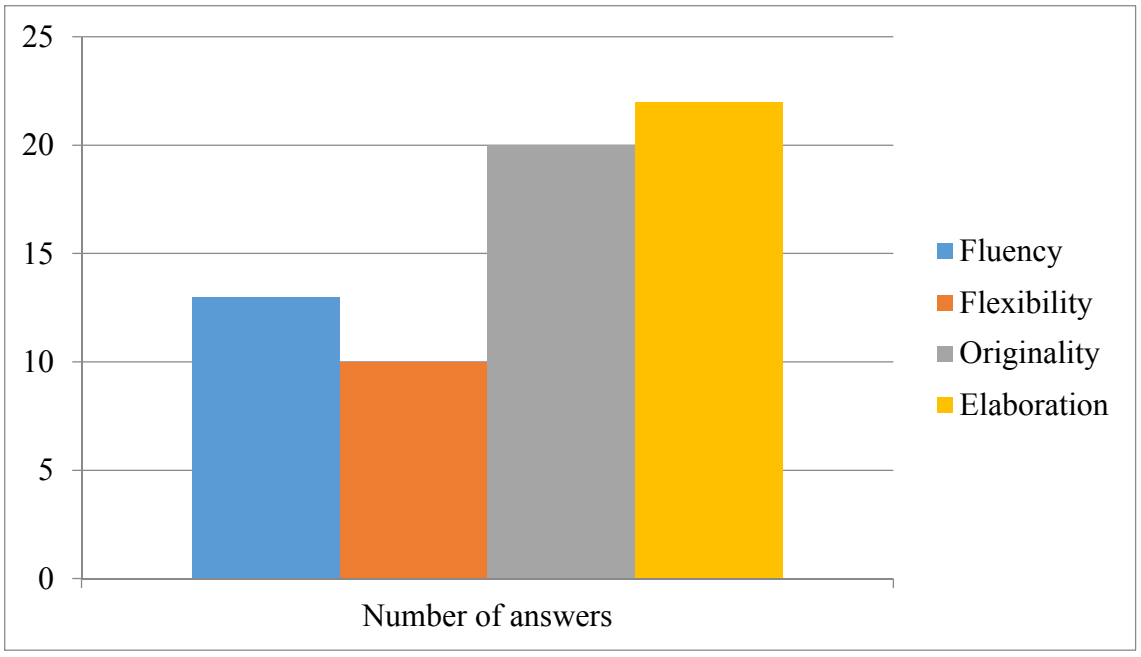


Figure 9: Puzzle 4 of session 1



Graph 4: Number of answers of puzzle 4 of session 1

The majority of participants (20), estimated at 68.9%, succeeded at providing original answers. Followed by 20 participants, estimated at 75.8% who gave elaborate answers. Thirteen participants, estimated at 44.8%, gave fluent answers. At last, ten participants, estimated at 34.4%, succeeded at providing flexible answers.

Activity 5

Add details to the shapes below to make pictures out of them. Make the diamond apart of any picture you make. Try to think of pictures no one else will think of. Add details to tell complete stories with your pictures. Give your pictures titles. You have 3 minutes.

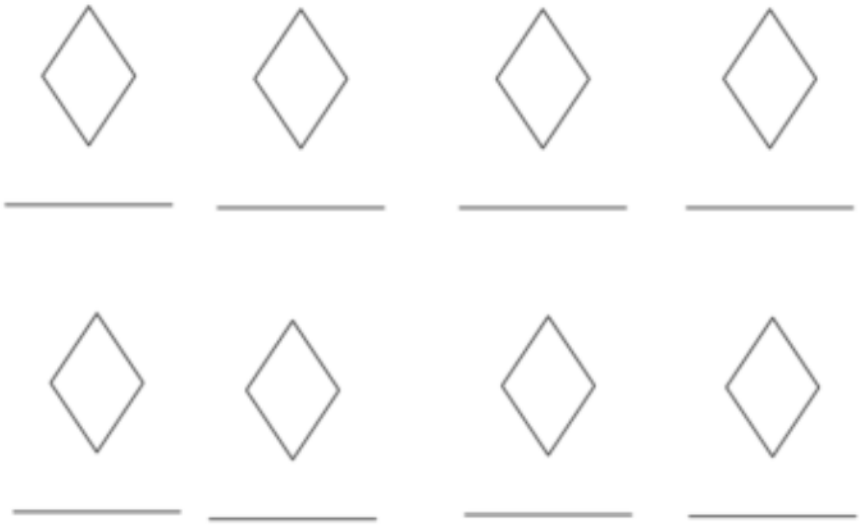
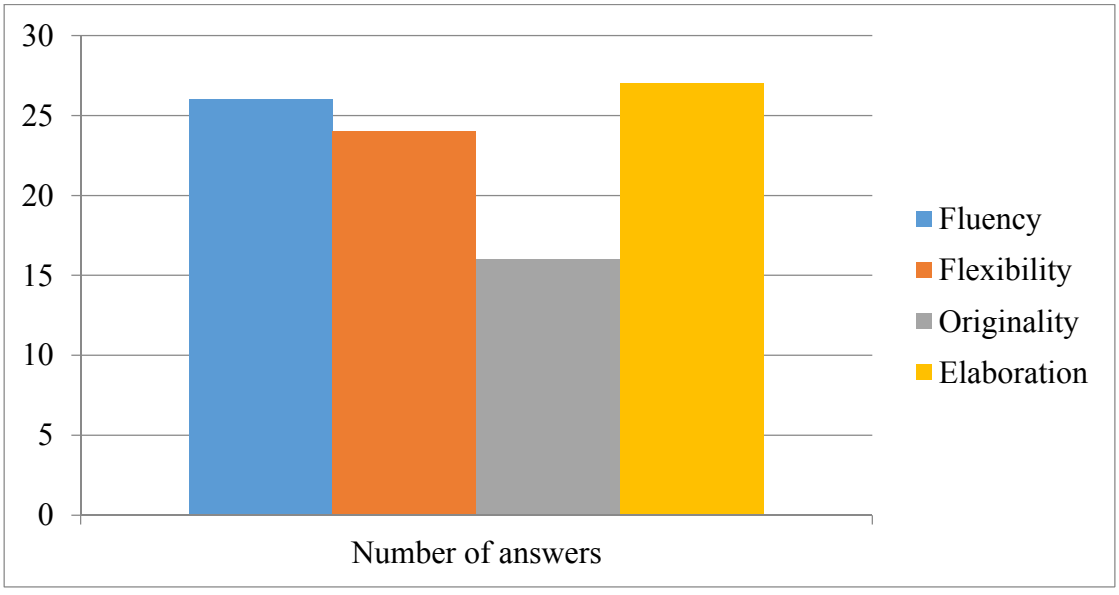


Figure 10: Puzzle 5 of session 1

This activity requires the ability to return to the same stimulus over and over, perceiving it differently each time.



Graph 5: Number of answers of puzzle 5 of session 1

The majority of participants (26), estimated at 93.1%, succeeded at providing elaborate answers. Very closely, 26 participants, estimated at 89.6%, provided fluent answers. The participants who gave flexible answers were 24, estimated at 82.7%. At last, sixteen participants, estimated at 55.1%, succeeded at giving original answers.

Commenting on Classroom Observation.

The students-participants demonstrated to be very curious about the educational puzzles. They were interested in finding the possible solutions of each puzzle in the shortest possible time. The students who were not able to find the solutions kept asking for further clarifications. At first, we explained the instructions of the tasks in different ways so that to make sure that all students understood well. Then, we clarified to them that not knowing the answer does not mean not understanding the instruction. After some encouragements, the students started to try harder to find the solutions. In this session, the students demonstrated to be engaged in answering; they were mostly discussing the answers with their classmates, or focusing on the tasks. The first puzzle confused some students more than the other puzzles. It is worth mentioning that males were more interested and could solve the fourth puzzle more than females.

Commenting on Classroom Discussion.

Due to the enthusiasm showed by the students, most of them engaged in answering the questions of the discussion. When it comes to the allocated time, some students answered that it was not enough while others said that it allowed them to think faster. All students agreed that it was the first time they deal with such educational tool. As a result, they did not perform at their best. When we asked them about the difficulties they faced while solving the puzzles, they answered that the situation of having to solve a problem in such a short time was new to them; they do not do such tasks usually as a part of their classroom instruction. The students also clarified that they enjoyed the session greatly, and that they would love their teachers to implement such a tool in classrooms.

The Second Session.

During the last session, we observed that the students-participants were welcoming of the idea of solving educational puzzles. Thus, we continued our intervention for the second session. For the sake of developing their creative thinking skills, we used a new and different set of educational puzzles which were a bit more difficult that those which were used in the first session. It is worth mentioning that the number of the students-participants who were present in this session was 28.

Puzzle 1.

Can you connect all nine dots by drawing four straight lines without lifting your pencil?

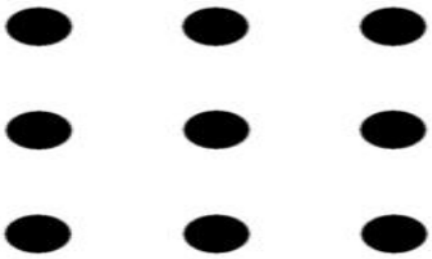
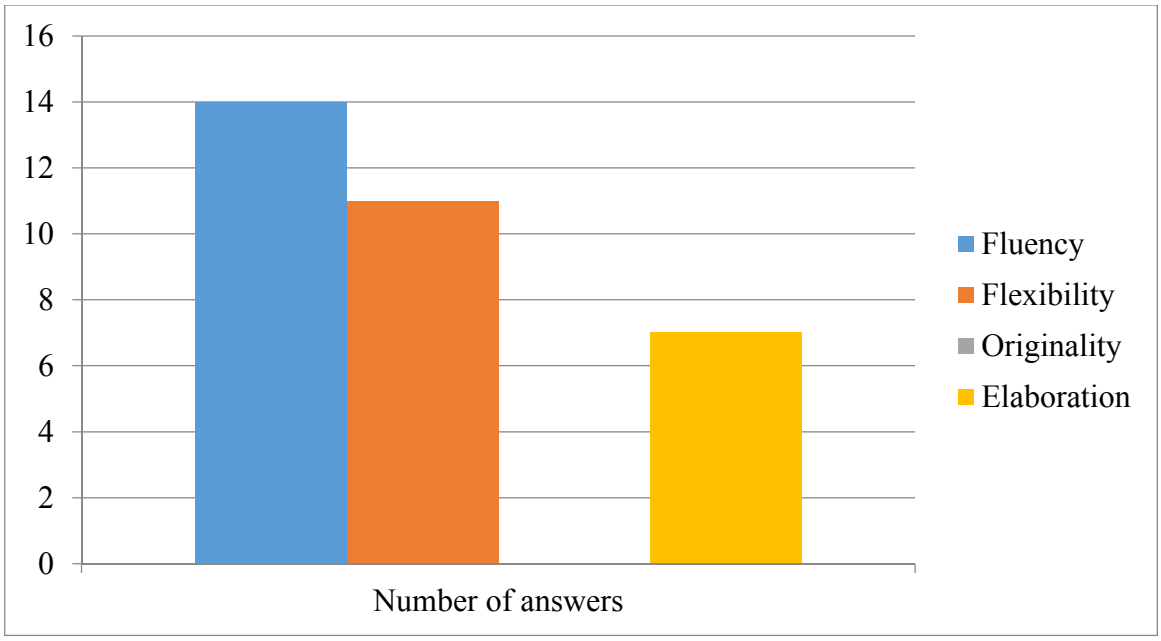


Figure 11: Puzzle 1 of session2

This classic puzzle is also known as the Nine Dots Puzzle. It is believed that the phrase “think outside the box” is based on the solution though the puzzle itself is much older than the phrase. Some historians attribute the puzzle to the English author and mathematician Henry Ernest Dudeney (1857 – 1930), who sometimes used the pseudonym ‘Sphinx’. It also appeared in Sam Lioyd’s 1914 Cyclopedia of Puzzles entitled ‘Christopher Columbus’s Egg’ (Meerman, 2008). Its unusual solution triggers the creative thinking skills.



Graph 6: Number of answers of puzzle 1 of session 2

The majority of participants (14), estimated at 50%, provided fluent answers. Followed by eleven participants, estimated at 39.2% who gave flexible answers. Seven participants only succeeded at providing elaborate answers. However, no participants gave an original answer.

Puzzle 2.

Three switches outside a windowless room are connected to three light bulbs inside the room. How can you determine which switch is connected to which bulb if you may enter the room only once?

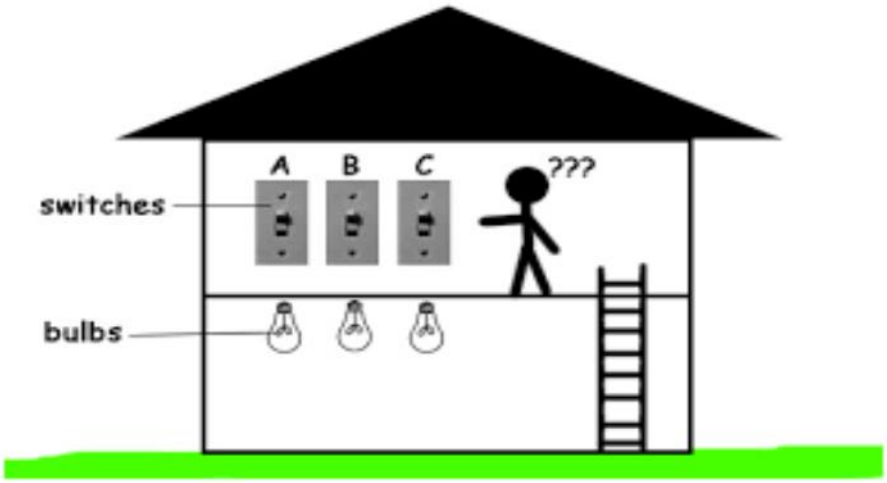
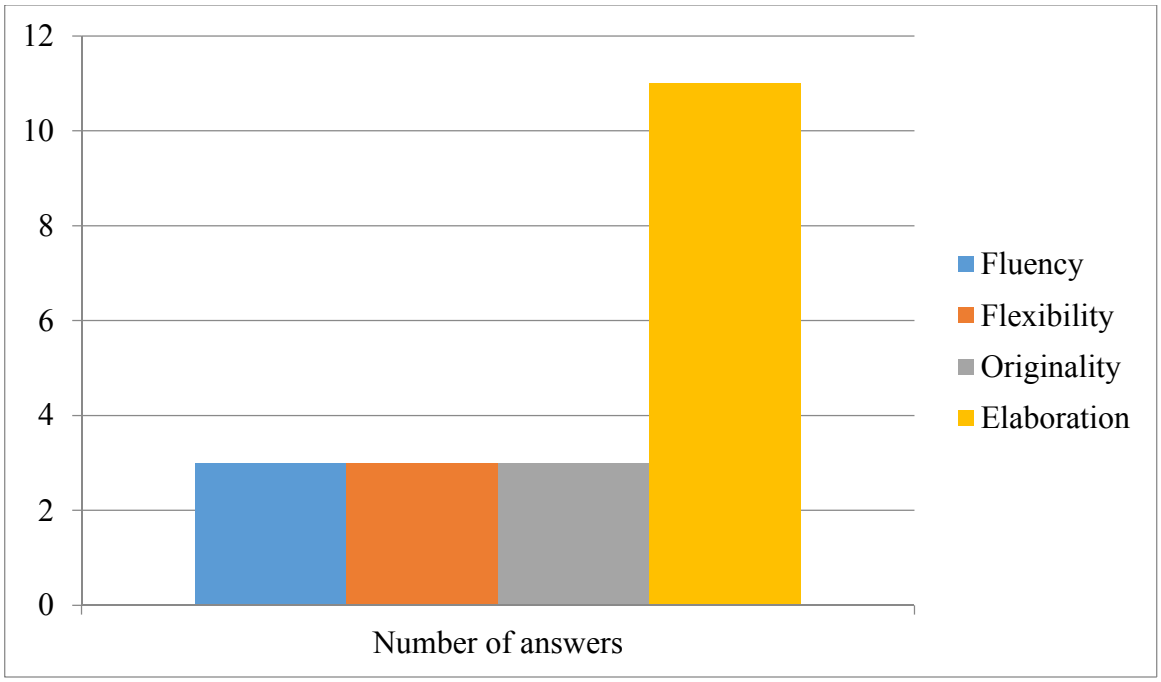


Figure12: Illustrative figure of puzzle 2 of session 2



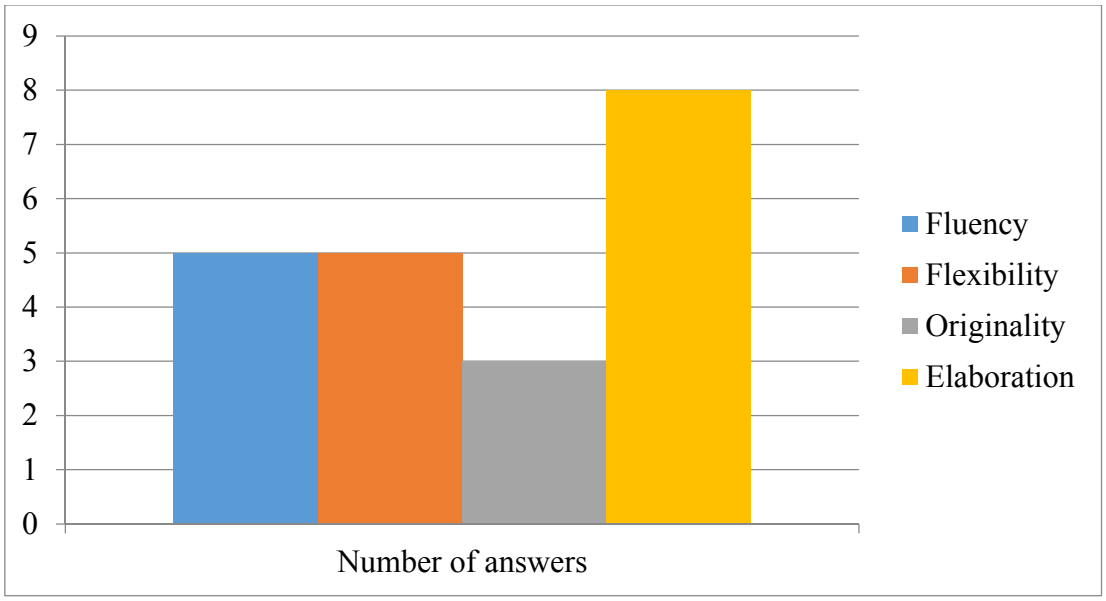
Graph 7: Number of answers of puzzle 2 of session 2

The majority of participants (11), estimated at 39.2% succeeded at providing elaborate answers. Three participants, estimated at 10.7%, gave fluent answers. Another three participants as well, estimated at 10.7%, gave flexible answers. However, only three participants only, estimated at 10.7%, succeeded to provide original answers.

The solutions given by the participants were in discussion format. The students asked for permission then gave their suggestions. The right answer was given at the end of the discussion. Eleven students gave elaborative answers; however, they were all wrong. Three of them tried for a second time, but failed. Two other female students gave wrong and un-elaborative answers. At last, three female students succeeded at finding the right answer.

Puzzle 3.

Suppose that you have only two egg timers, a 5-minute and a 3-minute. Can you use these two measuring devices to time an egg that must be boiled for exactly 2 minutes?



Graph 8: Number of answers of puzzle 3 of session 2

The majority of participants (8) estimated at 28.5%, succeeded at providing elaborate answers. Followed by five participants, estimated at 17.8% who gave fluent answers. Another five as well gave flexible answers. Only three participants, estimated at 10.7%, succeeded at providing original answers.

The answers for this puzzle were mainly found in the discussion phase. Three participants gave the right solution in the allocated time. Two female participants found the solution after one trial while one female participant succeeded after two trials. On the other hand, seven participants including five females and one male participated in the discussion, but failed to provide the right solution.

Puzzle 4.

A man is replacing a wheel on his car, when he accidentally drops the four nuts used to hold the wheel on the car, and they fall into a deep drain, irretrievably lost. A passing girl offers him a solution which enables him to drive home. What is it?

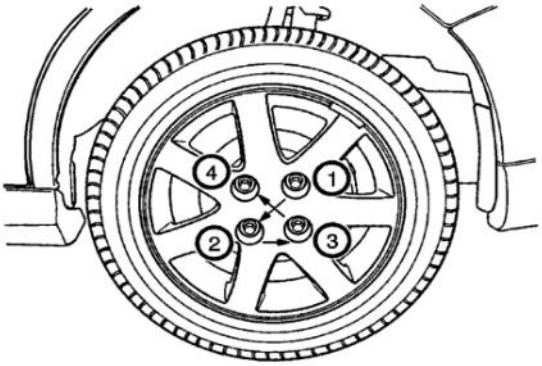
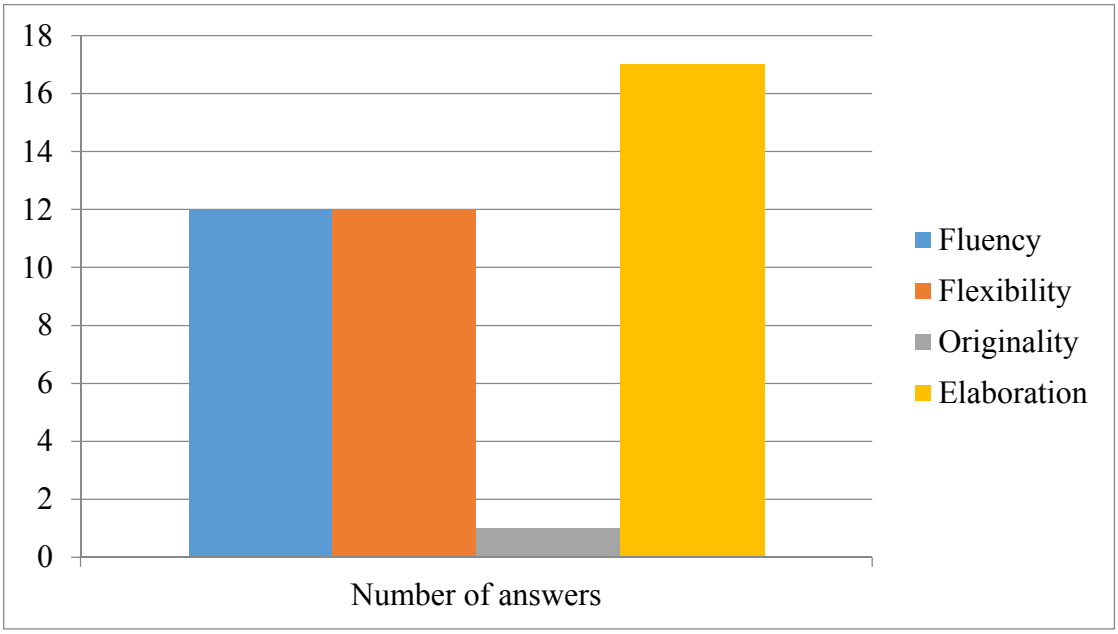


Figure.13: Illustrative figure of puzzle 4 of session 2



Graph 9: Number of answers of puzzle 4 in session 2

The majority of participants (17), estimated at 60.7%, succeeded at providing elaborate answers. Twelve participants, estimated at 42.8%, gave fluent answers. Another twelve participants as well gave flexible answers. Only one participant, estimated at 3.5%, succeeded at providing an original answer.

This puzzle was solved during the discussion phase. The majority of the students-participants failed at finding the right answer. Twelve participants, estimated at 42.8%, tried twice while four of them tried only once. Only one female student succeeded at finding the right solution.

Commenting on Classroom Observation.

The students-participants demonstrated to be quite interested; however, they felt a bit confused and they started asking for further explanation. As for the two first puzzles, the students drew different and funny shapes. Most of them were patient and did not give up. Others felt nervous because they could not connect all nine dots as they were asked. Though they used more than the allocated time, they all failed to answer the first puzzle. On the other hand, one student succeeded to find the solution of the second puzzle. As for the last two puzzles, some students appeared to be very enthusiastic about them while others demonstrated signs of boredom. They said that they did not want to think of an answer and that the puzzles were meaningless. They also claimed that they did not want to think neither inside the box nor outside it. Those who were interested started discussing between them hoping to find the right answer. One participant succeeded to answer the third puzzle, she could find the answer easily without further explanation. However, all of them were not able to answer the fourth puzzle though they were given more time. They were allowed to use helping devices, but that did not help them much. The result was that no one could find the solution of the last puzzle.

Commenting on Classroom Discussion.

During the discussion, the students-participants clarified that they found both puzzles to be difficult. They asked for further clarifications. It was clear that the obstacle was not time-related but idea-related. The second puzzle was even explained in their mother-tongue language (Arabic). The translation did not make a difference; however, one participant was close to the answer. The students agreed that the first puzzle was complicated and that they did not understand the instructions enough. As for the third puzzle, as soon as it was explained, one participant shouted the answer immediately which made the rest of the participants upset as they wished to find the right answer by themselves. As for the fourth puzzle, the students said that the allocated time was not enough. Some of them were reluctant to find a solution; therefore, they started mentioning silly answers.

The Third Session.

We have noticed that the students were enjoying the puzzles and that they are trying hard to improve their creative thinking skills. For the purpose of not losing their enthusiasm, we decided to opt for a new type of puzzles. In this session, we handed to them four educational puzzles consisting mainly of shapes which are made of matches. The objective was for them to move, remove, and/ or add a match or more to change the original shape into a different one. We believed that this type of puzzles would bring an element of novelty and curiosity among the students. The puzzles of this session are selected from Puzzle.com Web page. It is worth mentioning that the number of the students-participants who were present in this session was 22.

Puzzle 1.

Form the depicted bird with ten matches and a button as shown. Move two matches and a button to make the bird looking in another direction. The object is to move 2 matches to get the cherry outside the glass. At the finish, the glass may be turned in any direction, but it must be exactly the same shape as before.

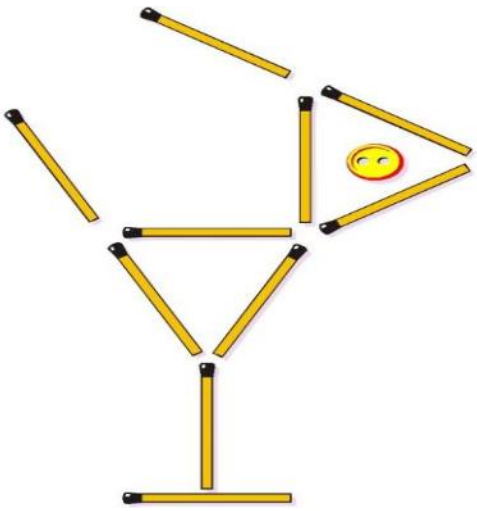
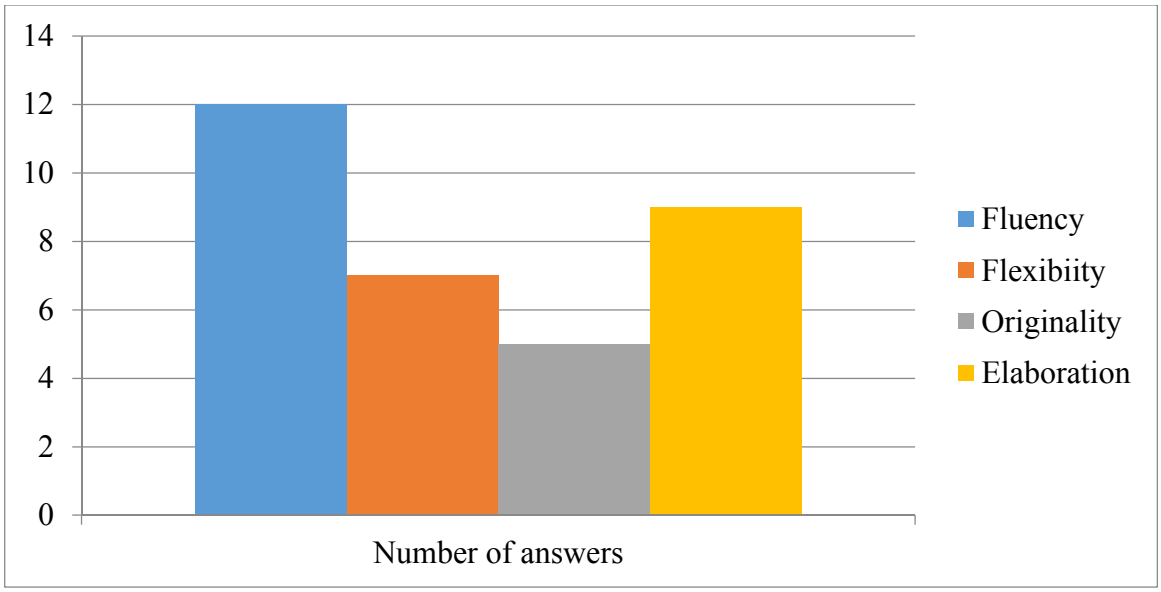


Figure 14: Puzzle 1 of session 3



Graph 10: Number of answers of puzzle 1 of session 3

The majority of students (12), estimated at 54.5%, provided fluent answers. Followed by 9 students, estimated at 40.9% who gave elaborate answers. Seven students, estimated at 31.8%, gave answers which were flexible. Only five students, estimated at 22.7%, succeeded at providing original answers.

Puzzle 2.

The object is to move 2 matches to get the cherry outside the glass. At the finish, the glass may be turned in any direction, but it must be exactly the same shape as before.

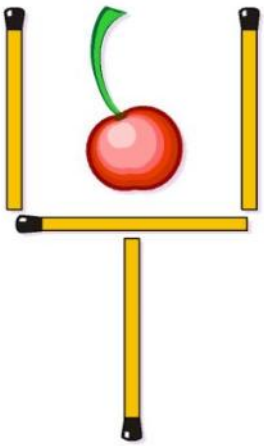
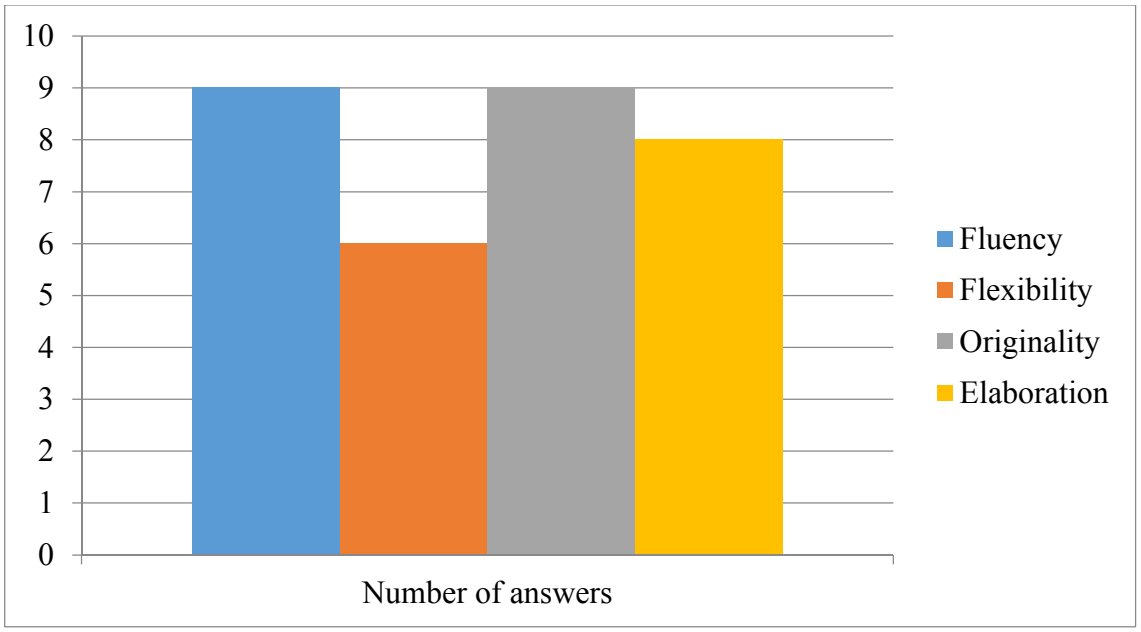


Figure15: Puzzle 2 of session 3



Graph 11: Number of answers of puzzle 2 of session 3

The majority of students (9), estimated at 40.9%, provided fluent answers. Another nine as well succeeded at providing original answers. Closely, 8 students estimated at 36.3% gave answers which were elaborate. Only six students, estimated at 27.2%, succeeded at giving flexible answers.

Puzzle 3.

Move only three matches so that the bat will fly in another direction.

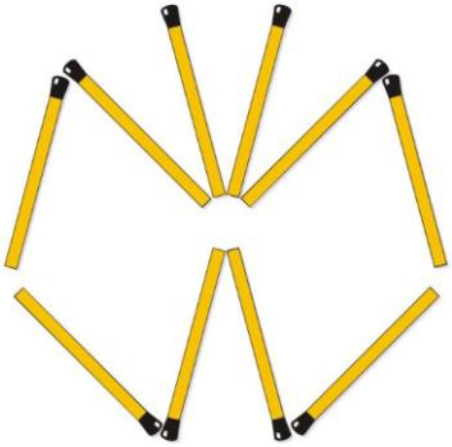
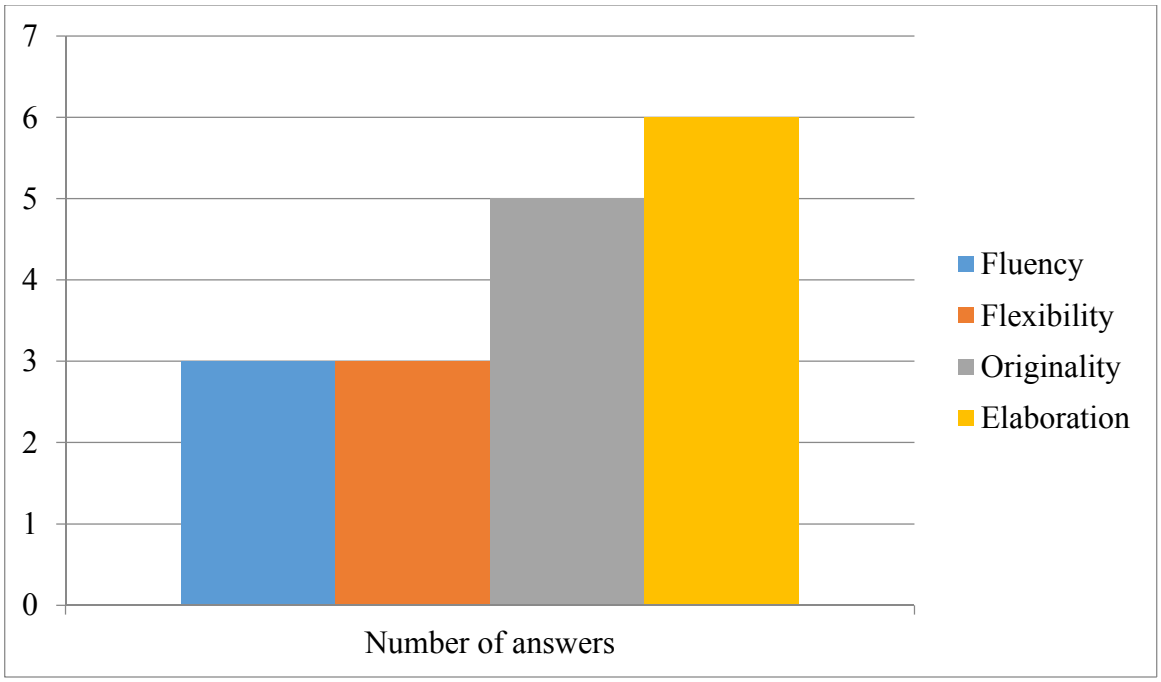


Figure 16: Puzzle 3 of session 3



Graph 12: Number of answers of puzzle 3 of session 3

The majority of students (6), estimated at 27.2%, gave elaborate answers. Closely, five students, estimated at 22.7%, succeeded at providing original answers. Three students, estimated at 13.6%, gave fluent answers. Another three as well gave flexible answers.

Puzzle 4.

Arrange seven matches and a button to form the hedgehog shown in the illustration.

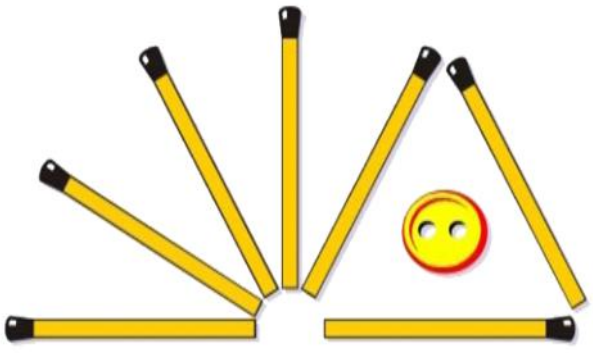
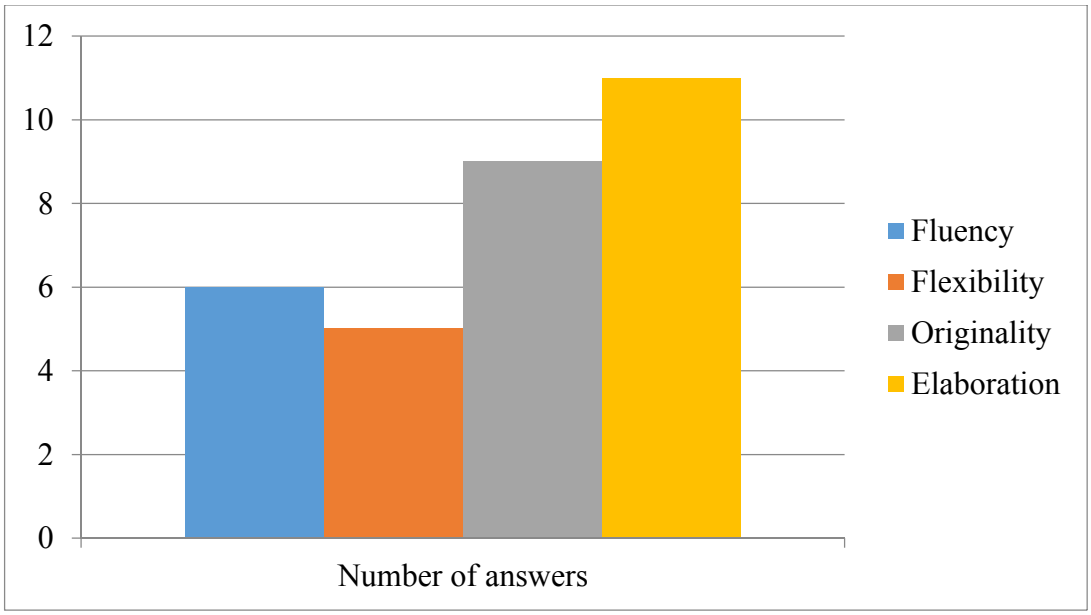


Figure17: Puzzle 4 of session 3



Graph 13: Number of answers of puzzle 4 of session 3

The majority of students (11), estimated at 50% provided elaborate answers. Followed by nice others, estimated at 40.9% who succeeded at providing original answers. Six students, estimated at 27.2%, gave fluent answers. Only five students, estimated at 22.7%, provided flexible answers.

Commenting on Classroom Observation.

The students-participants demonstrated to enjoy this type of puzzles because the instructions were simple and clear. Having to move a few sticks and/ or add or remove others appeared to grab their attention and enhance their pleasure. They were quite interested in each puzzle especially the first and the third even though they solve them with some difficulty. Some students could not finish within the allocated time and asked for a minute or two as prolongation. They were given permission to use two extra minutes only. Most students asked for further clarification for each puzzle. Sometimes, we had to explain the same instruction for more than five or six times. For the sake of simplifying the tasks' instructions, we used mathematical equations. The first and the third puzzles seemed to confuse students more than the second and the fourth. All students were engaged in answering; they did not give up at their first trials and kept drawing new shapes until the allocated time was over. It is worth

mentioning that three female participants were sitting near each other and working collaboratively. One of them was able to find the solutions at first or second trial only.

Commenting on Classroom Discussion.

The discussion during this session took most of the instructional time. We observed the students' increased interest in this type of puzzles; thus, we included them in explaining and correcting the puzzles. Instead of reading the instruction of each task, we asked them to volunteer and read them aloud. Then, we asked them to explain it to their classmates. When asked about the allocated time, the students responded that they needed more time for such puzzles as they were drawing new shapes every time. They said that even though the trails were numerous and tiring, they enjoyed them once they found the solution. In order to add an element of competition, we told the students that the first one to find the solution would write it on the board. As a result, each student who found a right answer would rush to write it n the board and explain it to his/ her classmates. The students who did not find the solutions, said that they were so nervous and exited to find the answer that they lost their focus. At last, they all agreed that discussing the answers with their classmates increased their engagement and interest and suggested to do the same for the upcoming sessions.

The Fourth Session.

During the previous session, we observed the students' increased interest in sticks puzzles. They have stated that they preferred this type of puzzles due to their limited instructions. In order to take their preferences into considerations as well as continue working on the research's objectives, we selected a set of puzzles which contained two new puzzle types, and two sticks puzzles. We were aware that familiarity and repetition may bring an element of boredom to the students as a possible implication. Moreover, we needed to ensure the students that this research is for their benefit, and that their suggestions will be taken into consideration. Furthermore, since this was the fourth session, we assumed that the students would be used enough to different types of puzzles. An important note for this session was

that we informed the students that we would be strict on the use of the allocated time as they can only start after the tasks have been explained. At last we opted for the open discussion and self-correction by the students themselves as it has been proved to be effective previously.

Puzzle 1.

Take a look at these two identical triangles. They are made with six sticks. Can you rearrange the sticks so that they form four triangles? All of the new triangles must be the same size as these original two.

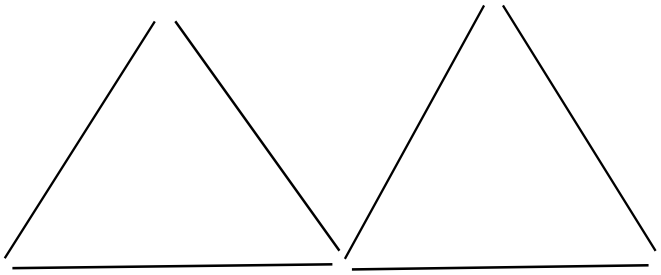
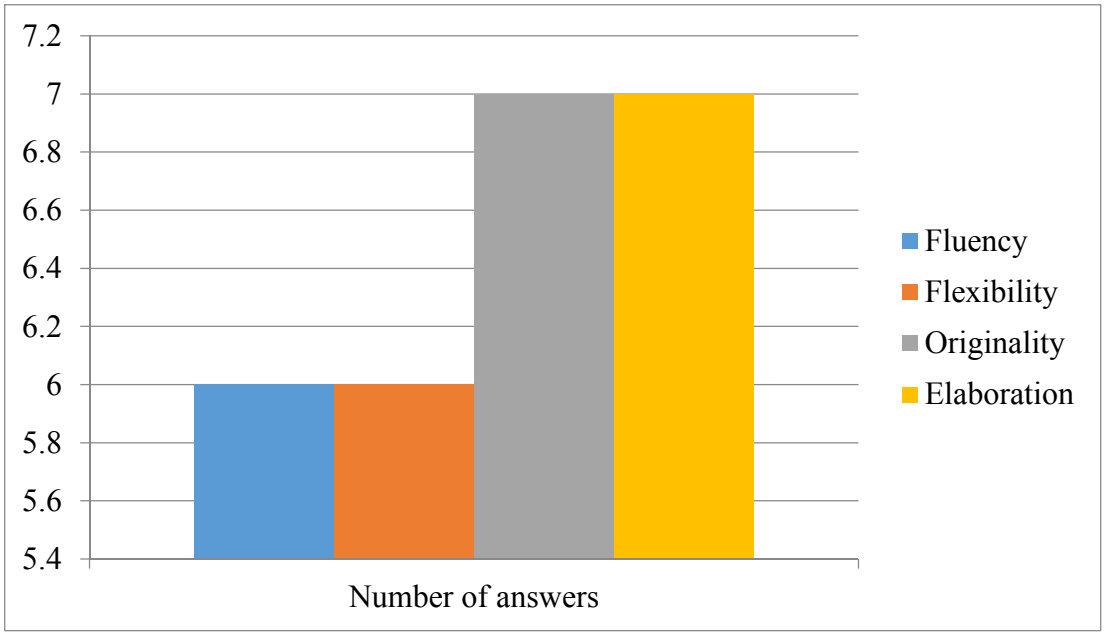


Figure 18: Puzzle 1 of session 4

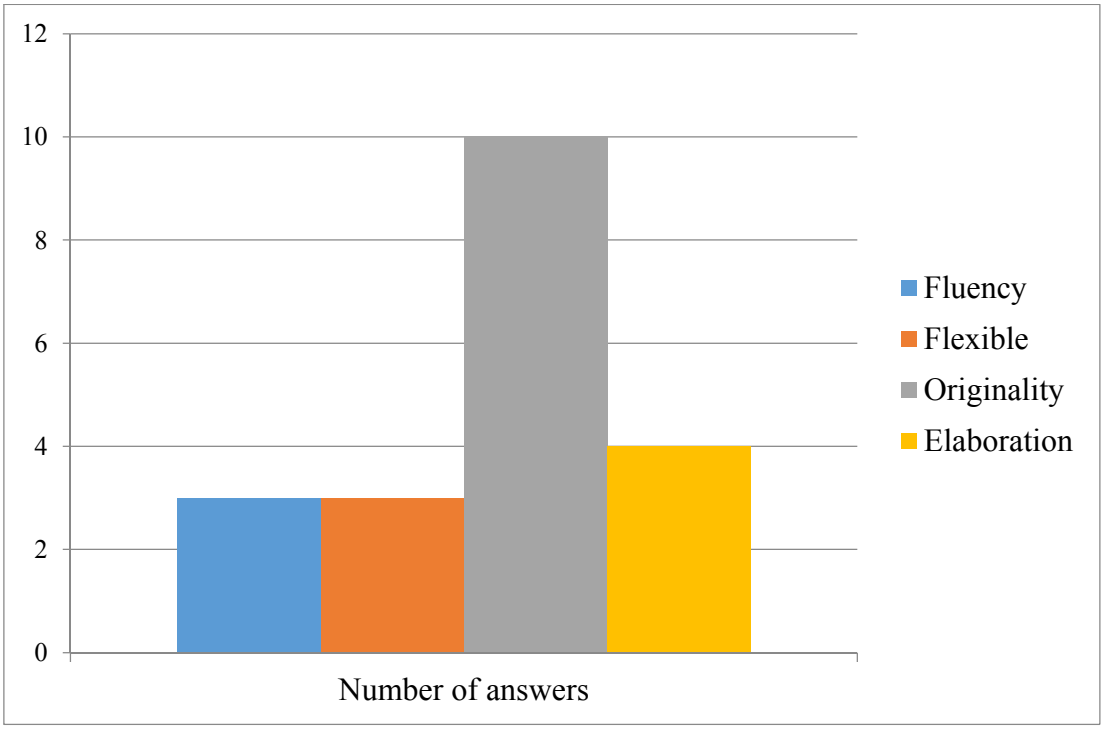


Graph 14: Number of answers of puzzle 1 of session 4

The majority of participants (7), estimated at 24.1%, provided original answers. Another seven participants also provided elaborate answers. Followed by six participants, estimated at 20.6%, gave fluent answers. Another six as well gave answers which were flexible.

Puzzle 2.

A truck is stuck at a road under a bridge. It's just a couple of inches too high to pass under. Any other route, avoiding the bridge would add a couple of hours to the journey. A young boy comes along and saves the day. How?



Graph 15: Number of answers of puzzle 2 of session

The majority of participants (10), estimated at 34.4%, succeeded at providing original answers. Followed by 4 participants, estimated at 13.7%, who gave elaborate answers. Three participants, estimated at 10,3%, provided fluent answers. Another three as well provided flexible answers.

Puzzle 3

These six toothpicks are arranged in a hexagon. Starting with this arrangement, can you form two identical diamonds by moving only two toothpicks and adding just one more?

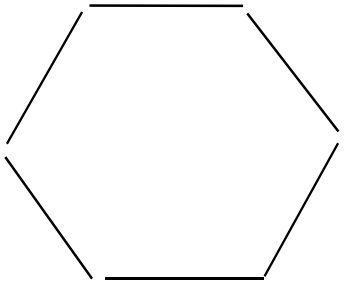
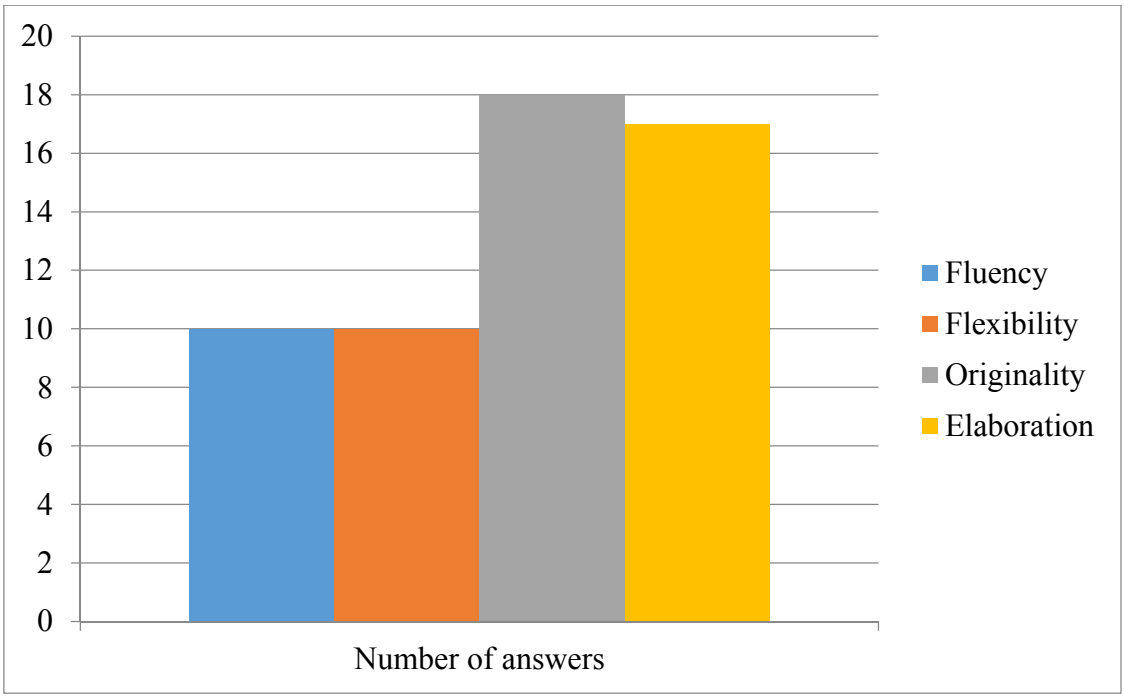


Figure 19: Puzzle 3 of session 4



Graph 16: Number of answers of puzzle 3 of session 4

The majority of participants (18) estimated at 62% succeeded at providing original answers. Closely, 17 participants, estimated at 58.6%, who gave elaborate answers. Ten participants, estimated at 34.4%, provided fluent answers. Another ten also provided flexible answers.

Puzzle 4.

Can you arrange these numbered blocks into three equal stacks so that the sum of the numbers displayed in each stack must be equal to any other stack?

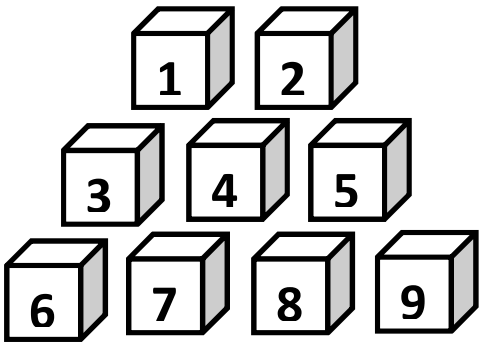
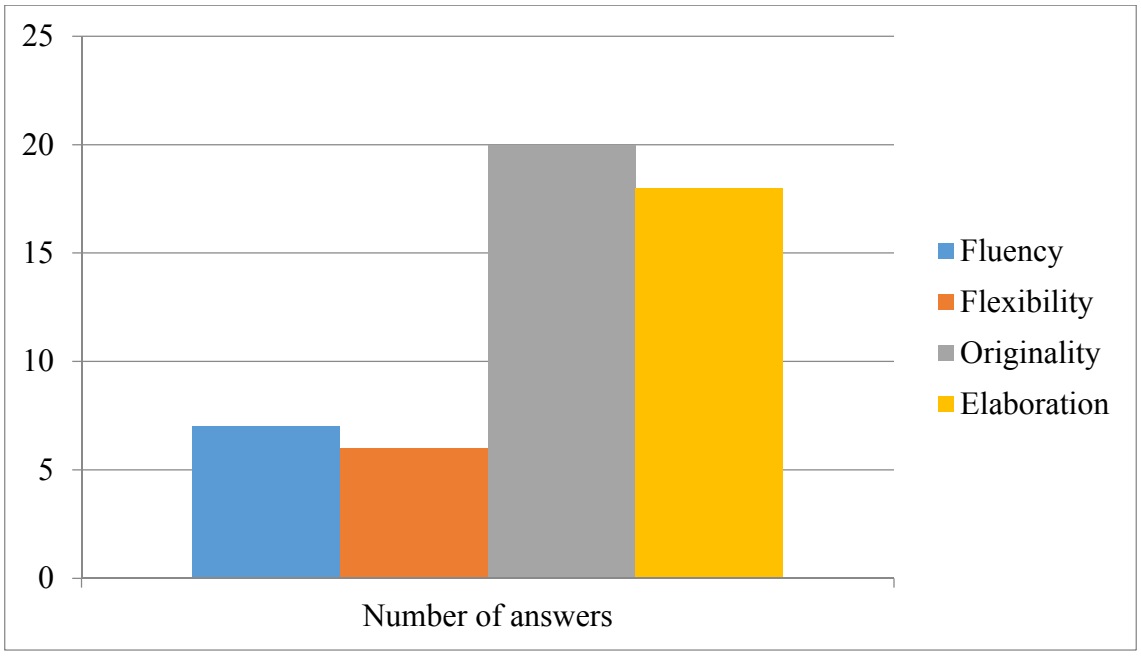


Figure 20: Puzzle 4 of session 4



Graph 17: Number of answers of puzzle 4 of session 4

The majority of participants (20), estimated at 68.9%, succeeded at providing original answers. Followed closely by 18 participants, estimated at 62%, who gave elaborate answers. Seven participants, estimated at 24.1%, provided fluent answers while only six, estimated at 20.6% who gave flexible answers.

Commenting on Classroom Observation.

The students-participants demonstrated again their enthusiasm for puzzles of this type. Even though we have informed them that they cannot use more than the allocated time, some of the students who did not finish on time asked for a two or three minutes as prolongation for each puzzle. We noticed that students were facing a difficulty in solving the first puzzle, so

we encouraged them by shouting the name of each student who solved it. The second puzzle was read and explained to the students by one of their classmates. We tried to clarify the puzzle many times, but we failed. The student who explained the puzzle had to draw an illustrative figure on the board and then explain the problematic situation to the class. Even at this point, they were still not fathoming of the task. We then concluded that it was a problem language-wise not information- wise. Therefore, we immediately elucidated the task in Arabic. After that, they started to solve the puzzle easily. Males, more than females, found the solution at first trial. While the third puzzle confused most students, the last one was a matter of their pleasure and interest. Some students used the calculator application on their mobile phone as helping devices, while others calculated the sums manually. Moreover, during the last puzzle, some students who were sitting close to each other were discussing among them with the aim of solving the puzzle.

Commenting on Classroom Discussion.

During the discussion, the students said that they were not able to solve all the puzzles even though they enjoyed them all. They confirmed that the first and the third puzzle were the most difficult ones. They laughed as they were aware that these two puzzles belong to the sticks puzzles type which they have suggested to be given in the previous session. Some students said that they felt that their brains froze and could not think anymore. All of them agreed that the first, the third, and the fourth puzzles required more time than they were allocated. The students who found the first puzzle to be difficult and were not able to solve it said that they were not as motivated as before to finish the rest of the puzzles. The solutions of this puzzles session were also given by the students themselves. They competed among them to finish first in order to write the answers on the board. Since the first and the third puzzles had more than one possible answer, we gave all students who had a different pattern to show their classmates their answer. At last, the students who did not solve the fourth puzzle

confirmed that if they had been given a clue of how to solve it, they would have succeeded at giving the right answer.

The Fifth Session.

During the previous sessions, the students developed some tactics to help them gain time and solve the puzzles they were given. With the aim of keeping the elements of curiosity and novelty in the puzzles we present, we decided to opt for four different types of puzzles. The puzzles we chose demand the use of systematic tools and skills of observation and attention to detail. The purpose of this session is to investigate the level of students' progress in spotting the hidden clues which are easy to be found with some attention. Also, we sought to investigate if the students can use the allocated time for such puzzles. At last, we needed the students to understand that they can use this educational tool as curricular and extra-curricular activities as they may find them in Web sites, newspapers, magazines, and other media tools. It is worth mentioning that the session puzzles are also taken from the web page Puzzle.com.

Puzzle 1.

The goal is to make a cut (or draw one line) "of course it needn't be straight" that will divide the figure into two identical parts.

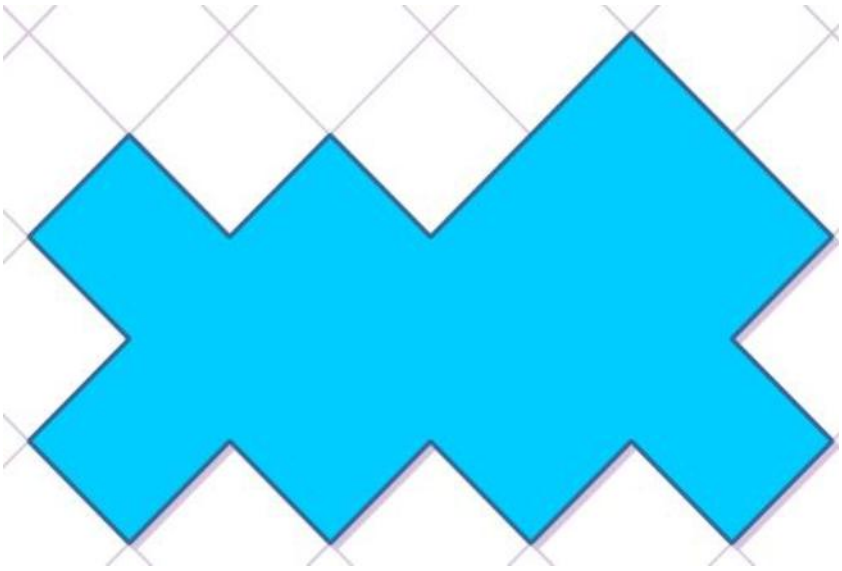
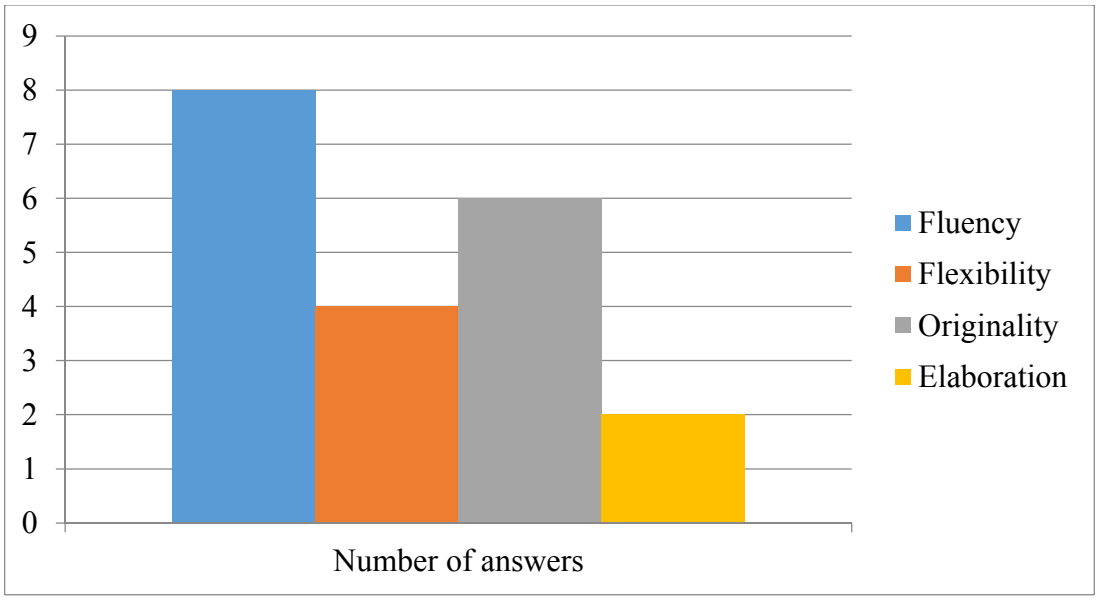


Figure 21: Puzzle 1 of session 5



Graph 18: Number of answers of puzzle 1 of session 5

The majority of participants (8), estimated at 72.7%, succeeded at providing fluent answers. Followed closely by six participants, estimated at 54.5% who provided original answers. Four participants, estimated at 36.3% gave answers which were flexible. Only two participants, estimated at 18.1% succeeded at giving elaborate answers.

Puzzle 2.

What symbol has to come next in the sequence of the five symbols in the illustration? Can you sketch this sixth figure?

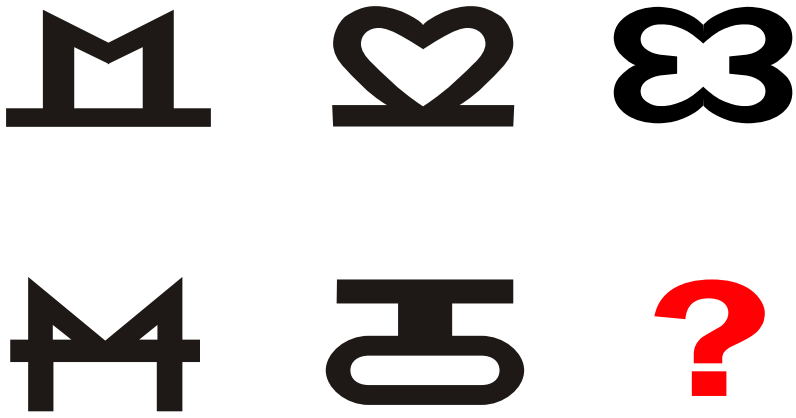
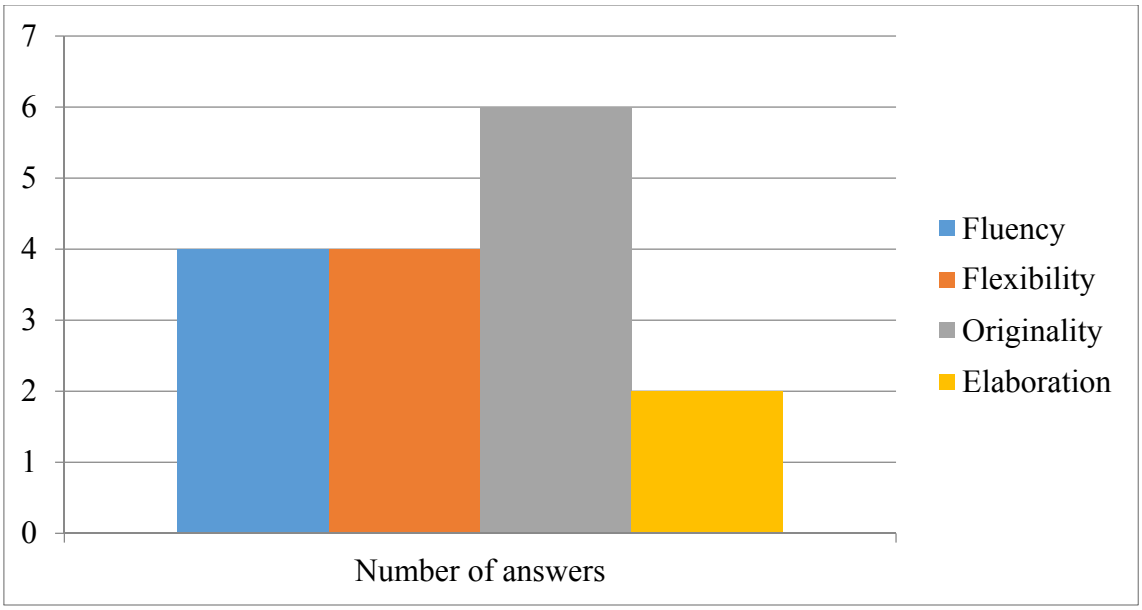


Figure 22: Puzzle 2 of session 5



Graph 19: Number of answers of puzzle 2 of session 5

The majority of participants (6) estimated at 54.5% succeeded at providing original answers. Followed closely by four participants, estimated at 36.3% who gave fluent answers. Another four as well provided flexible answers. However, only two participants, estimated at 18.1% gave elaborate answers.

Puzzle 3.

Place a chess knight (or a simple coin) in any cell of this board. The object is to visit with the knight every cell of the board exactly once, and return to the initial cell where your trip began from. The figure at the right shows some possible moves of the chess knight.

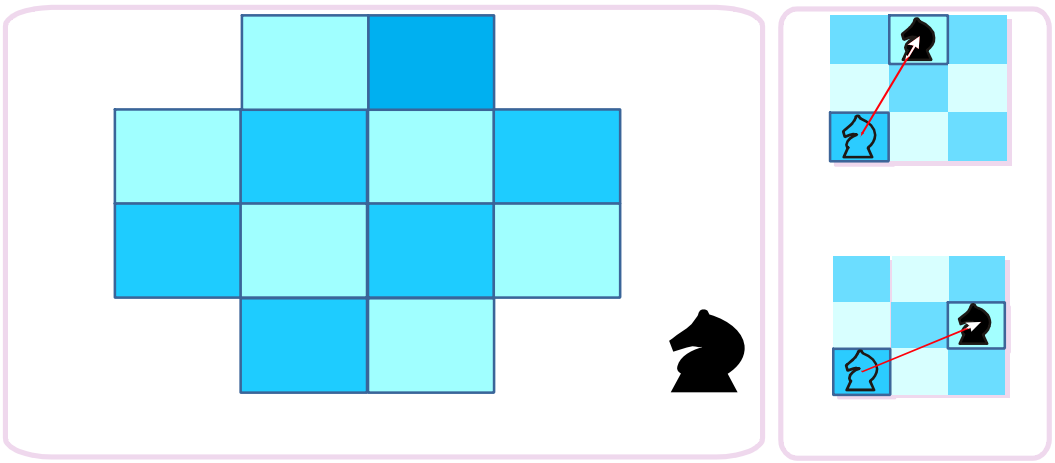
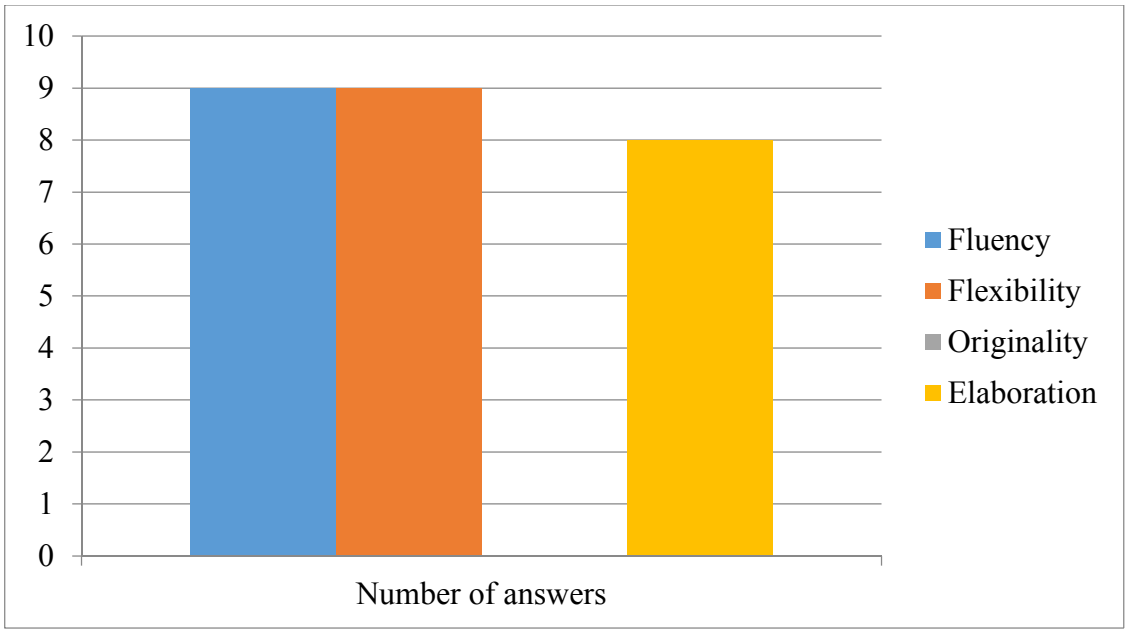


Figure 23: Puzzle 3 of session 5



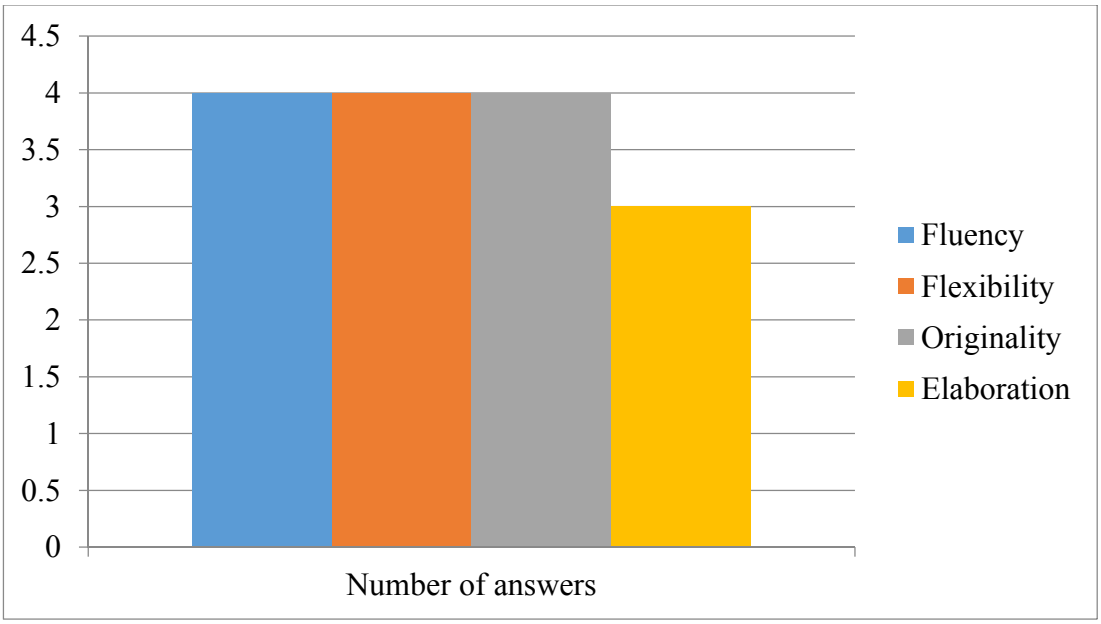
Graph 20: Number of answers of puzzle 3 of session 5

The majority of participants (9) estimated at 81.8% succeeded at providing fluent answers. Another nine as well provided flexible answers. Followed closely by eight participants, estimated at 72.7% who provided elaborate answers. However, no participant provided an original answer.

Puzzle4.

Can you arrange the five pieces with letters on them so that to spell the name of an animal?

Figure 24: Puzzle 4 of session 5



Graph 21: Number of answers of puzzle 4 of session 5

The majority of participants (4) estimated at 36.3% provided fluent answers. Another four as well gave flexible answers. Also four participants succeeded at providing original answers. Followed closely by three participants, estimated at 27.2% who gave elaborate answers.

Commenting on Classroom Observation.

The students demonstrated to be interested even though they expressed that they were quite tired because the exams period was quite near. At first, we worked on warming them up and setting a relaxed mood in the classroom. Then, they started to volunteer to read and explain to their classmates the instructions of the puzzles. They appeared to be comfortable and used to the puzzles. The first one confused them a lot. The few students who found the answers were teasing their classmates and even showing off! Three female students were not able to finish on time, and asked for a two minutes prolongation. Even after being given that, they still failed to find the right answer. Four students were asked for new worksheets as they were using theirs as drafts and had no space left to write the solutions on. During this session, the students were all sitting close to each other; therefore, they were at times discussing the possible answers among them. As for the third puzzle, all male students understood the task

immediately and started solving it, while no female student did. We had to explain it with the help of illustrative figures which we draw on the board, as well as the explanation of their male classmates. By the time we reached the last puzzle, some students had to leave the classroom to catch the bus, but they still solved it fast.

Commenting on Classroom Discussion.

The discussion took most of the instructional time of this session. We had pre-solving, while-solving, and post-solving the puzzles discussions. The pre-solving discussions consisted mainly of asking students if they felt that their creative thinking skills have developed so far or not. Some responded that they really do not know while others stated that they recognize the existence of a problem in every situation in life. They clarified that these problems can be solved easily only if we viewed them with a creative eye. Moreover, they expressed that they started to like the idea of being allocated only a limited number of minutes. The female students stated that they found the first and the third puzzles to be difficult. As for the first puzzle, they said that they did not realize early that the line should not be necessarily straight which lost them some time. As for the third puzzle, they clarified that they have never played chess, that is why they could not understand the task easily. Furthermore, all students said that they were excited to solve the second puzzle because they have already seen it with their teacher of ‘Oral Expression’ module.

The Sixth Session.

At this point of the intervention, we observed that the students-participants have developed a co-operative attitude towards puzzles. Therefore, we knew it was time to opt for more complex puzzles. It was one of the objectives of this research is to present graded puzzles with considerations of timing and students’ level and responsiveness. This does not mean that the chosen puzzles were too difficult or impossible to solve. Rather, it means that they required more developed skills of dealing with pressure and shortage of time in a

problematic situation. The puzzles used in this session differ in type and the needed techniques to be solved.

Puzzle 1.

A man lives on the tenth floor of a building. Every day he takes the elevator to go down to the ground floor to go to work. When he returns he takes the elevator to the 7th floor and walks up the stairs to reach his apartment on the 10thfloor. He hates walking so why does he do it? Clue: on rainy days he goes up in the elevator to the tenth floor.

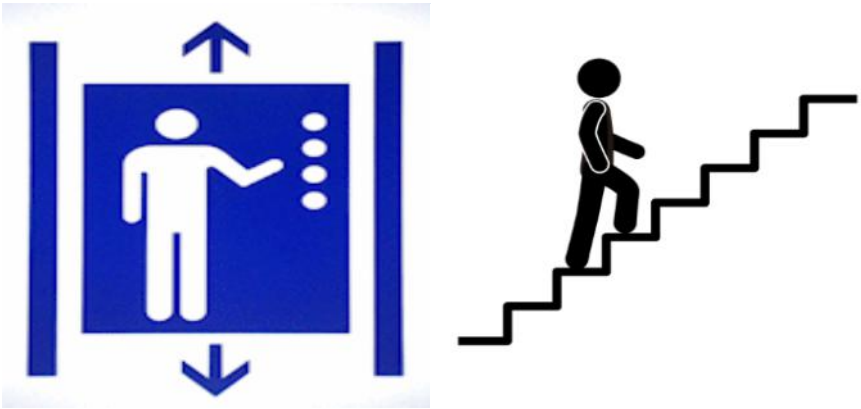
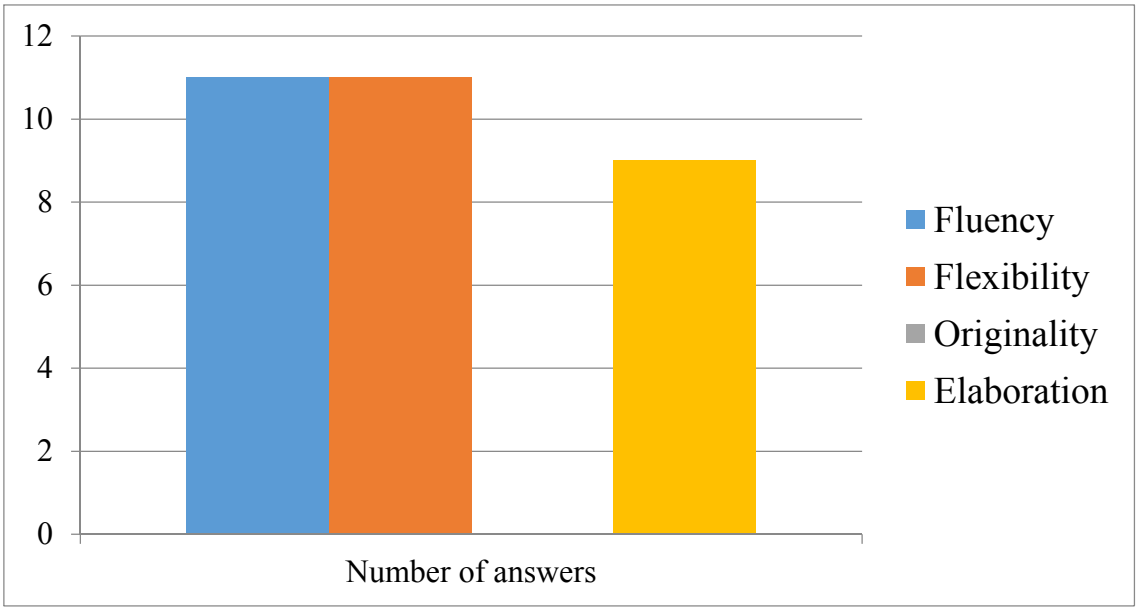


Figure 25: Illustrative figure of puzzle 1 of session 6



Graph 22: Number of answers of puzzle 1 of session 6

The majority of participants (11) estimated at 73.3% succeeded at giving fluent answers. Another eleven as well provided flexible as well. Nine participants, estimated at 60%, gave elaborate answers. However, no participants were able to provide an original answer.

Puzzle 2.

This arrow is pointing from south to north. Move one line and add another to leave the arrow pointing from east to west.

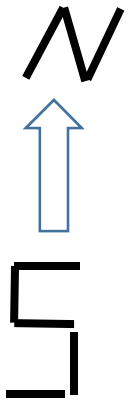
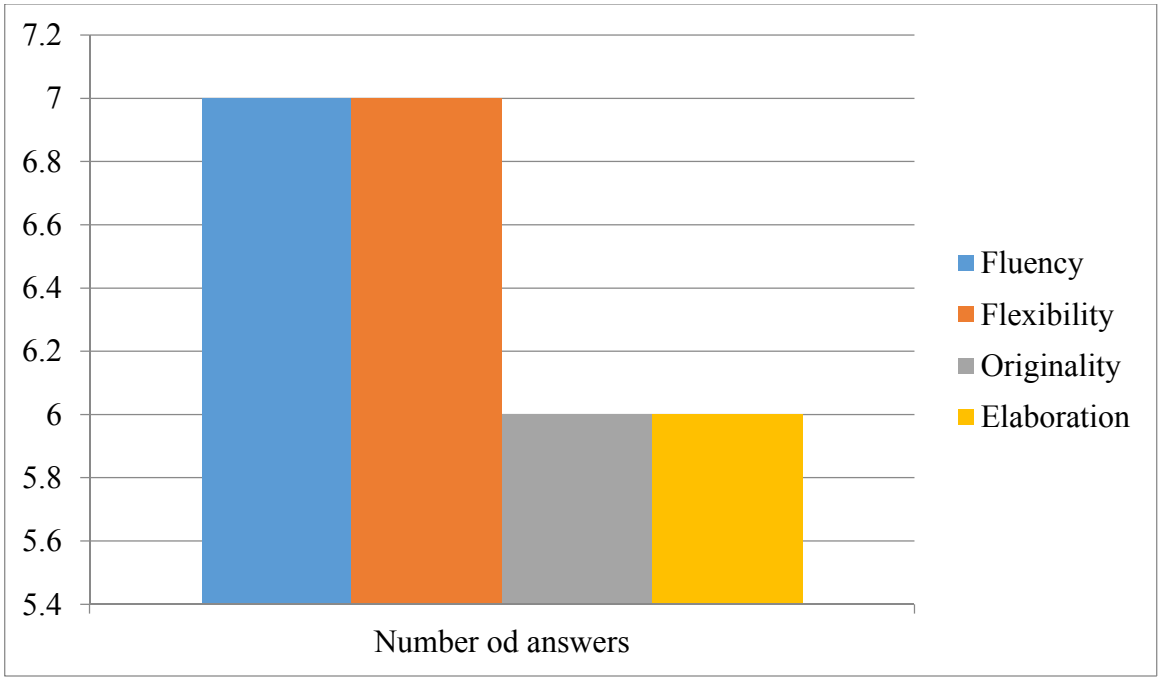


Figure 26: puzzle 2 of session 6



Graph 23: Number of answers of puzzle 2 of session 6

The majority of participants (7) estimated at 46.6% succeeded at giving fluent answers. Another seven as well provided flexible answers. Six participants, estimated at 40%, gave original answers. Also, another six gave elaborate answers.

Puzzle 3.

The shape below is made with one continuous line. Starting any-where, can you complete the shape without lifting your pencil from the page? As you probably guessed, your path cannot cross over itself.

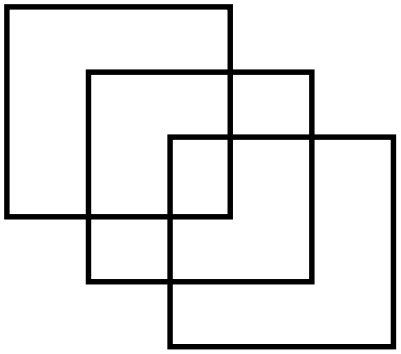
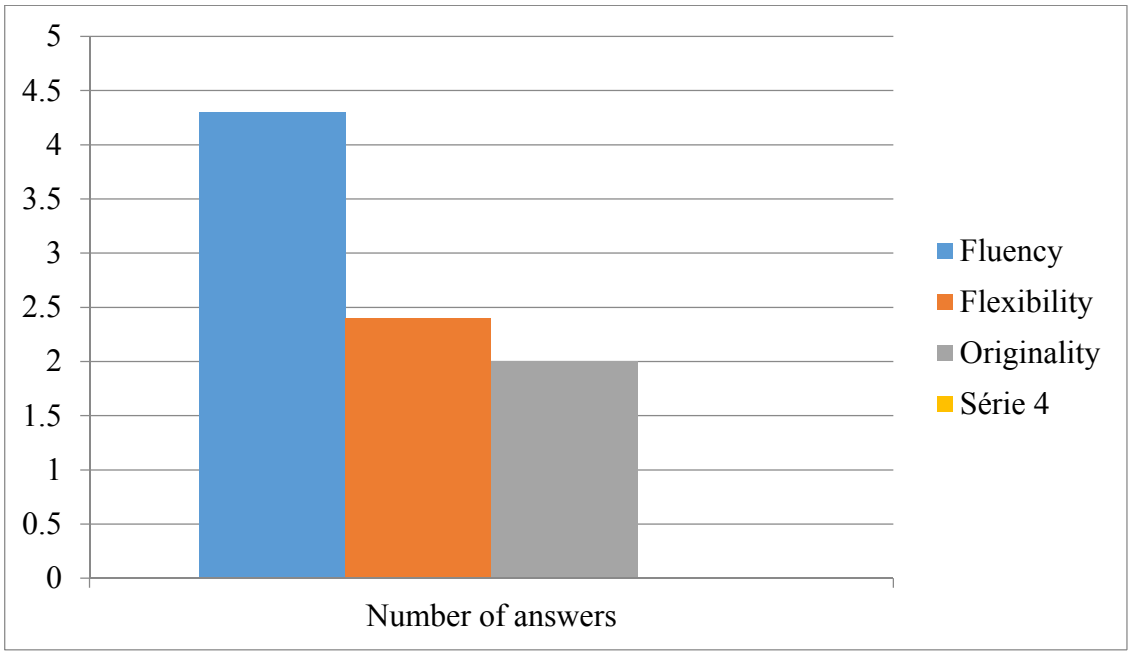


Figure 27: Puzzle 3 of session 6



Graph 24: Number of answers of puzzle 3 of session 6

The majority of participants (11) estimated at 73.3% succeeded at giving fluent answers. Another eleven as well provided flexible answers. Followed closely by ten participants, estimated at 66.6% who gave elaborate answers. Seven participants, estimated at 46.6% succeeded at providing original answers.

Puzzle 4.

The triangle below is made up of ten disks. Can you move three of the disks to make the triangle point in the opposite direction?

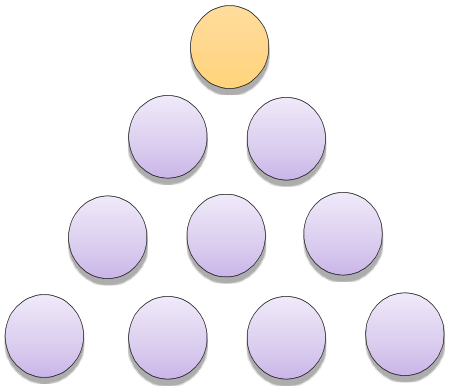
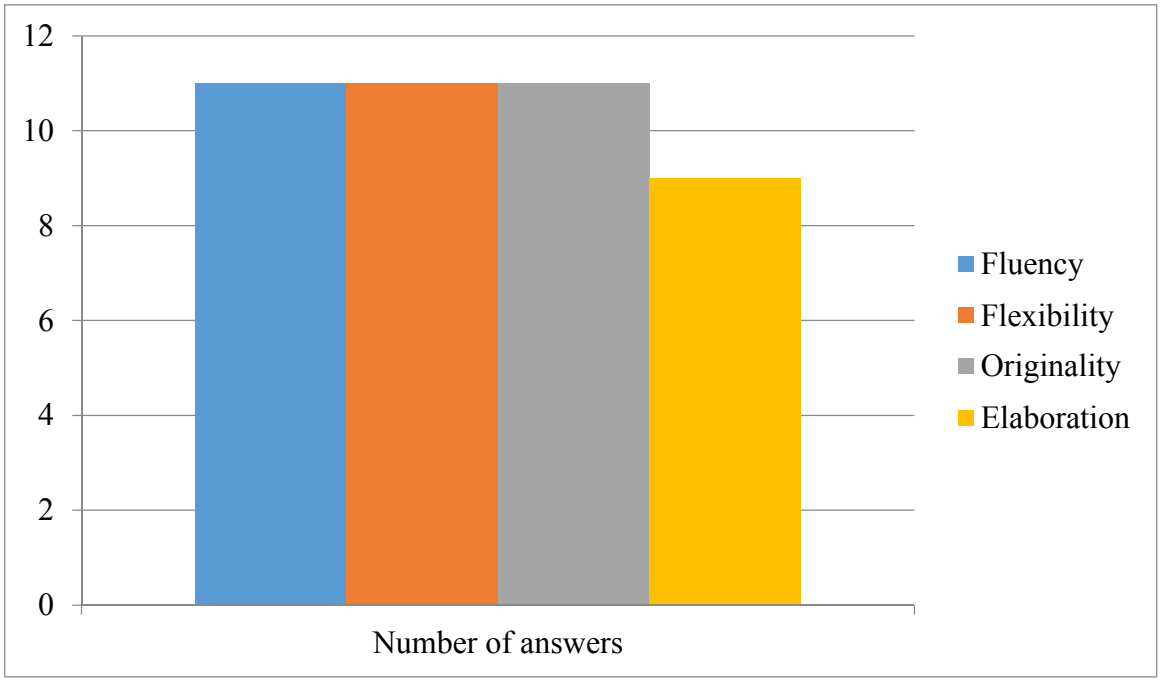


Figure 28: Puzzle 4 of session 6



Graph 25: Number of answers of puzzle 4 of session 6

The majority of participants (11) estimated at 73.3% provided fluent answers. Another eleven as well gave flexible answers. The same number of participants succeeded also at giving original answers. Followed by nine participants, estimated at 60% who were able to provide elaborate answers.

Commenting on Classroom Observation.

The students arrived fifteen minutes late for this session because we had to move to another classroom in order to complete our intervention. Nonetheless, they settled quickly and we started distributing the worksheets. The male students arrived with a very relaxed and joyful mood, so they were all volunteering to read, explain, and discuss the puzzles. The first puzzle bewildered all students. They kept reading the task over and over again, but they still felt confused. We had to inform them that they cannot us use the time dedicated to explanation to solve the puzzle since they understood it. No student was able to solve the puzzle even after using five minutes of prolongation as they asked for it. The second confused the female students more than the males. As for the third and the fourth puzzles, all students appeared to be very engaged in answering. The students were more enthusiastic than usual in this session. They were rushing to the board to solve the puzzles. There was even a waiting line on the board to give the answers of the third puzzle.

Commenting on Classroom Discussion.

The students discussed freely during this session. Since the first puzzle was the one which confused them all, they discussed it with their classmates many times. When they were given the answer, they all said that they would not have thought of such a solution! They confirmed that this was the hardest puzzle they had to solve. The students who were not able to solve the second puzzle said that their problem was looking at the puzzle from only one angle. We clarified to them that one of the underlying skills and attitudes of creative thinking is the ability to perceive the problem or the situation from different perspectives. Apart from the first puzzle, the students agreed that the fourth one was the more difficult to solve than the

second and the third. It is worth mentioning that during the discussion, the students demonstrated to be very fluent in ideas. They were no longer shy or hesitant to shout aloud any possible answers they think of. This has helped them greatly in finding the right solutions.

The Seventh Session.

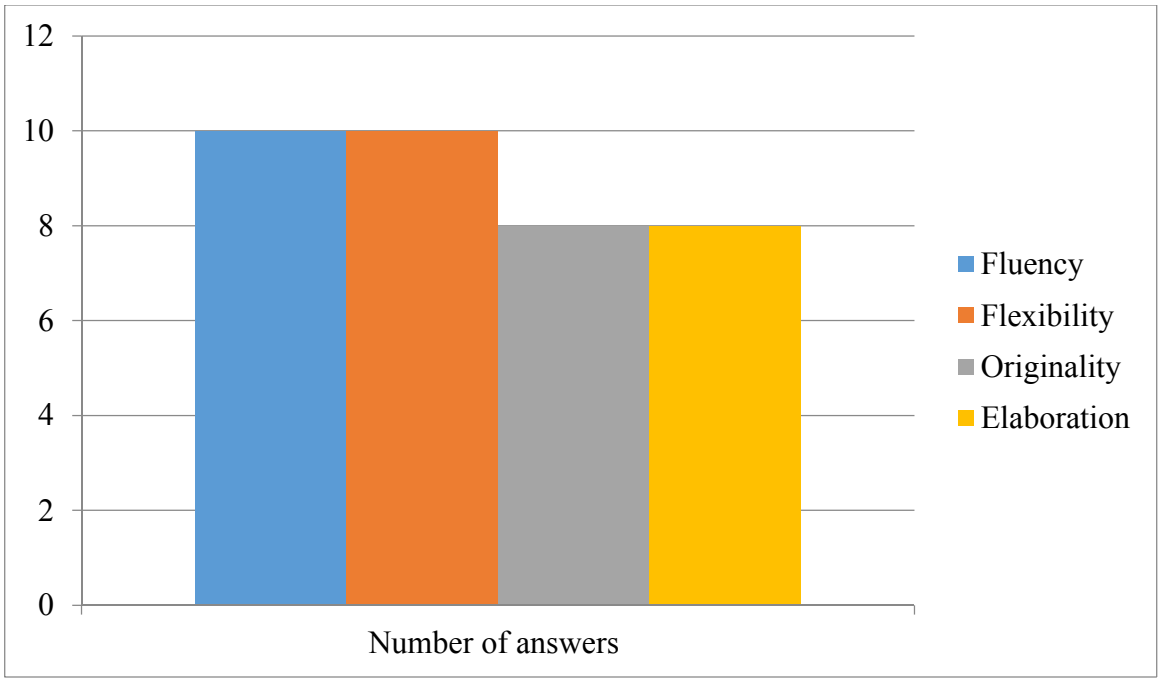
In the last session of our intervention, we wanted to test the students' responsiveness to puzzles which they are familiar with. For this purpose, we opted for a set of self-completed puzzles which resemble the TTCT that they have passed in the first session. One main objective in session was to ask the students about their attitudes towards puzzles, and if they believed that they have helped enhancing their creative thinking skills.

Activity 1.

Try to improve this stuffed toy rabbit so that it will be more fun to play with. You have 3 minutes.

Figure 29: Illustrative figure of puzzle 1 of session 7

This activity triggers the participant's ability to develop and play with ideas.



Graph 26: Number of answers of puzzle 1 of session 7

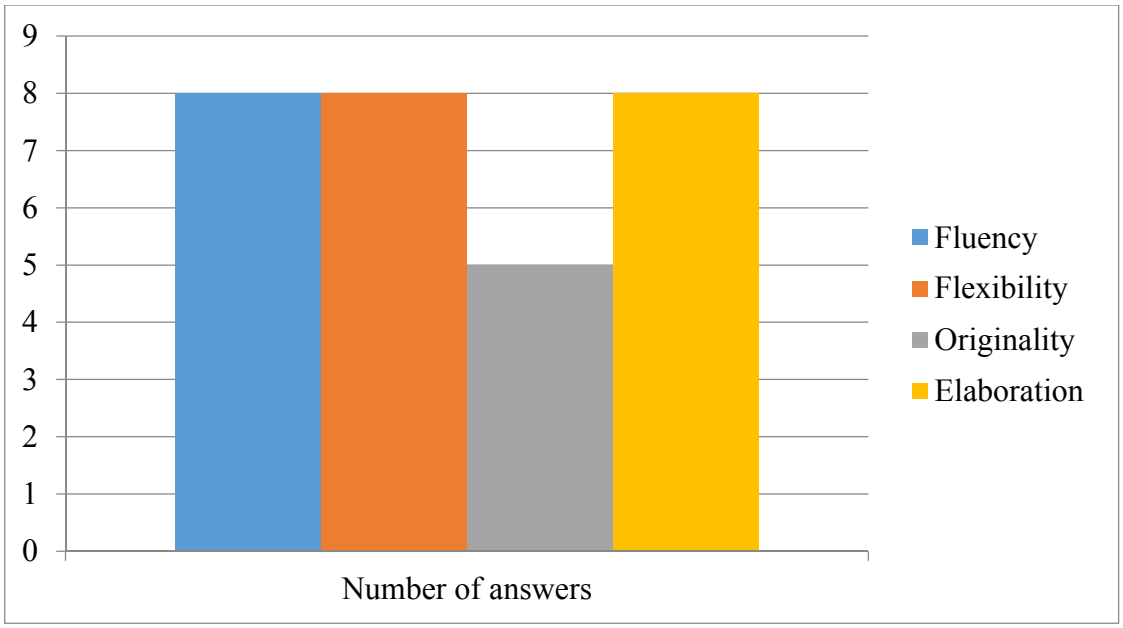
The majority of participants (10) estimated at 90.9% provided fluent answers. Another ten as well gave flexible answers. Followed closely by eight participants, estimated at 72.7% who were able to give original and new ideas as answers. Another eight as well proved to be elaborate in their answers.

Activity 2.

Just suppose that you are a superhero. What might be some things that would happen as a result? You have 3 minutes.

Figure 30: Illustrative figure of puzzle 2 of session 7

This activity is a test for 'playing with ideas and consequences' capacity and imagination.



Graph 27: Number of answers of puzzle 2 of session

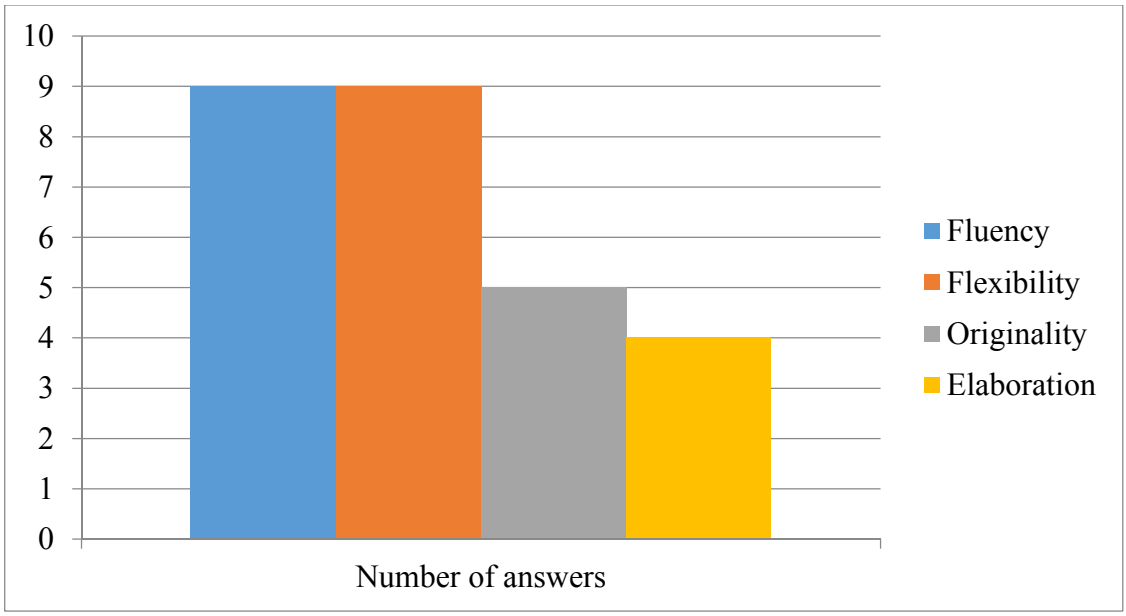
The majority of participants (8) estimated at 72.7% succeeded at providing fluent answers. Another eight as well proved to be flexible. Also, eight students were elaborate in answering. Whereas only five participants, estimated at 45.4%n succeeded at giving original and new answers.

Activity 3

What is the maximum number of unusual uses of a cardboard? You have 3 minutes

Figure 31: Illustrative figure of puzzle 3 of session 7

This activity tests the participant's ability to think originally.



Graph 28: Number of answers of puzzle 3 of session 7

The majority of participants (9) estimated at 81.8% provided fluent answers. Another nine as well gave flexible answers. Followed by five participants, estimated at 45.4% who gave original answers. Closely, four participants, estimated at 36.3%, were able to provide elaborate answers.

Activity 4.

Add lines to the incomplete figures below to make pictures out of them. Try to tell complete stories with your pictures. Give your pictures titles. You have 3 minutes.

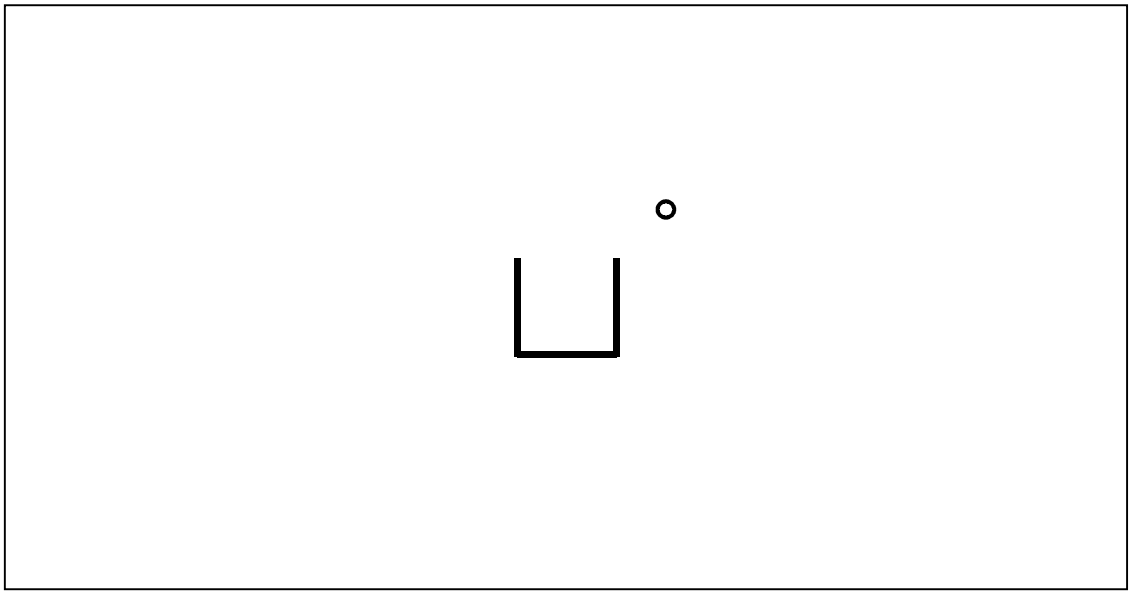
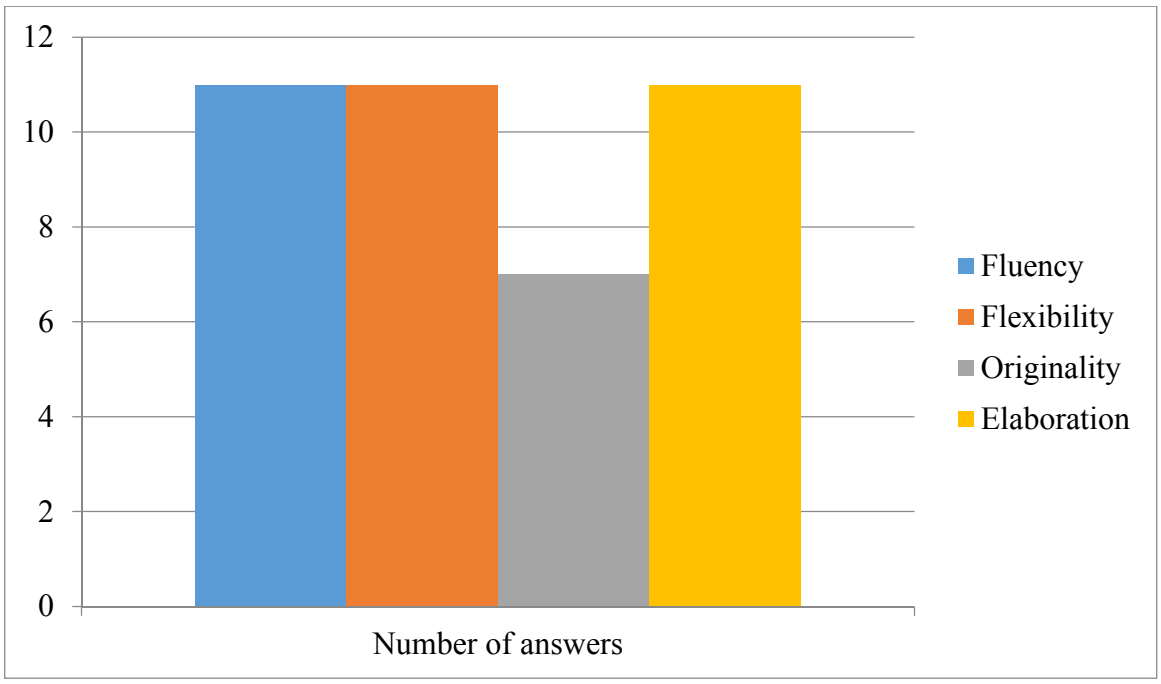


Figure 32: Puzzle 4 of session 7

This activity tends to give purpose to the incomplete figure and elaborate it further



Graph 29: Number of answers of puzzle 4 of session 7

All participants were able to provide answers which were fluent, flexible, and elaborate. While seven of them, estimated at 63.6%, were able to provide original answers.

Activity 5

Add details to the shapes below to make pictures out of them. Make the circle a part of any picture you make. Try to think of pictures no one else will think of. Add details to tell complete stories with your pictures. Give your pictures titles. You have 3 minutes.

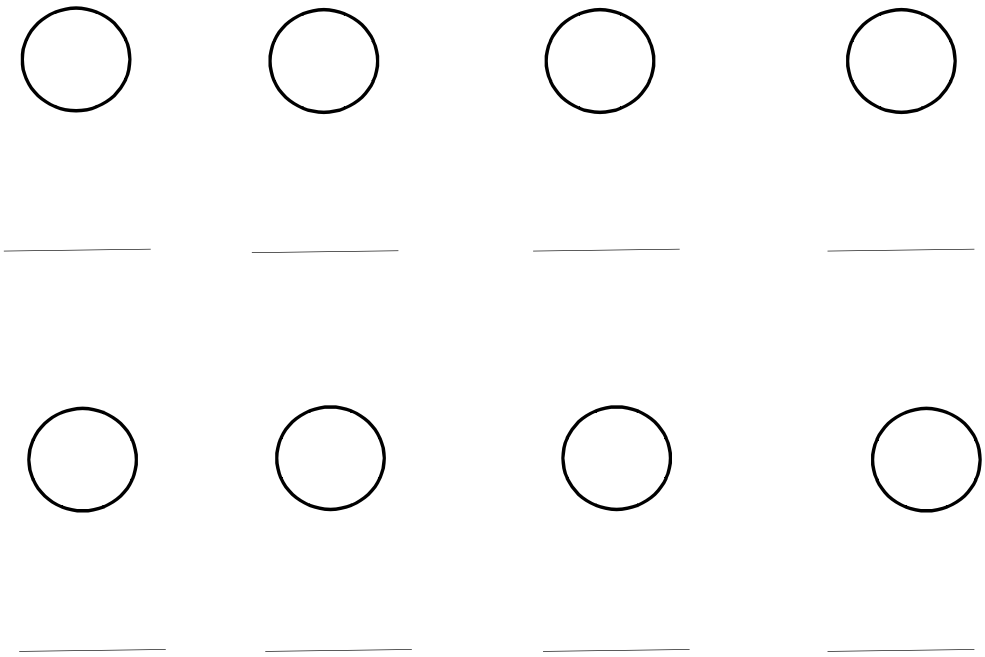
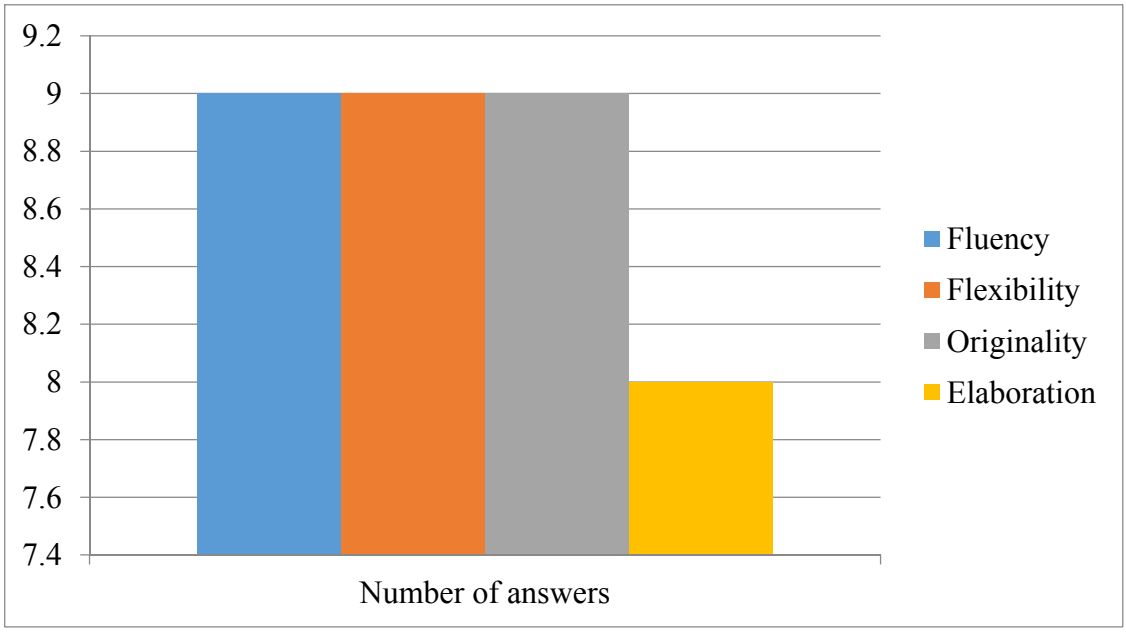


Figure 33: Puzzle 5 of session 7

This activity requires the ability to return to the same stimulus over and over.



Graph 30: Number of answers of puzzle 5 of session 7

The majority of participants (9) estimated at 81.8% were able to provide fluent answers. The same number of participants demonstrated their ability of giving flexible and original answers. Followed closely by eight participants, estimated at 72.7% who were able to provide detailed answers as a sign of elaboration.

Since eight participants demonstrated to be elaborate, they were all able to add details and titles to their drawings. As for the nine participants who provided flexible answers, they were drawing faces, people, objects, etc. When it comes to the original answers, they were making the circles parts of bigger pictures. Some examples are a snow man, an Emo young man looking down at a guitar, and a niqab covering.

Commenting on Classroom Observation.

The students-participants were aware that this session's puzzles are similar to the ones that have passed in the first session. They did not show signs of confusion at any level. They seemed to be more interested in solving the fifth puzzle. They were engaged in answering and did not discuss the answers much with their classmates. Some students seemed to be bored in the first activity as they were trying to think of new ideas but failed. The students used the allocated time effectively in the first, the second, and the third puzzles, but they asked for a two minutes prolongation in the fourth and the fifth ones. The male students were more interested in solving the second and the fourth puzzles while the female students were interested in solving the first and the third. Both gender seemed to be enthusiastic about the fifth puzzle. During this session, the students did not appear to be as active in correcting the answers as they were in the three previous sessions. They were most of the time silent and only reacted when we provoked discussions.

Commenting on Classroom Discussion.

The students said that they were able to solve all the puzzles in the allocated time even though some of them asked for a two minutes prolongation. They said that they found all puzzles to be easy because they have seen puzzles which were quite similar to these

previously. They said that the second puzzle helped them to imagine a new possible context with its consequences. About the fifth puzzle, they claimed that it was their favorite as they saw in each circle a new opportunity for imagination and creativity. They said that each new circle was like a second chance to let their imagination wonder more. When it came to the problems which they faced, they said that the only obstacle was their lack of imagination at times. The male students said that the fourth activity helped them to focus more and to see 'the bigger picture'. At last, we asked the students to describe their attitudes towards puzzles, and if they thought that being part of this intervention helped them to enhance their creative thinking skills. Some said that they have become more aware of the unlimited possibilities of each item that we use every day. They added that with some creativity, they can use these items in a more productive way. Others stated that creativity for them is more about elaboration. That is to mean, taking the existing elements and adding details to them in order to use them in new patters. All students agreed that they enjoyed this intervention, and that they would love their teachers to add such puzzles in the classroom instruction.

Conclusion

In this chapter, we have reported the date which have been collected through our research tools. The students participated in seven sessions of puzzle-solving activities as a class. They responded to designed worksheets consisting of four to five educational puzzles per session, and they participated in a guided classroom discussion. All the gathered data was described and interpreted thoroughly using the detailed elements of assessment. After analyzing the results of each session, we conclude that the students-participants have developed in applying elements of flexibility and elaboration followed by elements of fluency and originality into their creative thinking process.

In conclusion to this chapter, the analyzed results gathered from the puzzles' worksheets, classroom observation and classroom discussion have revealed the effectiveness of using puzzles as a pedagogical tool in enhancing tertiary students' creative thinking skills.

On the whole, the findings have demonstrated that a significant relationship between classroom discussions and peer-correction, and the students' responsiveness to creative thinking skills. The more opportunity to discuss and correct was given to the students, the more they were able to perceive the situation in various dimensions. In a nut shell, the implementation of educational puzzles as an instructional tool in the classroom is useful in enhancing tertiary EFL students creative thinking skills.

General Conclusion

The current attitudes and patterns of thinking among tertiary students appear to be lacking the element of creativity at numerous levels. Such a problem is very risky to those who are concerned in higher education. When university graduates tend to repeat the content of subject matters which they were taught without trying to perceive or use them differently, the whole educational system will suffer and deteriorate as it will no longer be subject to progress. Today's tertiary students are tomorrow's researchers, teachers, educators, curriculum designers, inspectors, schools' headmasters, and most importantly, knowledge holders and representatives. If these students lack higher order thinking skills, they may be of danger to the higher education society. The observer of the attitudes which students show during lectures and exams notices the absence of the original, flexible and elaborate thought. Students have developed a reluctant system of thinking based on accepting the existing as perfect that does not need to be improved or further elaborated.

For this reason, the present study was conducted to test the efficiency of a suggested instructional tool, educational puzzles, in developing creative thinking skills among tertiary students. Puzzles were the chosen instructional tool among various others because they are known for being entertaining to students. Usually, when students hear the terms 'creative thinking skills' they thinking of a difficult and complex process which is farfetched. Therefore, we needed to opt for the best available tool to teach them while making students feel comfortable as the same time. In this sense, this study was carried to confirm or reject two main hypotheses. The first states that if teachers use educational puzzles as part of classroom activities, tertiary students' creative thinking skills are to develop. The second one states that if teachers provoke guided classroom discussion and opt for peer correction in the

process of puzzle solving, tertiary students' responsiveness to creative discussions will improve.

To reach this objective, an intervention was conducted as a part of a qualitative approach. Educational puzzles, classroom observation, and classroom discussion were the used tools of gathering data which were then described and interpreted. The intervention took place at Mohammed Kheider University of Biskra over a period of seven sessions. The puzzles of the worksheets were extracted from the TTCT and Web sites of puzzles. The answers of the students were assessed according to four major elements of creative thinking which are fluency, flexibility, originality and elaboration. The classroom observation targeted mainly behavioral patterns of the students-participants such as interest, boredom, confusion, engagement in discussion, use of allocated time, use of helping devices, the rate of asking for further explanation, the gender effect, and any other notes which were observed but not included in the check-list. The classroom discussions took place while-solving and/or post-solving the puzzles. The discussions consisted of asking students direct question about the process of solving the puzzles, and their correction afterwards.

The analysis of gathered data revealed that the students developed their creative thinking skills along the process. The first element which was developed is elaboration. The students learnt to further clarify their answers by adding significant details. The second element which was developed is flexibility. The students' answers became more and more flexible as they learnt to perceive the situation from more than one perspective. The third element which was developed is originality. The students were providing more new and unusual ideas. The fourth and last element which was developed is fluency. The students were proving more answers for each question item progressively.

Following these results, we accept both hypotheses. The students' creative thinking skills developed in an obvious manner and they were more responsive to creative discussions and peer correction. This research proposed three questions to be answered. The first question

was if tertiary students had initial creative thinking skills. Through analyzing the students' results of worksheets and discussion, we assert that tertiary students have initial, but primary creative thinking skills. The second question was if the use of puzzles helped in fostering creative thinking skills among students. Through both worksheets and discussions, we found that puzzles helped in enhancing creative thinking skills. The third question sought to discover the underlying advantages of using puzzles purposefully in EFL classrooms. The advantages which we noted were learning new language items, breadth in perception, and motivation to learn and create.

In short, the present study is of great importance to both teachers and students. As for teachers, it provides a new and entertaining method of application to teach one of the highly demanded higher order thinking skills which is creative thinking. This method is affordable by all teachers as they can freely download suitable, targeted, and well-graded educational puzzles, then print them and present them to their students. AAs for students, it offers them an educational tool that can be used with or without the teacher's guidance, hence; allowing autonomous learning.

Pedagogical Recommendations

After interpreting and analyzing our data, we suggest the following recommendations:

- Teachers need to implement creative discussions in the course of teaching content of any subject matter.
- The students ought to be given the opportunity to correct their mistakes with their peers.
- Teachers can at least implement one educational puzzle per session. This way, they gain time and can continue the normal course of their instruction.

- Teachers can conduct a needs analysis of their students prior to implementing the puzzle based approach in order to know which type of puzzles their students need and prefer.
- Students can be asked to choose the puzzles for the class. This way, they will be more engaged in the process of learning.
- Teachers should implement at least one warm up educational puzzle in the beginning of each session in order to enhance the students' readiness for thinking.
- Teachers ought to implement puzzle based learning in new spaces rather than classrooms such as parks for instance because classroom instruction may be boring for most students.
- Teachers can bring the material elements used in puzzles rather than just printed worksheets. This method may be expensive, but it may give better results.

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APPENDICES

APPENDIX 1

Worksheet of session 1

The first session

Directions: Do not begin until you are told to do so.

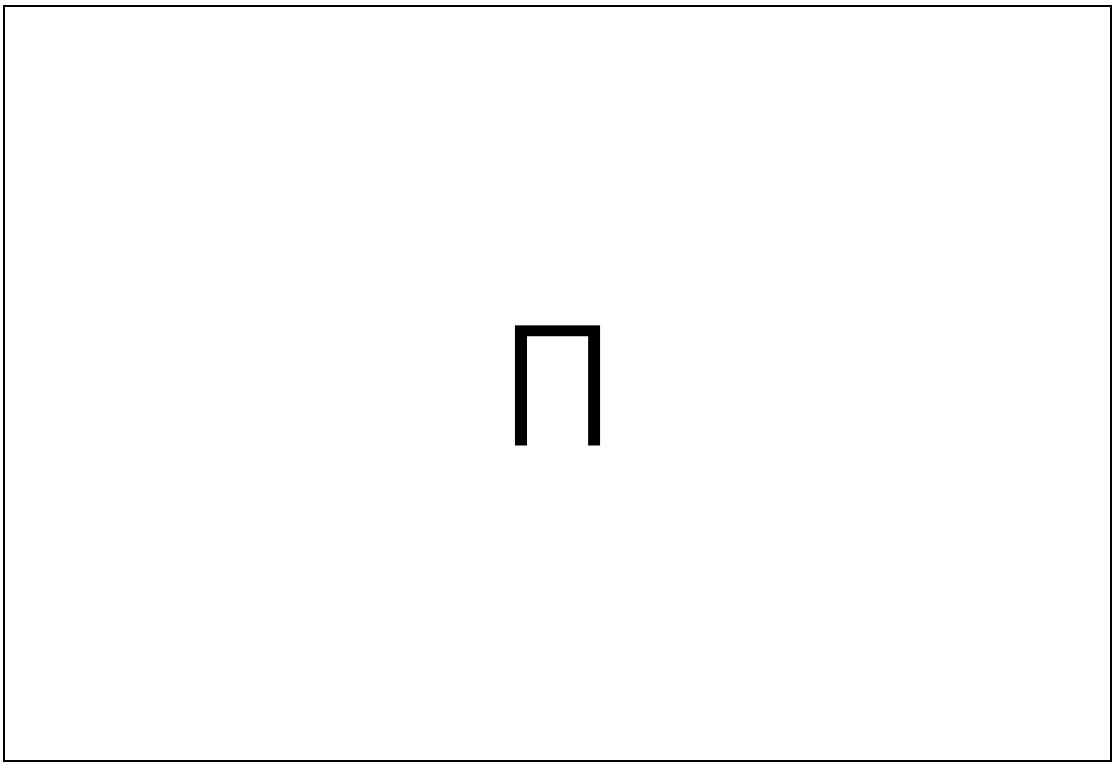
- ✓ Try to think of things that no one else will think of.
- ✓ Try to think of as many ideas as possible.
- ✓ Add details to your ideas to make them complete.
- ✓ If you finish before time is up, you may continue to add details or sit quietly.
- ✓ Please do not go to the next activity until told to do so.

Activity 1: Try to improve this stuffed toy rabbit so that it will be more fun to play with. You have3 minutes.

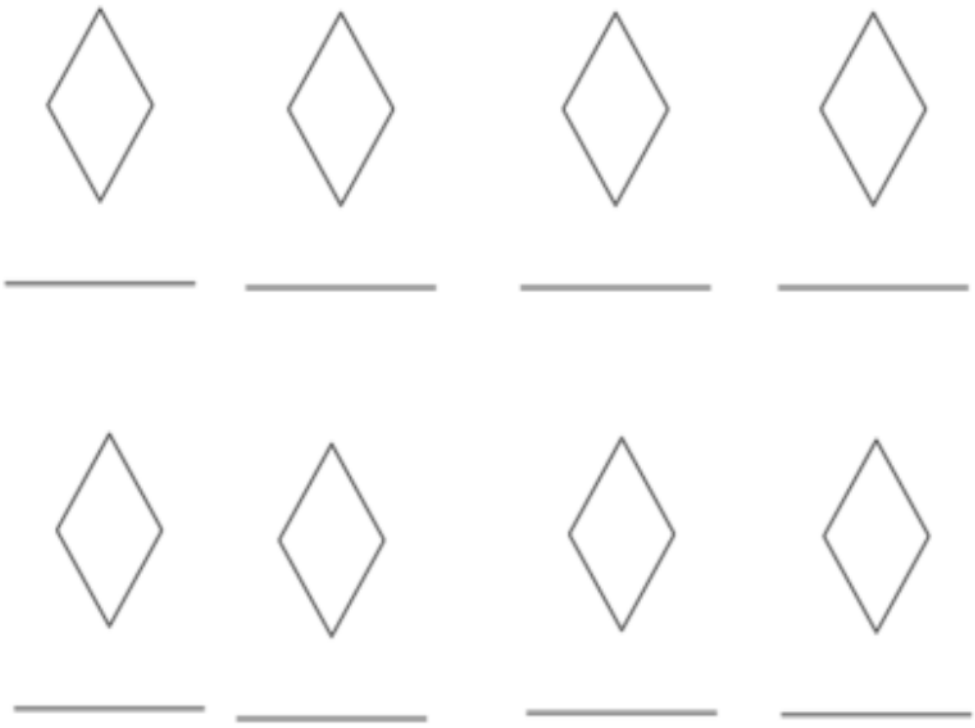
Activity 2: Just suppose that you are magician. What might be some things that would happen as a result? You have 3 minutes

Activity 3: What are the maximum number of unusual uses of your pencil? You have 3 minutes

Activity 4: Add lines to the incomplete figures below to make pictures out of them. Try to tell complete stories with your pictures. Give your pictures titles. You have 3 minutes.



Activity 5: Add details to the shapes below to make pictures out of them. Make the diamond apart of any picture you make. Try to think of pictures no one else will think of. Add details to tellcomplete stories with your pictures. Give your pictures titles. You have 3 minutes



Name: ……
Date of Birth: … / … / ……
Email: ……
Or

Fb account: ……

Thank you.

APPENDIX 2

Worksheet of session 2

☺Just to enhance your creative thinking skills☺

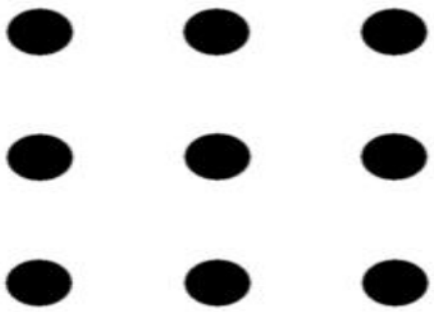
The second session

Name:……
Date of Birth: …/ …/ ……
Email:……
Or
Fb account: ……

Instructions: **Please;**

- **Fill in the asked information.**
- **Follow your instructor lead.**
- **Try to focus and think outside your box.**
- **Use the paper as draft for your trials.**
- **Use the allocated time to each puzzle.**

Puzzle 1: Can you connect all nine dots by drawing four straight lines without lifting your pencil?



Puzzle 2: Three switches outside a windowless room are connected to three light bulbs inside the room. How can you determine which switch is connected to which bulb if you may enter the room only once?

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Puzzle 3: Suppose that you have only two egg timers, a 5-minute and a 3-minute. Can you use these two measuring devices to time an egg that must be boiled for exactly 2 minutes?

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Puzzle 4: A man is replacing a wheel on his car, when he accidentally drops the four nuts used to hold the wheel on the car, and they fall into a deep drain, irretrievably lost. A passing girl offers him a solution which enables him to drive home. What is it?

……

……

Your Remarks:

……

……

Thank you.

APPENDIX 3

Worksheet of session 3

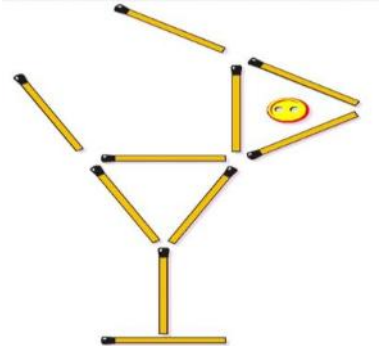
Just to Enhance your Creative Thinking Skills ☺

The Third Puzzle Section

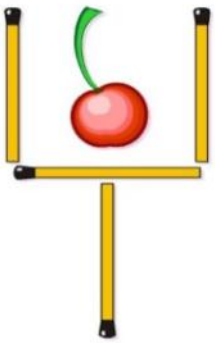
Name: …… **Date of Birth: … / … / ……**

Email: …… **Or** **Fb account: ……**

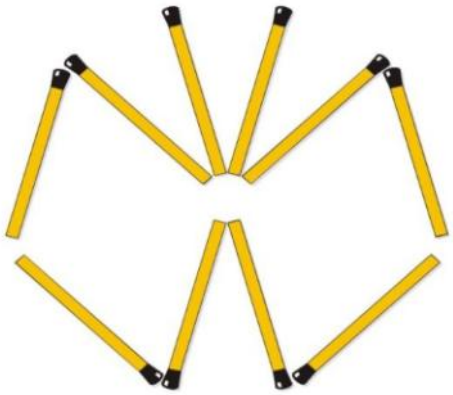
Puzzle 1: Form the depicted bird with ten matches and a button as shown. Move two matches and a button to make the bird looking in another direction.



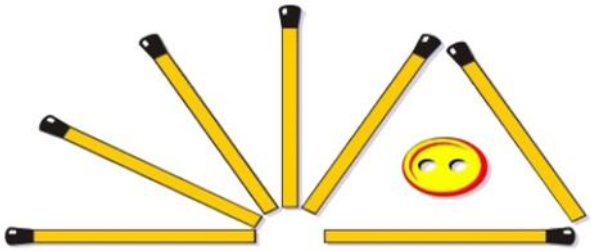
Puzzle 2: The object is to move 2 matches to get the cherry outside the glass. At the finish, the glass may be turned in any direction, but it must be exactly the same shape as before.



Puzzle 3: Move only three matches so that the bat will fly in another direction.



Puzzle 4: Arrange seven matches and a button to form the hedgehog shown in the illustration. The object is to make the hedgehog running in another direction moving every time a button and: a) two matches; b) three matches; c) five matches



Your remarks:

Thank you

APPENDIX 4

Worksheet of session 4

☺Just to enhance your creative thinking skills☺

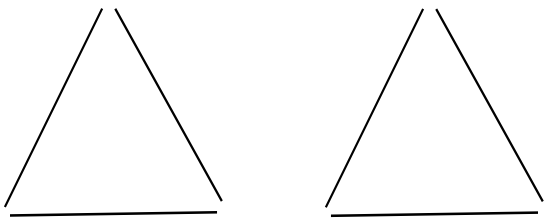
The fourth session

Name: .....
Date of Birth: ... / ... / .....
Email: .....
Or
Fb account: .....

Instructions: Please; - Fill in your information.

- Follow your instructor lead.
- Try to focus and think outside of the box.
- Use this sheet as a draft for your trials.
- Use only the allocated time to each puzzle.

Puzzle 1: Take a look at these two identical triangles. They are made with six sticks. Can you rearrange the sticks so that they form four triangles? All of the new triangles must be the same size as these original two!



Puzzle 2: A truck is stuck at a road under a bridge. It's just a couple of inches too high to pass under. Any other route, avoiding the bridge would add a couple of hours to the journey. A young boy comes along and saves the day. How?

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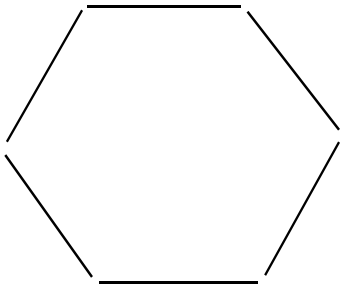
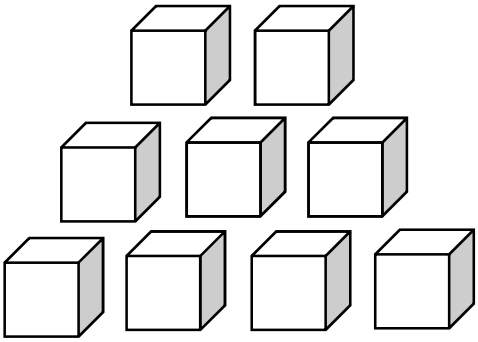
Puzzle 3: These six toothpicks are arranged in a hexagon. Starting with this arrangement, can you form two identical diamonds by moving only two toothpicks and adding just one more?



Puzzle 4: Can you arrange these numbered blocks into three equal stacks so that the sum of the numbers displayed in each stack must be equal to any other stack.



Thank you.

Your Remarks:

……..

……..

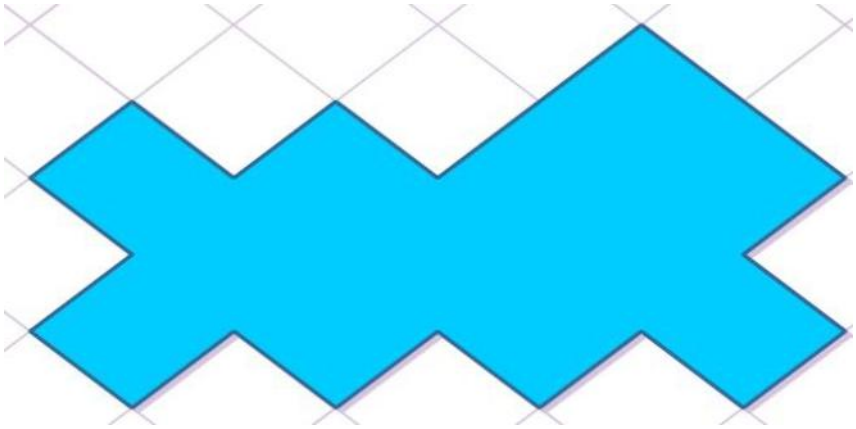
APPENDIX 5

Worksheet of session 5

Just to enhance your creativity☺

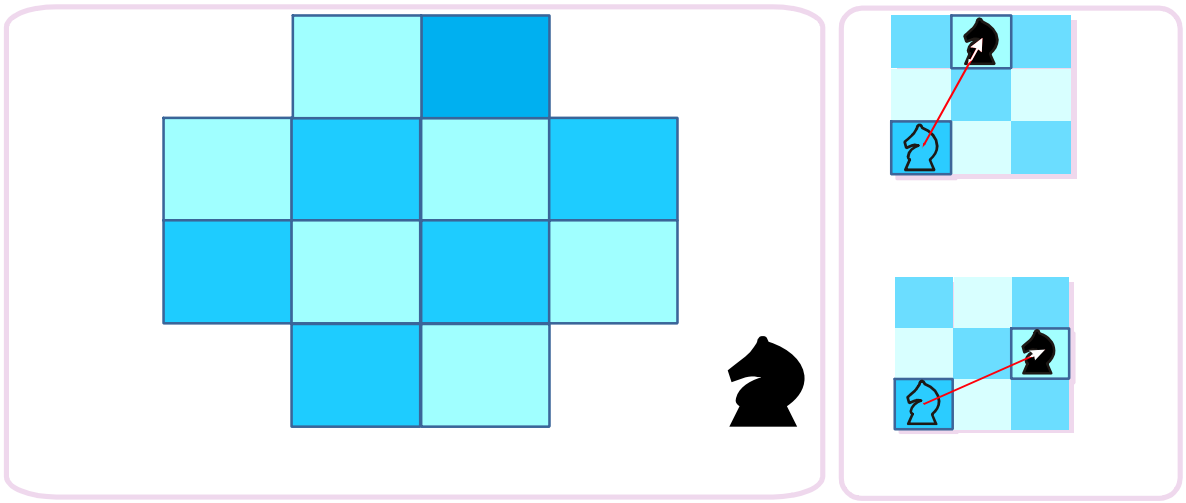
The fifth session

Puzzle1: The goal is to make a cut (or draw one line) ''of course it needn't be straight'' that will divide the figure into two identical parts.



Puzzle2: What symbol has to come next in the sequence of the five symbols in the illustration? Can you sketch this sixth figure?

Puzzle3: Place a chess knight (or a simple coin) in any cell of this board. The object is to visit with the knight every cell of the board exactly once, and return to the initial cell where your trip began from.



Puzzle4: Can you arrange the five pieces with letters on them so that to spell the name of an animal?

Your remarks:

Thank you.

APPENDIX 6

Worksheet of session 6

☺Just to enhance your creative thinking skills☺

The sixth session

Name: …… **Date of Birth: … / … / ……**

Email: …… **Or Fb account: …….**

Instructions: Please; - Fill in your information.

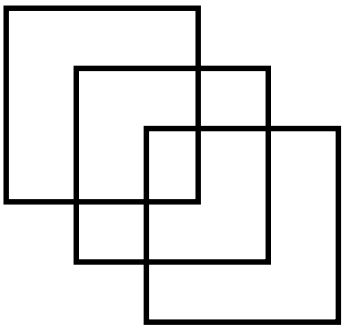
- **Follow your instructor lead.**
- **Try to focus and think outside of the box.**
- **Use this sheet as a draft for your trials.**
- **Use only the allocated time to each puzzle.**

Puzzle 1: A man lives on the tenth floor of a building. Every day he takes the elevator to go down to the ground floor to go to work. When he returns he takes the elevator to the 7th floor and walks up the stairs to reach his apartment on the 10thfloor. He hates walking so why does he do it? Clue: on rainy days he goes up in the elevator to the tenth floor.

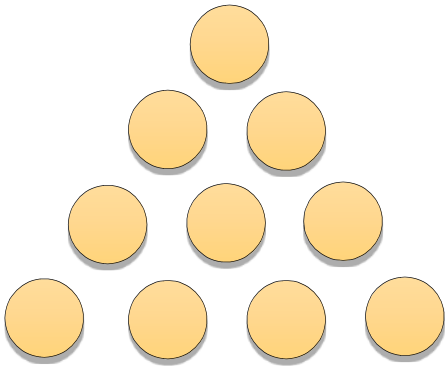
……

Puzzle 2: This arrow is pointing from south to north. Move one line and add another to leave the arrow pointing from east to west.

Puzzle 3: The shape below is made with one continuous line. Starting any-where, can you complete the shape without lifting your pencil from the page? As you probably guessed, your path cannot cross over itself.



Puzzle 4: The triangle below is made up of ten disks. Can you move three of the disks to make the triangle point in the opposite direction?



Thank you.

Your Remark:

…….

…….

APPENDIX 7

Worksheet of session 7

The seventh session

Directions: Do not begin until you are told to do so.

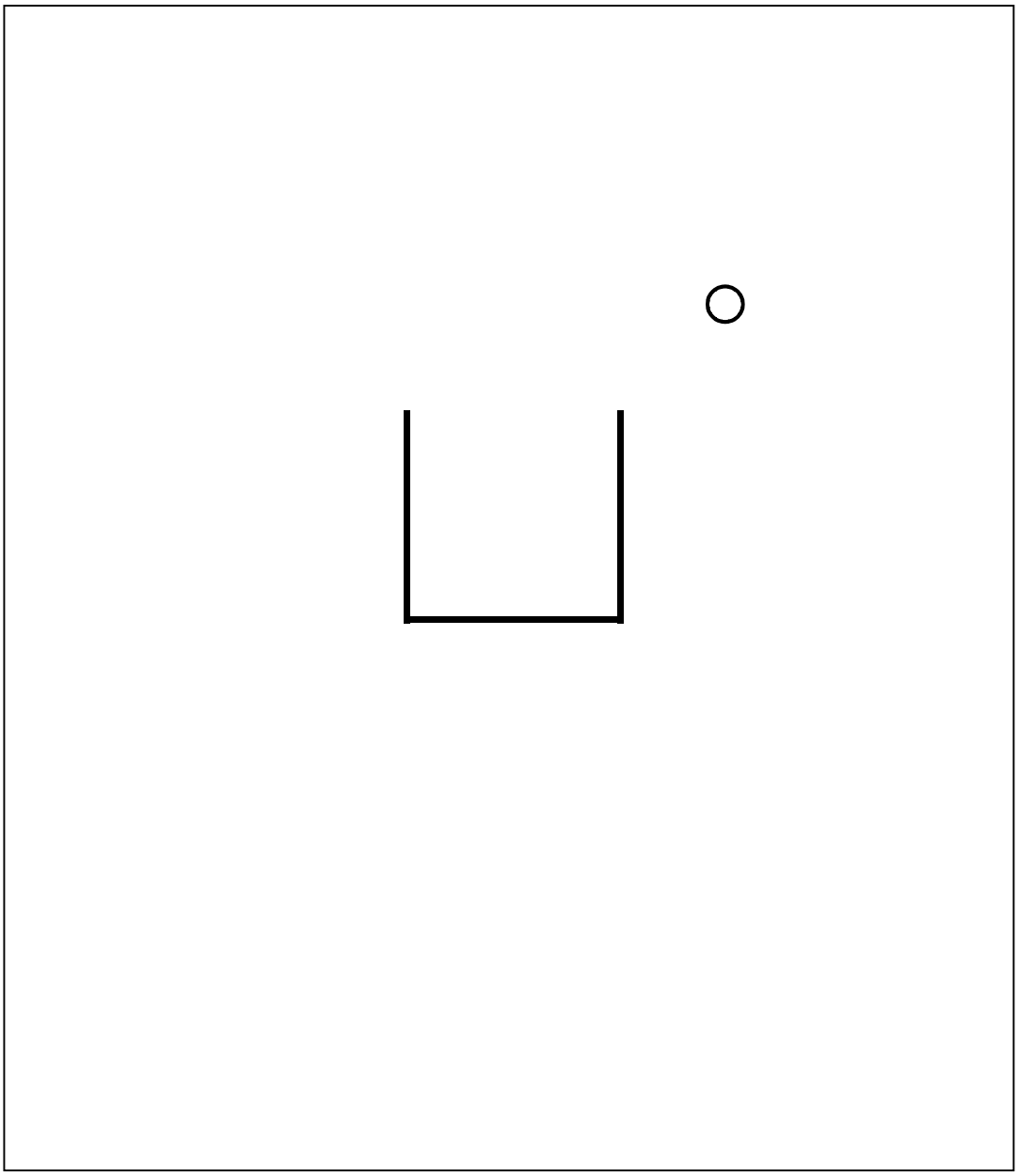
- Try to think of things that no one else will think of.
- Try to think of as many ideas as possible.
- Add details to your ideas to make them complete.
- If you finish before time is up, you may continue to add details or sit quietly.
- Please do not go to the next activity until told to do so.

Activity 1: Try to improve this stuffed toy rabbit so that it will be more fun to play with. You have 3 minutes.

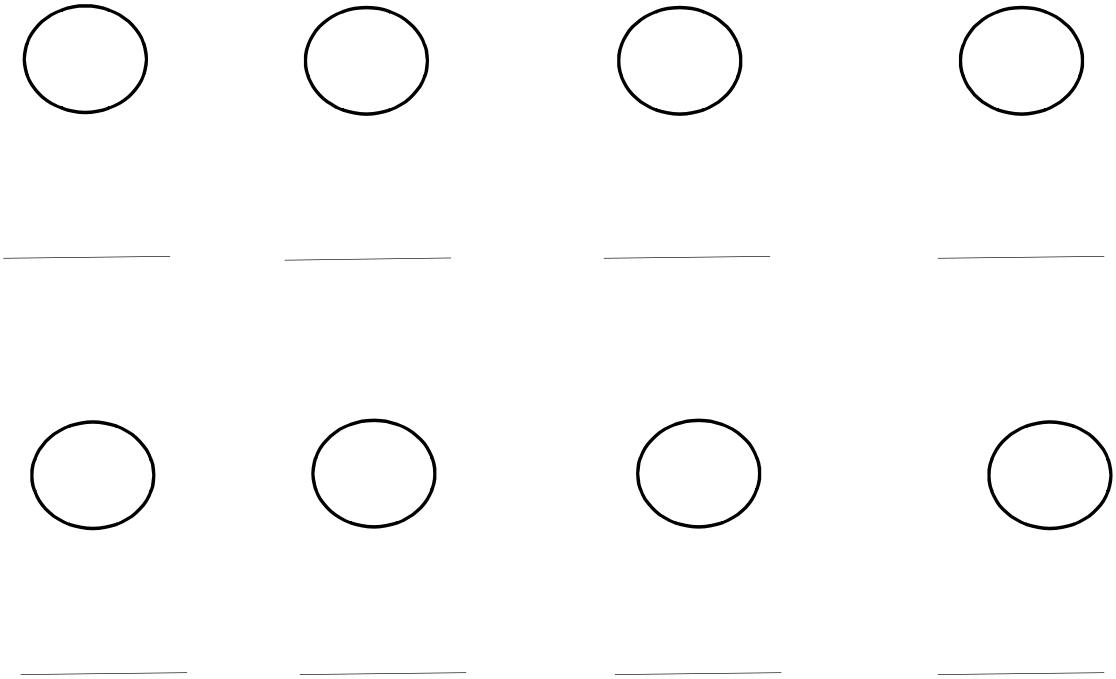
Activity 2: Just suppose that you are a superhero. What might be some things that would happen as a result? You have 3 minutes

Activity 3: What is the maximum number of unusual uses of a cardboard? You have 3 minutes

Activity 4: Add lines to the incomplete figures below to make pictures out of them. Try to tell complete stories with your pictures. Give your pictures titles. You have 3 minutes.



Activity 5: Add details to the shapes below to make pictures out of them. Make the circle a part of any picture you make. Try to think of pictures no one else will think of. Add details to tell complete stories with your pictures. Give your pictures titles. You have 3 minutes.



Name: _____

Class: _____

Gender: _____

Date of Birth: _____

Your remarks: ……. …..

……

Thank you.

ملخص

تهدف هذه الدراسة إلى تطوير قدرات التفكير الإبداعي لطلبة اللغة الإنجليزية كلغة أجنبية و ذلك باستخدام اللألغاز التربوية. يعتبر التفكير الإبداعي واحدا من أهم القدرات الفكرية إذ بدوره يتطلب قدرات المخاطرة، الخيال، المقاربة المغايرة للمشاكل، و توليد الأفكارالمتعددة. افترضت الدراسة أنّه و عن طريق إدراج الألغاز كوسيلة تربوية سيتم رفع قدرات التفكير الإبداعي لدى الطلاب. لتحقيق أهداف الدراسة المسطرة تم اتباع المنهج الوصفي التحليلي، و تركز الدراسة اهتمامها على طبيعة العلاقة بين متغيرين أساسيين هما القدرة على التفكير الإبتكاري و الألغاز التربوية. اعتمدت الدراسة على أداتي البحث الملاحظة و النقاش في الفصل لتحصيل أفضل النتائج. عينة البحث مكونة من 29 طالبا في السنة الثالثة تخصص اللغة الإنجليزية بكلية الآداب و اللغات الأجنبية بجامعة محمد خيضر بسكرة. بعد تحليل نتائج الدراسة تم التوصل إلى تأكيد فعالية استخدام الألغاز التربوية كوسيلة تعليمية في تحفيز و تطوير قدرات التفكير الإبداعي لدى الطلبة، واللذين استجابوا لحصص الألغاز و استحسنوا التجربة كثيرا. في الأخير و انطلاقا من النتائج المتحصل عليها تم اقتراح بعض التوصيات و الملاحظات البيداغوجية التي نأمل ان تساعد الأساتذة في إدراج الألغاز التربوية في الفصول التعليمية.