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**Enhancing Problem-solving Skills and Motivation
through Cooperative Learning**

**The case of postgraduate Students, Department of
Geology, University of Mentouri Brothers, Constantine**

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the LMD Doctorate in "Didactique des Langues Etrangères"**

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DEDICATIONS

This thesis is dedicated to my beloved family for their unconditional care, support and patience.

This work is heartily dedicated to my late aunt, may she find peace and serenity in the heaven, ameen!

This dissertation is dedicated to the world, thank you for the great diversity of miracles and wonders everywhere!

To everyone!

“Tell me I will forget,

Teach me and I may remember,

Involve me and I understand”.

Chinese proverb

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Abstract

The present research aims at showing the significance of active involvement into learning for boosting academic achievement, through exposing postgraduate students of the Department of Geology of the University Mentouri Brothers at Constantine to a problem-solving and cooperative learning training program, which includes a combination of activities, such as team building, and thought-provoking activities. We intend to get learners actively involved into thought-provoking tasks, which necessitate the application of problem-solving skills, and cooperation, then see the effect of training program on learners' academic performance. The general objective which steers the entire research is that learners learn better through hands-on activities which are particularly designed to enhance problem-solving skills and cooperative learning. Cooperative problem-solving provides learners with genuine opportunities to explore and practice problem-solving skills, namely deductive reasoning skills, and inductive reasoning skills within cooperative learning environment. Learners foster cooperative learning skills such as positive interdependence, face-to-face interaction, communication, and team working while dealing with issues which require deep thinking, and problem-solving skills. Our research design studies the effect of training program on learners' learning; the results obtained show a difference in learners' learning performance due to an exposure to a set of cooperative problem-solving activities, compared with their performance before being trained to do cooperative problem-solving activities, thus supporting the hypothesis of the present research. So, cooperative learning is directed toward getting learners engaged into exploring, employing and therefore improving their cooperative problem-solving skills; hence, active involvement into learning can actually be deemed as the cornerstone of effective and meaningful learning.

Key words: problem-solving skills, motivation, cooperative learning

List of Abbreviations

P.S	Problem-Solving
C.L	Cooperative Learning
W.M	Working Memory
S.T.M	Short-term Memory
L.T.M	Long-term Memory
D.V	Dependent Variable
I.V	Independent Variable
S.R	Stimulus-response
R.R	Response-response Law
N	The Total Number of the Participants (in the sample)
L.L	Language Learning
M.E.H	Means-end Heuristics
H.C.H	The Hill-climbing Heuristic
P.L	Phonological Loop
V.S.S.P	Visuo-spatial Sketch Pad
M.P	Modus Ponens
M.T	Modus Tollens
A.C	Affirmation of the Consequence
D.A	Denial of the Antecedent

STAD Student Teams-achievement Divisions

TGT Team-games-tournaments

GI Group Investigation

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Introduction

1. General Introduction

The present research is an attempt to unveil the relationship between problem-solving skills, motivation and cooperative learning for achieving higher academic performance. The three requirements of the contemporary education, which are respectively the ability to undertake real-life problems, the willingness to cooperate to achieve a common goal, and self-motivated attitudes, along with extrinsic motivation strategies and cooperative learning skill, are suggested to be the cornerstone of social constructivism. The latter underlines the external factors, which trigger and enhance thinking skills, as well as the focus on the reciprocal interaction between learners, teachers and knowledge, which pave the way not only to the achievement of a higher academic performance, but also to broaden learners' understanding of world.

Problem-solving skills are fundamental thinking skills, which involve deductive reasoning and inductive reasoning skills used to help in interpreting the world. Such skills in their essence are unobservable; we can only deduce that they are being used, for they are aspects of higher-order thinking, which require learners to think carefully about something (a problem), and act accordingly.

In other words, problem-solving skills are deliberate and conscious mental activities, which take place in one's inner world, and applied to make sense of her or his environment; these are the thinking skills which are used to formulate and test hypotheses, generate new knowledge, deduce from

available information, and constructively dealing with difficulties which may arise.

The aforesaid problem-solving skills are only made obvious through learners' response (behavior) toward an issue, and the educational outcomes (product) which reveal improved learning results, deeper comprehension of information, and the strategies which are used during problem solving tasks.

Cooperative learning emphasizes a genuine interaction between learners to solve problems, and offers the possibility to bring learners' various abilities (cognitive, personal, social etc...) to the field through actively engaging them into learning and problem-solving activities, in kagan's words (2009): "the students in the cooperative learning class [...] develop a wide range of personal and social skills"(Kagan,2009: 63).

Cooperative learning encourages every learner to be an active participant to the problem-solving and learning tasks; to make sense of different information and learning skills within a cooperative learning environment. Learners learn to work cooperatively toward a shared aim, they also develop a positive perception of the significance of cooperation, in order to deal with the problems which may occur in the work place or wherever they are encountered with; learners experience cooperative problem-solving as a sort of genuine preparedness for the future challenges.

During cooperative problem-solving process, learners together learn to utilize problem-solving skills, and learning strategies, in order to achieve a common goal. Given a problem to solve, learners attempt to define it, decompose it to its components, understand each component, and

brainstorm a set of alternatives to solve it, and back again to test the effectiveness of the solution being proposed.

Learners at the University need to learn skills which can be used in different contexts, and which enable them to interact effectively with the environment. Problem-solving skills and cooperative learning skills are the skills which are most needful for the contemporary education. This is so, because the main objective of education is to prepare effective problem-solvers, who can use problem-solving skills competently in different context, as well as being deeply conscious of their responsibility for their own progress, and willing to cooperate with others, in order to achieve a particular aim.

Consequently, learners become aware of the importance of thinking skills and strategies as being inevitable and essential part of their lifelong learning career. Hence, learners in their attempt to improve their learning, they experience a variety of learning activities which foster different aspects of thinking; they actively search for different types of knowledge, make use of the research tools, and also learn to direct their attention toward figuring out relevant information, and more importantly, they learn to apply what they have learnt while interacting with real-life issues, which will in turn develop a deeper comprehension of knowledge and achieve competency to handle real life problems.

So, University learners should understand that their learning is not only a preparation for an exam to pass with high marks, but they are to get actively involved into enhancing their thinking skills, as well as cooperative learning skills which enable them to succeed in their future occupations.

2. Aim of the Research

This research aims to apply cooperative learning and teaching method to enhance learners' academic performance. Our main commitment is to the social constructivist's notion which proposes that learners possess a set of mental skills, as well as social skills which help them excel in any subject they wish to learn, and therefore achieve better academic results.

Problem-solving skills are thinking skills which can be fostered through genuine social and cooperative interaction (for learning does not take place in isolation) with others (peers, group mates, experts, parents, friends etc...). This is so, because learners are the social beings, who are naturally endowed with the ability to think, which can be enhanced while cooperatively interacting with each other to deal with an issue (Williams and Burden, 1997; Brown, 2007).

A learning environment which allows every learner to enhance his or her thinking skills in a unique and personally meaningful way, and most importantly it encourages learners to adopt cooperative learning to handle a matter of concern, which is relevant to real-life situations and thought-provoking (referring to what is actually happening in real life during problem-solving tasks triggers an intensive mental work and increase learners' motivation to find out a solution). Consequently, learners learn to take advantages of the cooperative classroom which provides them with learning experiences that are much involving and motivating. In so doing, learners not only maintain their individuality while cooperatively solving a problem, but they develop a deeper sense of social belongingness to a particular group, which boosts their motivation and encourages them to foster their cognitive potentials even more.

The most important observations about our learners is that they act competitively few days before an exam, for they want to get the highest mark (and probably rewards), highly reticent when they are confronted with learning obstacles (they rarely address their problems), others are seen to seek merely a pass mark which allows them to succeed, even at the expense of achieving a complete understanding of information made available during classroom discussions , probably to maintain a positive self-image in front of their classmates (and parents). Cooperative learning encourages learners to develop and meet long-term objectives, and invest genuine effort and time (cognitive and social) into enhancing their problem-solving skills through active involvement into thought-provoking and cooperative learning activities.

According to Slavin (1995) learning to cooperate, and cooperating to learn, have become increasingly needful more than ever for nowadays education. This is so, because cooperative learning is probably the only method which enables learners to acquire thinking and cooperative skills, which allow them to interact adequately and cooperatively with their society. This view stems from an evolutionary perspective, which highlights the environmental influences on human behavior which led our ancestors (Homo sapiens) to develop and to cooperate, in order to survive. Hence, cooperative learning is suggested to aid learners to adapt to the continuously changing world (Slavin, 1995; Myers, 1999).

3. Statement of the Problem and Hypothesis

The main concern which led us to carry out the present research is that, most of the time, learners are observed to care merely for getting a pass-mark (Labeled, 2007), instead of focusing on the true meaning of learning,

rarely exchange their learning experiences with each other, talk less about difficulties they encounter during learning, perhaps due to an unwillingness to appear unsuccessful, and seldom exert sufficient mental work to understand and use information effectively, which is clearly manifested in their learning outcomes.

What is more, libraries are found hardly full, cyber space is not used frequently, either due to learners' ability to access internet from their smart phones or any other devices such as laptops, or uninterested in surfing the web at all. Faculty corridors are the most straightforward instance where learners crowd, and waste their most precious hours probably feeling bored, or unaware of how to benefit from meeting together.

Learners should be helped to understand that the University is a place where they learn different skills, including problem-solving and cooperative learning skills to boost their academic achievement.

What makes things worse is that our learners have started to believe that going to the University is aimless (Laped, 2007), and the most boring duty they are to stick to throughout the school year. (The latter can be noticed particularly when closely connecting with students from different domains, as an attempt to find out learners' attitudes toward learning, and therefore figuring out obstacles and difficulties they face during their school year). Hence, absenteeism rate has dramatically increased due to the lack of sufficient conviction and motivation, thus more time is wasted in the faculty corridors, and more potential (cognitive and social skills) are not being invested.

Nevertheless, the faculty administrations of foreign languages, as well as Geology have imposed a discipline and exclusion policy on learners'

repeated and unjustified absences. Yet, it is probably deemed useless to force learners to attend to something in which they lack interest, or believe it to be personally unappealing to their learning objectives, unless our aim becomes disciplinary more than educational. In this case, discipline may flood over long-term educational objective, and thus overlooking this latter which is to improve learning performance characterized by the ability to apply thinking, as well as cooperative learning skills and boosted motivation, which are in fact, the cornerstone of a higher academic achievement indispensable for meeting future challenges.

What is more, as teachers, we continue to behave like knowledge-deliverers in the 21st century; we prepare for a particular lesson, come to the classroom, state clear objectives of a lesson, and carry on with lesson elements, and when few minutes are left, we ask our learners questions, and allow those who are interested or have answers to raise their hands, and finally we allocate time for an exam, in order to assess learners' performance. Such traditional way of teaching does not help much to attain the objectives of meaningful learning.

We think that learners learn better when they are assigned roles to play through cooperative learning. The latter allows learners to take advantage of hands-on learning experiences, which are thought-provoking and meaningful. In other words, cooperative learning is the learning method which gets learners actively involved into a set of learning tasks, which are relevant to real-life situations, and which necessitate both deep thinking, and cooperativeness for their fulfillment. In so doing, learners develop an environmental perspective on the enhancement of different thinking skills, and the cooperative construction and understanding of knowledge, as well as an increased awareness of the importance of employing problem-solving

skills to real-life situations, along with a long-term storage of information, and maintaining alertness to incoming information.

The above state of affairs led us to construct the following questions:

- First, can deductive and inductive reasoning skills be promoted through an educational program of three months duration?

-Second, is it possible to stimulate learners both intrinsic and extrinsic motivation via cooperative learning and teaching approach?

-Third, is it possible to assume that enhancing learners' capacity to think deductively and inductively, i.e. being trained to practice problem solving skills, may 'guarantee' to a great measure a boosted level of motivation to apply problem solving skills when a situation calls for?(Knowledge boosts confidence).

-Fourth, can learners be trained to adopt group investigation as a learning method to uncover and understand the world?

Based on the previous questions, the hypothesis can be stated as follows: learners would better promote their problem-solving skills and motivation if they adopt cooperative learning as a learning method. Such state of affairs would get them actively involved into different problem-solving tasks, and permit a genuine cooperative interaction with group mates, as well as with the environment.

4. Methodology

A sample of twenty students ($N=20$), is randomly drawn from a population of sixty six (66) earth sciences students of the Department of Geology of the University Mentouri at Constantine. We will expose them to a training program which constitutes a set of thought-provoking, as well as

team building activities during three months. Our intention is to get the participants actively involved into problem-solving and cooperative learning activities, in order to foster their ability to cooperate to learn and learn to cooperate ,therefore improving their academic performance.

The improvement of performance is evaluated via the administration of post-test after the treatment. The latter is labeled a training program, which is introduced to see its effect on learners' performance, and show any significant difference between the pre-test scores and the post-test scores.

5. Structure of the Thesis

The present dissertation contains five main chapters. Four chapters are concerned with the literature review of the main concepts; chapter *one* and *two* cover the theoretical background of higher-order thinking skills, namely thinking aspects, and problem-solving skills. Chapter *three* attempts to shed some light on important perspectives on motivation, such as the social cognitive views, and distinguishing the well-known two types of motivation namely the extrinsic and intrinsic motivation, along with discussing some techniques, which are believed to increase both types of motivation, one of which is adopting cooperative learning. Chapter *four* reveals different reasons which justify our choice for cooperative learning, such as enhancing learners' thinking and learning performance. This also includes the possibility of involving learners into real-life problems, which call for cooperation and thinking skills. In Chapter *five*, the findings which are obtained will show whether or not there exist significant differences between two cases, namely, non-

exposed and exposed to the training program as will be displayed via the pre-test and the post-test scores. The training program is designed to show the learners the importance of hands-on experiences on their performance, that they learn better when the task requires the gathering of many minds to the accomplishment of a given task.

For a more detailed description of our doctoral dissertation, in chapter *one*, we presented a plethora of definitions of thinking from different perspectives. Thinking in Holyoak and Morrison (2005) is the cognitive manipulation of information, which takes place within the social setting (Wertsh, 1985). In this chapter we focus on the social factors, which contribute to the activation and improvement of thinking aspects. Problem-solving, memory, decision-making and metacognition are thinking aspects, which interact together while handling problem-solving tasks. Also, we highlight the importance of the dual coding theory, which explains the necessity for processing information on two registers, visual and verbal. This is worth emphasizing because of two main reasons: 1) that every learner is unique in her or his ability to respond to and act upon particular information. Dual coding permits the visual and verbal projection of data, a way which meets different learning preferences, 2) learners attempt to explore the relationship between what is said, and what is being shown, a task which requires them to keep alert and concentrated on the information being conveyed (Van Boxel et al, 2002).

Decision-making and problem-solving are the thinking aspects which are strongly intertwined. This is so, because problem-solving tasks require learners to find out several alternatives, and then opting for the one in terms of its expected high value, then once again, the one being chosen is to be evaluated for its effectiveness for problem resolution.

Decision-making heuristics, which are used to solve a wide range of problems, are employed while conducting a scientific research; these are the representativeness heuristics, the availability heuristics, and the anchoring and adjustment heuristics (Matlin, 2003).

Metacognition, which is perceived as thinking about thinking itself, is an advanced thinking aspect, which is indispensable for unlocking the intellectual potentials, including reflective thinking skills, reasoning skills, and the ability to maintain concentration on a given task for sufficiently long time. At the end of this chapter, we draw attention on the instruction which highlights 'how to think', and not 'what to think', that is learning thinking skills is to be our main commitments while teaching, because they aid learners to learn anything they wish, instead of limiting teaching with concepts and easy-made information, which are probably destined to fade away, or neglected in the mind's archive, as soon as the examination is passed with success.

In the second chapter, we will center our discussion on two main problem-solving skills, namely deductive and inductive reasoning skills. The latter are a range of significantly and extremely indispensable thinking skills, which are used to broaden comprehension of real-life issues and deal with any problem which appears in the field. Deductive and inductive reasoning skills enhance meaningful learning, and increase self-confidence, mainly due to experiencing several learning tasks, which call for hands-on conventional research tools, such as observation, experimentation, testing and drawing valid conclusions as based on the laws of logic. In so doing, learners will be able to explore their ability to handle any situation, which requires deeper thinking, and increase their understanding that thinking business is no more but a king's duty. Also, in

this chapter we will discuss deductive teaching approach as related to foreign language teaching. Grammar translation method seems to be the most straightforward instance which necessitates a careful presentation of grammar rules, then drawing a 'valid' conclusion from the given propositions, or rules (Richards and Rodgers, 1986).

Nevertheless, deductive reasoning is believed to be limited to the given premises, and brings nothing new to the world, but helps learners to organize new information into an accessible whole (Cohen et al,2000; Holyoak and Morrison,2005; Anderman and Anderman, 2009). On the other hand, inductive reasoning, which is contrasted with deductive reasoning, leads to exploring new information, through drawing inductive conclusions, which are based on the observation of a set of repeatedly occurring examples. Observation, hypothesis formulation and testing, experimentations, and drawing inductive generalization, are types of inductive reasoning skills, which allow learners to gather empirical data, and act upon the observed instances, which would finally enable them to obtain new knowledge and make sense of the world. The conclusions which are inferred from a set of instances are said to be probable, reliable or strongly reliable, yet not absolute, depending on the supporting data which are gathered.

Conducting a scientific experiment is viewed to include hands-on experience, inductive reasoning and deductive reasoning. On the basis of repeatedly occurring events, the experimenter formulates a hypothesis, which is perceived as a tentative statement or guess that the occurrences of some instances are due to particular factors, that is determining the

cause-effect relationship between two or more variables; that something causes something else to appear (Sternberg, 2009). In the subsequent step in conducting scientific experiment, the researcher attempts to test the validity of his or her hypothesis following conventional and empirical principles, this includes a comprehensive review of the background literature, choosing a research design, and finally drawing implications.

Conducting a scientific research can be an extremely confusing experience, particularly when the experimenter is not completely sure about the steps which are to take while conducting the research (Cohen et al, 2000).

Learning strategies are a wide range of tools or plans (Oxford, 1990; Schunk, 2009), which are used to overcome learning obstacles, and which are believed to accompany a problem-solver in his or her endeavor to handle an issue or solve a problem. Closely related learning strategies to the present study are the cognitive and metacognitive learning strategies, such as summarizing and planning, which are used to facilitate the attainment of knowledge, and improve the performance of learners. Getting learners into the process of exploring learning strategies for themselves while dealing with problem solving tasks, is the way which guarantees a life-long skillful ability to employ them in different contexts, for learners learn effectively when they are asked to try something for themselves. Cooperative learning allows hands-on problem-solving skills, and exchange of knowledge and previous experiences between learners, as well as the application of learning strategies to facilitate learning while handling an issue.

In Chapter *three* we will go through different definitions and perspectives on motivation, and techniques used to enhance both forms of motivation, namely intrinsic motivation and extrinsic motivation. Motivation is perceived as the 'wheel' which steers forward one's progress and achievement, and which makes learning meaningful and worthwhile (Brophy, 2004). Also, we will show how highly motivated learners may influence low motivated learners, and the role played by active involvement into different activities which leads to an increased motivation, and maintain effort to achieve a common goal; in a word, motivation is highly contagious. Holding high expectations for learners' capacities pushes them to perform better, probably as their attempt to meet those expectations which are held by the significant others, such as the teacher, parents and group mates, and encourage them to seek more significant opportunities, which allow them to build their own comprehension of a topic being investigated or learned.

The behaviorist perspective on motivation suggests that motivation to learn is broadly controlled by external influences (stimuli), that is to say learners are triggered to behave in a particular way (stimulus-response) to meet their basic needs, and their learning depends on different forms of reinforcements; learners behave in a particular way because they expect a reward from their teachers in return, which entails that the environment is the most important factor ,which leads to the reoccurrence of desired behaviors. This is so, because the environmental interaction is unavoidable in many cases, either while cooperating with the group-mates as to work on a particular task or interacting with the society, external influences such as positive reinforcement(or negative

reinforcements) effect to a great deal one's motivation to pursue(or abandon) a job (Jordan et al,2008).

The cognitive approach to motivation displays the role of thoughts or reasons behind certain behaviors, that a person is guided by inner convictions which make her or him act in a particular manner; in brief, the cognitive perspective on motivation is closely related with intrinsic factors, such as self-determination, and the meaningfulness and the expected value of the task being dealt with. The social constructivist views of motivation suggest that motivation is one's journey toward making sense of the world .The discrepancy between what is already known, and the newly introduced information creates a sort of disequilibrium, or conflict in one's mind, so the learners are motivated by the desire to resolve such cognitive tension (Williams and Burden, 1997). This includes the application of a range of learning strategies and problem-solving skills, while cooperatively interacting with group mates, the teachers and the task. So, according to the social constructivist view of motivation, a positive learning environment is such an indispensable requirement for enhancing motivation to learn and to think; learning environment which triggers each learner to develop on his or her own way, and most interestingly emphasizes active involvement into learning experiences to construct meaningfulness of the task, and calls for cooperativeness to reach a common goal (Williams and Burden, 1997).

In chapter *four*, we will discuss cooperative learning, along with displaying its cognitive, motivational and social advantages for enhancing learners' academic achievement. Indeed, so many times we have been through the statement: 'University is a melting pot', that is students,

teachers and scientific researchers, being the holders of the flame of knowledge, but, unfortunately only few of them (compared with the number of students who enroll at the university of Constantine) would continue to interact together toward improving the performance, and learning outcomes of the academic institutions. So, we would not be exaggerating if we say that people of different cultures and backgrounds are to assemble together, not only to search for knowledge, yet to exchange their experiences with each other, and cooperate, in order to undertake worldwide issues, and solve common problems.

Accordingly, each person comes to the field probably armed with a set of learning strategies, and thinking skills, and would contribute to enrich the given learning practices, and even attempt to cooperate with others, in order to find out a solution to a problem, or meet common challenges which become more and more complicated than they were in the past, therefore learning and thinking tasks turn into a motivating and meaningful learning experience. Human beings succeeded to survive not because they are the strongest, the biggest and the fastest species compared with other species, which had become extinct, but because of their ability to use their cognitive potentials while cooperating with others toward a common goal (Slavin et al, 1985).

Cooperative learning is not simply telling a group of people to do a certain job, but it is about teaming together to cooperate and provide each other with cognitive, social and motivational support until they learn an academic content (Slavin, 2009). Higher-order thinking skills, including deductive reasoning skills and inductive reasoning skills are likely to foster

and improve, due to being actively involved into activities, which are intended to trigger thinking and cooperative problem-solving skills.

Cooperative learning enhances problem-solving skills because it is a highly structured form of group work (Millis, 2010). It allows the integration and application of knowledge and skills while looking for a resolution of a problem, therefore, a deeper comprehension of real-life situations, and long-term retention of knowledge along with building healthy relationships are much more promoted. Also, participating in cooperative learning tasks calls for an engagement into thoughtful discussions and cooperative interaction with the society (learning environment which includes teachers, experts, peers, learning tools...etc) which would enhance both thinking skills and communication skills (Slavin, 1995; Millis, 2010; Woolfolk, 2004).

To Johnson and Johnson (2009), prior to involving learners into a task which requires problem-solving skills, they should be capable of showing the willingness to trust each other, provide support, communicate effectively, and deal with occurring conflicts in a constructive manner, which encourage a positive interruption into their cooperative problem-solving task, and therefore contribute to the accomplishment of their common goal. Modeling is a way which aids learners to understand, and employ interpersonal skills. To be precise, a range of interpersonal skills are to be explicitly presented, explained, and exemplified, either through referring to real life events, or narrating relevant short stories, or role plays; the teacher acting as a coach, may enjoy using her or his imagination as to try and reflect on different ways to expose learners to interpersonal skills.

The role played by the basic means of communication, namely verbal language, is never overlooked. Having a common goal to achieve, a problem to solve, or a learning obstacle to overcome induces learners to use various verbal expressions in their attempt to convey information, or explain a concept to group-mates, in so doing they develop both thinking skills and verbal communication: in a word, meaningful conversations stimulate thinking aspects, and promote problem-solving skills, which in their turn elaborate communication skills and enrich the group discussion, therefore leading to even better performance. Group investigation is among a set of cooperative learning methods, which is thought to contribute to the enhancement of thinking skills through investigating a research topic. Indeed an exhausting and extremely demanding job to be responsible for carrying in-depth research, particularly when individual work is strictly emphasized, group investigation as its name suggests, makes the task of in-depth research less confusing, easier and meaningful, because it requires group mates to cooperate together throughout their research journey to accomplish the task. Together choosing a topic of research, planning and implementing the research plan, having back-up plans or alternatives, constantly attempt different research tools and distinguishing relevant references to their task keep learners actively involved into group investigation(Slavin et al,1985).

In chapter *five*, we shall present and analyze data we gather through paired t-test, which is used to compare between the pre-test scores and the post-test scores as to see any significant difference between before and after the intervention, which is presented as the training program of

three months. That is involving learners into various activities, including team building activities which are intended to bring learners closer, and show them the importance of positive interdependence, also activities which are meant to develop and enhance thinking skills in relation to relevant life issues. In brief, learners will be trained to use their cognitive potentials (problem-solving, decision-making, communication, etc...) while cooperating toward a common goal.

Chapter .1

Thinking

1.1. Introduction

Human being is the most complicated yet capable species, which is able to learn how to perform a range of tasks which require thinking. Making choices, solving problems, and attending to an event are just few examples, which stand for the so called human phenomenon which is thinking.

1.2. Thinking as a Human Experience

Interestingly, thinking about how to solve problems, complete a task, or attain knowledge, and make use of it in different contexts, fosters learners' thinking skills, and improves their competence to interact with the surrounding environment. So, thinking is the mental faculty, which distinguishes human, from non-human, and which is steered by a purpose in mind. Thinking is defined as "The use of knowledge to accomplish some sort of goal: to perceive and understand our world, to communicate with others and to solve the problems we encounter in our lives" (Cited in Pastorino and Portillo, 2011:288).

For this, struggling to fulfill a goal, sustaining perseverance to meet a need, and the occurrence of obstacles, increase learners' motivation to explore useful learning methods, which are thought to facilitate a comprehensive understanding of a situation, tackle unexpected problems, or even reflect on some instance of behaviors and events, which may startle one's curiosity during moments of solitude, as well as while interacting with the environment.

Sometimes, learners may appear extremely overwhelmed by the occurrence of a number of unexpected events before them. Some events are neglected,

probably due to irrelevance to one's own goal; others may call for in-depth investigation, which may serve learners to elicit and figure out reasonable explanations. However, throughout the research journey, the learners may startle by the occurrence of unexpected obstacles, which may arise, and therefore may feel uncertain and unaware of which procedure to apply to solve problems, partly because of the endless number of the suggested alternatives, or probably misled by the insignificant part of data, which hinders successful problem solution. As a consequence, our learners may suffer an unpleasant learning experience, which debilitates their motivation to persevere, and prevents learning to take place, particularly when thinking is not sufficiently emphasized, and cooperative learning is completely avoided.

As humans, curious and inclined toward progress by nature, we constantly seek opportunities, which allow us to think effectively about everyday activities. In so doing, we also search for a variety of learning tools which satisfy our wondering intellect, genuinely connect with the environment, observe and hypothesize, as to construct our own comprehension of the world. Also, and at times, if we are fortunate to encounter a gifted person, with 'untamed' and creative thinking skills, we would notice her or his ability to visualize entirely unusual ideas before a genuine creation and application of knowledge, seeking to bring about new thoughts to the world, or probably a way to defeat boredom.

Hence, as can be deduced, the term thinking includes the interrelation of a number of mental acts, where an attempt to trigger and use a type of thinking act doesn't exclude another type of thinking, for thinking is an extremely complicated human phenomenon, which occurs only via one's changed behavior, we call learning, to review few: decision-making, problem solving,

and creative thinking, are only few aspects of the key term, which is thinking, which take place interactively; so, the term thinking cannot be presented shallowly, without exhibiting an effort to provide instances for every type of thinking act, and show how they relate with each other.

As can be deduced, handling the challenge of thinking is very important during learning process, where learners are to concentrate on the process of data attainment, data interpretation, and data generation, and consider the reciprocal influence of practice, and knowledge on both thinking potentials, and promote their competence to act effectively in the environment, a process which fosters thinking skills, stretches comprehension of the given information, and encourages classroom interaction.

Before going into defining thinking from different perspectives, the attention is to be drawn, primarily, to the difference between conscious, and unconscious thinking. The former entails a deliberate cognitive effort, which is directed toward making sense of the surrounding, whereas the latter stands for an unconscious thought, although it is perceived as mental acts, such as daydreaming, which are best illustrated to fall under the heading of unconscious thinking. In our research, we are committed to the conscious type of thinking, mainly deductive and inductive thinking.

Furthermore, On the basis of the literature review of thinking, a plethora of definitions of thinking are exposed. One definition attempts to highlight thinking as the faculty, which distinguishes human beings from other species, being the mental power, that makes them unique and exceptional creatures from the very old history, which is characterized by the first human walking the earth. In short, the ability to think allowed humans to compensate for their physical weakness, and supported survival throughout history.

As previously mentioned, thinking is not of a single portion, that is, the term 'thinking' is used to describe any cognitive, and intellectual activity, including directed mental acts such problem solving, and decision making, as well as, some thoughts, where a person is not fully aware of, such as daydreaming(Moseley et al,2005).

Thus, regardless of being aware of or otherwise, our learners are believed to possess the ability to remember, and learn from previous experiences, solve problems, and adjust their comprehension of information to the ever- changing world's requirements.

So, what is thinking?

1.3. Thinking Defined

On the basis of the literature review of thinking, we noticed several definitions, which are suggested by a number of psychologists, and philosophers, including Moseley (2005) Smith (2004) and John Dewey (1910), who used thinking and thought interchangeably to point out to everything, which cross through one's mind, and she or he is conscious of it. Things like beliefs, judgments or imaginative thoughts, which go through our mind during our waking life are said to be thinking.

So, the basic quality which highlights the human uniqueness, as compared to other species, is the distinctive property, which is called thinking. Hence, as human what makes us particularly unique in our ability to make use of the available tools, to manipulate the surrounding environment with reasonable ease, is thinking, compared with non-human species, yet, we must be fair in our stand, by stressing the fact that apart from few intelligent species (e.g.,like chimpanzees) which are noticed to be capable of solving some problems

intelligently, the rest are said to be led by their instinct to survive. In brief, thinking is the mental engine, which compensates for human's physical limitation.

On the basis of what has been said so far, it can be concluded that learners possess the ability to remember, to solve problems ,to learn from previous experiences, to connect to past events and to adapt to the ever- changing world, that is thinking, regardless of how well, or poorly they do so.

Based on the view which focuses on the crucial importance of carefully specifying the kind of instruction, as to improve a specific kind of thinking that the teacher wishes to enhance in learners, take for instance, reasoning skills, or decision making skills, she or he opts for particular instructions, and activities, which are meant to stimulate thinking, and improve learners' performance on the aforesaid thinking skills (Williams and Burden, 1997).

Interestingly, as to improve thinking skills, and maintain focused attention on thinking improvement, learners' awareness is to be raised toward the need to acquire knowledge, and act upon it in a way, which guarantees long-term retention and comprehension of information, namely through being actively involved into tasks, which require problem solving, decision making, reasoning, and hands-on learning, namely, tasks which are especially designed to trigger the aforesaid aspects of thinking. The learners get the best out of learning when they are asked to be a part of the learning process itself, a process which allows them to interact with a variety of learning tools, and cooperate with people who show awareness of the same interest in thinking skills enhancement, and learning via hands-on experiences, which indeed played a crucial role in boosting learners' motivation, and lead to the construction of meaning, and long-term remembering of knowledge.

So, due to a meaningful exposure to thought provoking tasks, the following thinking skills are only some examples of skills that our learners can improve:

1. Draw inferences from a set of given premises(reasoning)
2. Make Use of the previous experience to reach some sort of objectives(reasoning, remembering, and reflective thinking)
3. Explore differences or similarities or both which highlight two seemingly analogous topics, or objects(reasoning via analogy)
4. Willing to engage into the challenge of thinking(active learning)

1.3. Psychological Perspective of Thinking

In the realm of psychology, thinking is an internal mental process, which is responsible for constructing, and operating on mental representation of information (**Moseley, 2005**), that is, thinking is the cognitive endeavor to manipulate a mental representation of information within a particular domain, such as philosophy, psychology etc., so, as to transfer the current presentation of a given information into a new one for the sake of an aim or goal (Holyoake and Morrison, 2005).

Accordingly, thinking is said to include a purpose or goal to achieve, either to understand a new idea, or to find out an appropriate solution to a problem, and so on.

Moreover, understanding the need to make our learners act upon information, (which call for reviewing the previously encountered experiences knowledge and skills, whereabouts background knowledge contains information which are stored in long-term memory and retrieved, to meet a particular aim), increases learners' awareness of the world's constant fluctuations, and maintains attention on the material being learnt, all of which

are the privilege of being exposed to meaningful learning experiences in the past. Hence, an exposure to successful learning experiences, knowledge and skills, helps in the activation and use of several thinking activities, namely to convey meanings, elaborate on a given idea, define, and solve a problem, and contribute to knowledge construction.

Generating new knowledge is the result of conducting in-depth research, and exchange of data, a process which is deemed of a tremendous significance to improve learning performance, and enhance thinking skills simultaneously. So, in order to enhance thinking skills, learners should never cease searching for knowledge, and attempt to make mental associations, and representation of knowledge, which enable later memorization of knowledge, and which aids effective problem-solving.

In short, being assigned a task to accomplish, without being provided with ample amount of data related to the given problem, our learners may expect repeatedly occurring obstacles, while learning to think, and to make use of their cognitive potentials. Accordingly, the problem remains unresolved, and confusion effects learners' motivation to pursue the given problem-solving task, and increases a feeling of incapability to persevere in their efforts (Partillo, 2009).

Building on the aforesaid view, let us assume that learners are assigned a particular task to complete , or a problem to solve, say the Hobbits and Orcs problem(Matlin,2003); a well known problem in the realm of reasoning. In order to solve this problem, learners are to inquire about all the relevant data and details of the given problem, including the correct number of the Hobbits, and Orcs, and the time that appears appropriate for crossing the river, bearing in mind not letting any chance for Orcs, and Hobbits to assemble etc.... In this

case, the problem-solver (the learner) may hesitate to act immediately before being certain, that all the necessary information are available, such as the transportation means, the exact time and the defense mechanisms for the Hobbit to survive, if any unexpected trouble or circumstance arises.

Accordingly, learners learn to think creatively and rationally at the same time; they consider several alternatives, and make decision, plan, and implement the plan, then take an action to fulfill the task, and so on. Hence, thinking is an extremely complicated and demanding mental behavior, which requires the ability to act flexibly toward a thought-provoking topic. Yet, effective thinking is constrained by the amount of information available.

Educators such as Vygotsky noticed that thinking takes place within a social setting, where learners are assembled together, and with significant others, within enriched learning environment with divers up-to-date learning tools, which stimulate thinking potentials, and which make available unlimited opportunities for genuine interaction with peers, and more knowledgeable persons, or both, therefore our learners improve their perceptions, and gain more understanding of the world, which influence their motivation as well (in Wertsch, 1985).

When appropriately designed, though-provoking activities, which are suggested within the social setting, bring about an increased positive outcome to both one's thinking, and other skills progressively. Skills such communication skills, which include turn taking, active listening, fluency, and accuracy are very important skills for effective learning, which can genuinely be fostered, while interacting with individuals from different backgrounds in different contexts, a process which enhances thinking skills as well, namely the positive influence

brought by others' thoughts, and attitudes toward learning on one's adjustment, and development of thinking aspects.

Additionally, as far as meaningful learning is concerned, learners in an interacting situation, learn to suggest new ideas, elaborate on the given ideas, or bring new tools, which stimulate a genuine thinking effort, and allow hand-on learning, while collaborating, and participating in a classroom discussion.

Also, during a genuine interaction, learners learn to tolerate differences of attitudes, and be open to different suggestions to solve a problem, that is to say they learn to cooperate, and cooperate to learn , for an ultimate common goal to achieve, along with meeting personally meaningful goals, such as improved one's learning performance. For this, we continue to hold to the suggested research hypothesis, namely thinking within cooperative environment ensures win-win situation.

Also, it worth mentioning that knowledge generation is triggered, and deeper interest in getting a solution can plainly be noticed in the presence of others (Slavin,1995).

Furthermore, the ability to explore effective strategies, or skills, which are necessary to deal with a given situation, and which aids in the collection and evaluation of relevant data within a limited period of time, may sound to some students as extremely demanding task, or even a heavy burden to carry, especially when the emphasis is put on individual work, that is every single learner relies on his or her individual effort to accomplish the task. For this, we suggest that learning, and reasoning skills can be better improved, when learners' attention is drawn toward learning through cooperative learning, as to enhance both learning, and thinking skills.

Also, promoting the ability to take advantage of the previously acquired knowledge, which is stored in long-term memory, and retrieved when required allows learners to handle successfully many daily activities, to mention few, knowledge saved in memory helps learners to know how to act when encountered with a problem, to refrain from doing unbearable mistakes due to previous undesirable experiences, and effectively communicate with other people.

So, background knowledge is of a tremendous importance for boosting high learning outcomes, and effective social interaction.

Moreover, our learners need to be instructed the significance of being flexible, and open-minded while learning, and applying knowledge , for they will be able to find out, what many problem-solvers already did that what worked before in specific situation, would not serve their aim in another situation. Also, we reemphasize the need to apply knowledge just after learning it, for we dare to say that an awareness of strategies, skills or learning tools without application is meaningless, and subject to fading away quickly.

Furthermore, learning to explore effective learning strategies, such as problem solving strategies, as well as reasoning skills, requires thorough comprehension, and the ability to employ them effectively, as an indispensable requirement for handling any problem-solving situation.

Problem-solving skills, which include the collection, and evaluation of relevant data, and the ability to exhibit the end result in front of peers, or group of examiners within a limited period of time, a task, which may sound to some students as particularly demanding task, which put a heavy burden on them, especially when they are unfamiliar with such high quality thinking tasks, and individual work is the only method, which is adopted instead of

cooperation. For this, we think that learning, and reasoning can better be fostered, when learners are oriented toward cooperative learning as to enhance the quality of their learning and thinking, basically for several reasons, which will later be revealed in an entire chapter, which is entitled cooperative learning.

Now, we move to discussing a set of thinking aspects, which are believed to interact with each other while dealing with a situation.

1.4. Aspects of thinking

1.4.1. Problem Solving

Problem solving is a directed thinking, which is related to other types of thinking such as reasoning, and decision making (Anderman and Anderman, 2009).

Hence, problem-solving is thinking, which involves mental acts, such as recognizing, and defining a problem, brainstorming, and choosing from a range of alternatives to solve a problem. Problem-solving is thinking, which is considered a major educational aim to help learners to improve through practice (Use it or lose it).

The ability to use problem-solving improves the quality of thinking itself, and renders it more elaborate, and powerful. Therefore, one's ability to apply information, including problem solving skills, and strategies, which are obtained through research, discussion, and practice in different situations, entails increased competence in the use of thinking skills, and learning strategies.

Thus, problem-solving is an essential requirement for higher academic achievement (Matlin, 2003; Anderman and Anderman, 2009).

Moreover, problem-solving is said to be a broad term, which includes reasoning, decision-making, and creative thinking, that is, problem-solving is a directed thinking, which requires not solely a search for a solution *per se*, yet the enhancement of other thinking skills at the same time, essentially through active involvement into activities which are designed to improve thinking performance.

The ability to employ past experiences to understand the causes of a given problem, necessitates a rigorous thinking work (e.g., reasoning, problem-solving and memory) which is consecrated for planning and re-planning, presenting and representing, evaluating and reevaluating the result (the problem resolution).

Accordingly, understanding the components of the problem, and figuring out how they relate is considered a step forward to its solution.

Being involved in problem solving, learners are actually fostering many thinking skills at the same time, such as maintaining attention on the task, decision-making and memory, which will actually help them adapt with various new learning, and problem-solving contexts and situations (Anderman, and Anderman, 2009). Our learners are to hold to their responsibility for their success, through which they learn to value their Potentials, raise positive expectations from themselves, set goals, and look forward for the end results.

Similarly, Schunk (2009) states that problem solving is the most important type of mental processing, which occurs during learning, that is being faced with a difficult learning situation, a problem-solver looks for the most effective

problem-solving methods and strategies(heuristics), which lead to achieve the desired situation or goal (Schunk,2009).

Thus, while dealing with a problem, a deep cognitive processing (in contrast to the shallow processing which is less important) of the existing information, is much more important for learners to experience. Hence, for learners to retain relevant information, they need to get actively involved into problem-solving strategies, a process which is extremely necessary to facilitate long-term retention of details, which are related to the problem. This includes elaboration, and referring to everyday experiences, which are few examples of memory strategies, which allow deeper processing of information, and stimulate response to the given learning task (Schunk, 2009).

However, a question which might be asked by a reader is that: how can learners possibly be certain that the given task requires problem-solving ability?

The answer is provided by Anderman and anderman (2009), in their own words:

“A problem exists when a problem-solver has a goal, but does not know how to accomplish it”

(Anderman and Anderman, 2009:702)

A closer look at the above statement, aids us to elicit specific reasons for a problem solver to realize, that the situation actually calls for the problem solving ability:

So, our learners may reflect on the following:

- an identified current state, the desired state and the obstacle;
- operations or plans meant for facilitating the achievement of the desired state are not known as yet;
- The whole business is taking place within the learner's cognitive system.

Interestingly, in an educational domain, where the major goal is to help learners foster their ability to solve problems, problem solving is considered as an active process, which calls for learners' commitment to plan, implement, analyze, and evaluate data, and seek to choose the most useful solution for the problem at hand. Learners are given hints, not straightforward answers, which trigger more mental work, and which direct them toward specific activities or operations, which are believed to help them to get to the desired end result (Schunk, 2009).

Additionally, as mentioned before, background knowledge, which contains past experiences, should not be overlooked, for it facilitates deeper comprehension of the present state, and lead to solutions.

For this, within a rich learning environment, learners are to be exposed to a variety of sources, which contain important information that stimulate their thinking.

Furthermore, it is worth remembering a highly significant learning strategy, which stimulates thinking, and increases better performance, which is known as analogy. Due to its effectiveness for successful problem solving, our learners are to be instructed to deal with problems through analogy, which is the process of comparing between two, or more seemingly similar situations, as to investigate important components, which may provide insights to solve the

main problem, that is, finding out how to reduce the discrepancy between the given state, and the goal state through analogous cases (Brown, 2007). (Problem-solving via analogy will be discussed later with more details)

According to Brown (2007), as far as learning is concerned, problem solving is viewed as a kind of learning, which is tightly grounded upon a set of internal events, such as attention, memory and decision making, all of which fall under the key term, which is thinking (Brown, 2007).

So, it is strongly argued that problem solving cannot be detached from the highest mental faculty, which is thinking. Thus, problem solving is thinking, say a deliberate intellectual work, which calls for a flexible interaction, between thinking different faculties, and which is directed toward finding a solution to a problem. Flexibility can only be achieved via regular practice, which also includes hands-on problem solving activities (Brown, 2007).

Popper (1963) a key figure in the philosophy of science, describes problem solving as a salient pattern included within the topic of learning. For him, a problem exists when there is a discrepancy between the current state, and the expected state. So, our learners are challenged with thought-provoking activities, which encourage them to attempt constantly different operations, which are suggested to reduce the distance between the current state, and the goal state. Also, Popper (1963) explains that learners are to be asked to think loudly, revise and adjust expectations to be compatible with the given problem (in Olson and Hergenhahn, 2009).

An implication of Popper's view of problem solving is that learners are to be provided with the opportunity to vocalize different components of the problem, during problem-solving process, boldly conjecture many novel ideas, and confident enough for they feel not humiliated if they commit mistakes, which many people may consider they threat their self-image, thereby, our learners are much more able to develop creative problem-solving, as well as speaking skills.

Furthermore, Popper (1963) continues to think, that after suggesting a plethora of ideas, not considering their appropriateness, or correctness, nevertheless, he argues, they must be relevant to the given problem. In the subsequent step, according to Popper, what our learners should take into account after collecting sufficient amount of new ideas is the need to evaluate them according to certain criteria, say for instance their utility to the classroom debate, and the anticipated effectiveness to reach a goal, then, as might be evidently suggested, the problem should not be left unresolved, our learners are to opt for the most effective idea or solution, and implement it(Olson and Hergenbahn, 2009).

Additionally, with regard to the think-aloud strategy used to enhance thinking skills, Sternberg (2009) reports that problem-solving ability increases, when learners are instructed to speak up their thoughts, or write down a description of the given problem solving strategies, which were used during the problem solving task.

Furthermore, a relaxed learning environment, which triggers the habit of thinking, and encourages our learners to take initiatives of the challenging problem-solving activities, is tremendously indispensable for increasing

academic performance. Learning environment, which is characterized by the reciprocal exchange of ideas, and which emphasizes cooperative investigation of information, where a set of interesting and thought-stimulating learning tools are made available, aids learners to dig deep into the realm of their thinking faculty, while interacting with the others.

A focal opinion is to be highlighted with regard to the most engaging learning environment, alongside the aforesaid implication which is suggested by Popper's view, and his emphasis upon thinking out loud throughout problem-solving process, a judgment-free learning environment sustains learners' attention on the task, and encourages creative problem-solving. Popper (1963) suggests that it is very important to remember that no response or contribution by learners is deemed unimportant, or a waste of time. In so doing, learners feel at ease to brainstorm new ideas abundantly, as much, and creative as possible, all of which for the purpose of enhancing learning, and problem solving skills (Olson and Herganhahn, 2009).

Also, our learners need to understand that, if they are to master the use of problem solving ability, they should realize that any problem, which occurs while learning, calls for an internalized comprehension of its components, along with developing their reflective thinking, which is focused on discovering how those components are possibly related. For this, attention is to be paid to every detail, which is contained in the problem.

1.4.1.1. Characteristics of a Problem

Sometimes we feel unable to recognize the existence of a problem around us, and without paying attention we continue to feed it more problems, which may render it even worse. For this reason, we need to bear in mind the following characteristics, which distinguish a problem, from non-problem situation:

First, all the problems have an initial state, which might be partly recognized by a previously experienced situation, which is stored in long-term memory. Again, we see that memory plays a crucial role in problem-solving, so, there is no doubt that thanks to memory, and problem solving, human beings could survive throughout history.

Second, all the problems have for the thinker a particular goal, that is a solution.

Third, the problem should be broken into sub problems, to facilitate the attainment of the ultimately desired situation (the goal).

Forth, learners should perform certain operations on the initial state, as well as on the sub-goals, seeking to reduce the distance between the goal state, and the desired state (Schunk, 2009).

Interestingly, as far as language learning is concerned, Williams and Burden (1997) shed light on the significance of considering the process of learning a new language as a problem to solve. In other words, during language learning process, learners' awareness is to be raised to take into account the importance of experiencing abundantly various language learning tools, and directing necessary language learning strategies to their own use, so as to develop their ability to master the use of the target language, and make it their own. For instance, dividing the major problem into sub problems, therefore mastering a new language is deemed a problem or a "mission" to accomplish, and we point out to sub problems as being the speaking skills, writing skills, listening skills, and reading skills, all of which are requisite for our learners to master, in order to make the target language their own (Williams and Burden, 1997).

So, in order to reduce the distance between knowing and not knowing how to use the target language, language learners need to perform certain activities (operations), which help them to master the use of the target language skills. In short, learners deal with the aforementioned sub-problems, in order to reach the ultimate goal, namely mastering the target language (Williams and Burden, 1998).

Let us consider the following example, where the speaking skill is deemed a sub problem:

Learners of English language may decide to perform certain activities, which are suggested to increase effective communication, where the main problem was inability to speak in front of others using the target language, which actually hinder their progress to master the use of the new language effectively. Failure to communicate in the target language, is mainly due to insufficient practice, which cause hesitation, inaccuracy, as well as the fear to switch to the mother tongue, when basic, and appropriate vocabulary, which are required to convey the intended meaning are not available as yet.

So, learners of English language, perform the following:

- Gathering and evaluating data in the target language
- Acting upon the available information; for example, mentally attempt to represent the information.
- Assessing the utility of the activities, and outcomes
- Holding the responsibility, and control over learning in general, and speaking skill in particular (Williams and Burden, 1998).

According to Schunk (2009), problem solving is particularly involved in meaningful learning, either learning a new language, or sciences.

Learning through problem solving, ensures a deeper comprehension of information, and application while dealing with a particular problem, mainly when our learners are able to recognize the need for a reciprocal interaction between the task, the learners and the teachers throughout problem-solving and learning process.

1.4.1.2. Problem-Solving Strategies

Now let us shed light on problem-solving strategies, known as heuristics, w used mainly to facilitate the accomplishment of a problem-solving task.

So, what is meant by heuristics?

Heuristics are defined as being methods, which are used to attain a solution, yet not necessarily a guaranteed solution to the given problem (Matlin, 2003).

Sternberg (2009:437) describes heuristics as being “informal, intuitive speculative strategies”, which can bring about a solution to a problem; nevertheless, they fail to achieve the goal in some situations (Sternberg, 2009:437).

According to Holyoake (2005), heuristic strategies are characterized as being highly flexible and general strategies, which can frequently be used in different situation.

Heuristics comprise a list of principles, which are used to solve a problem; they are called the rules of thumb. Rules of thumb are steps that lead to a solution in several cases, and which help learners to be systematic problem-solvers (Schunk, 2009).

In problem solving, heuristics are not strict or rules-bound strategies. In other words, problem-solvers are free to choose any heuristics, which serves the accomplishment of their aim.

Also, our learners begin problem-solving by realizing its existence, and definition, and then they continue the task through gathering relevant data, planning and carrying out the plan to solve the problem. The learners attempt to look at the problem from different perspective, which enable to internalize the entire components of the problem, therefore exploring totally different details, which may broaden comprehension and possibly reveal further effective solutions for the problem, probably unlike earlier discovered alternatives , thus a new developed understanding of the given problem leads to restating, re planning and re implementing and reevaluating the end result(the problem-solution), and vice versa. In brief, the rules of thumb are very flexible strategies, for we can manipulate their order as to achieve a goal.

The following heuristics are considered a useful model, which constitutes of a set of procedures, which are developed to deal with problems in almost any domains:

1. Understand the problem:

- What is the problem?
- What is the unknown?
- What are the data?

2. Devise a plan:

- Find out the relation between data and the unknown(the unknown can be the steps that can solve the problem)
- Break the problem into sub problems
- Restate the problem

3. Carry out/ implement the plan:

- Check each step while carrying out the plan
- Implement all the steps

4. Look back(revise and review) :

- Verify the effectiveness of the solution
- Try out other possible solutions

Polya's list of mental operations, which are involved in problem-solving (1945/1957).

Source: Schunk (2009:199)

According to the rules of thumb listed above, problem-solving is a sequence of stages, through which several metacognitive components, including planning, and behavior modification are in attendance throughout the process (Williams and Burden, 1998; Schunk, 2009).

Now, we move to underline the three kinds of problem solving heuristics, which are believed to be very useful for problem solution, yet not limited for particular problems. These are Means-End Heuristics, Analogical Approach, and finally Hill-Climbing Heuristics. These methods are suggested to achieve steps forward toward the desired goal.

1.4.2.2. 1.Means-End Heuristics (MEH)

This method is concerned with determining plainly, the goal state, the current state, and the operations, which are called for to reduce the distance between the current situation, and the desired one. Also, using Means-End Heuristics, indicates that our learners are to be instructed to make a constant comparison between both states, while acting on the given state, via operations, as to

minimize the difference, and make sure that the operations being introduced are truly effective, and reveal possible progress, all of which at the same time (Sternberg, 2009).

Two main components of means-end strategy are to be pointed out, they are as follow:

- a. The division of the whole problem into smaller and more approachable portions.
- b. Reduce the distance between the initial state and the goal state of every portion in the problem (Matlin, 2003: 372).

In several circumstances, Means-end heuristic are seen to be learners' most preferred problem solving strategy, for it is easier than many strategies, and can generate solutions. In this strategy, the learners should be able to identify each sub problem, find out what brings them together, and what might cause the discrepancy between the given state, and the goal state.

Moreover, cooperative learning yields to cooperative problem solving, due to the fact that cooperative data collection, analysis, revision of findings, and collaboration are regarded as the learning strategies, which lead to win-win situation and which lead to the accomplishment of a shared goal(Schunk,2009; Trenholm,2008).

Notwithstanding its significance for minimize the distance between two situations, it is worth saying that Means–End heuristic burdens learners working-memory, which is a necessary mental faculty for the temporary storage, and manipulation of different phonological, and visual items, beside the items that are decades ago. This occurs, particularly, when learners are faced with a complicated problem solving activity, where multiple number of

important data are to be considered, while trying to solve the problem, the learners may be subjected to miss required details while analyzing another. Take for instance, trying to determine which kind of relation that link two apparently related factors, where learners have to keep track of several items, including the phonological, and visual data, as well as the items that are stored in long term memory. The aforesaid mental acts are coordinated via the chief sub-system constituted in working memory, namely the central executive (Schunk, 2009).

Two main types of means-end heuristics are working forward, and working backward.

In working forward, learners start their search for a solution from the beginning until the end (Sternberg, 2009).

Let us consider the following example:

A researcher is conducting a scientific research; She or he starts by observing repeatedly occurring instances, formulating hypotheses, followed by developing a research proposal, then surveying the literature review of the topic being studied, after that, the researcher moves to conducting an experimental design to gather descriptive data, evaluating the findings, confirm the hypotheses, which was suggested at the very beginning of the research, and finally suggest recommendations for future application and research . So, we notice that working forward is strictly methodological strategy, which takes us to solve a problem by dealing with its component one by one.

In working backward strategy, the learners focus on the end state, and move backward from there (Sternberg, 2009).

The main objective of working backward strategy, is that learners get involved into the “the realm” of problem solving with the end state, or goal in the head. In other words, the goal is already visualized in the mind, and the real occupation is to discover ways or methods that can possibly achieve the goal, which is the desired state. The latter should be broken into sub goals, as a method to facilitate understanding, and implementation of each sub-goal for the sake of the already aimed state. In addition, several moves or approaches are made, which are thought to achieve the goal, and finally get the job done, and so forth (Schunk, 2009).

1.4.2.2. 2.The Analogy Approach

Analogy is described as “the process by which a problem-solver maps the solution for one problem into a solution for another problem” (Anderson, 2000:247).

So, based on the above description, we notice that the analogy approach to problem solving is concerned mainly with unveiling a special kind of resemblance between two analogous cases, which share common patterns among their elements. Learners are should learn to use the analogy approach, which enables her/him to benefit from the initially experienced case, which contains information that are thought to be well understood, and which contain similar components that may pave the way for better comprehension of the current situation, which is perceived as the target situation. For instance, the analogy between introducing new system of education, which is called LMD, and the classical system .The learners evaluate both systems, and search for shared characteristics, which show similarity between both educational systems (Holyoak and Morrison, 2005).

For classroom practice, the analogy approach is made possible, when learners are presented with models for solution. Take for instance, an analogy between body building exercises, which include weight lifting, and health diet, and brain building activities such as brain games, reading, and conducting researches. This example suggests that those common patterns, which exist in both exercises, that is body building, and brain building, that building strong muscles to increase body fitness, is as similarly important as reading to build a flexible brain, able to act properly to daily activities. So, at the end, the learner will be able to deduce that both the body and the brain need regular exercises to keep them fit.

In the analogy strategy, our learners should understand that the principle requirement is not simply of considering the superficial structure of the analogous cases, that how the shared patterns look like, but of analyzing the abstract meaning of both cases, and the implication carried by both, a process which actually necessitates not only reading both cases to detect any sign which may satisfy superficial thinking, yet digging deep into the shared components, to decode possible hidden meanings, which means that our learners develop not just their ability to solve problem via analogy, yet they are involved into reflective thinking, which requires sustained attention and deeper mental effort (Matlin, 2003).

Likewise, Reisberg (2001) notes that learners are motivated to use the analogy heuristic, when they are challenged from the start to attend to the deep structure, and the intended implication of a particular text or situation.

That is it is necessary to delve deep into the meanings of the given information, and cling to comprehending what may initially sound incomprehensible, instead of looking at the surface, which may contain misleading features (Reisberg, 2001).

Moreover, the analogy approach is believed to facilitate understanding, and leads to a solution for the problem, mainly when our learners are provided with a variety of sufficient examples. Hence, an exposure to a set of models or instances, which include analogous cases or problem features, fosters learners' ability to search for similarities, and possible differences between analogous activities as well. Trying to solve a problem, via analogy, will definitely aid better treatment of the present one, and enhance thinking skills. The aim is to teach learners that previously applied strategies in a situation can also be of a great usefulness to the current one (Matlin, 2003).

Problem solving by analogy entails a constant stimulation of thought, by reflecting, rereading, comparing, and testing, etc... Our learners review their background knowledge, which contains previously experiences learning situations, which may comprise patterns that sound familiar, which are likely to aid problem comprehension, and solution. In other words, analogy makes learning, meaningful, motivating, and easier, when unfamiliar concepts or problem solving activity is illustrated in terms of what is familiar (Holyoak and Morrison, 2005).

Furthermore, when learners are asked to analyze the relation between features shared by both cases, they develop their conceptual and analytical thinking skills, while acting up information, which are available in both

analogous cases; they compare between the given instances and search for shared components which bring them together. Hence problem solving via analogy is better achieved, when a large body of analogous topics is made available. Cooperative learning encourages problem solving via analogy, because it emphasizes search and exchange of information, and meaningful group discussion (Anderman, and Anderman, 2009).

1.4.2.2.3. The Hill-Climbing Heuristic (H C H)

According to the hill -climbing heuristic, problem solving is regarded as the highest spot on a hill our learners are challenged to reach. So, our learners need to climb up towards the goal, for they are made aware that each right step they make, will take them closer to the goal (Anderson, 2000).

Hence, the distance between the desired goal state, and the current situation or problem, can be reduced via making certain operations (Activities).

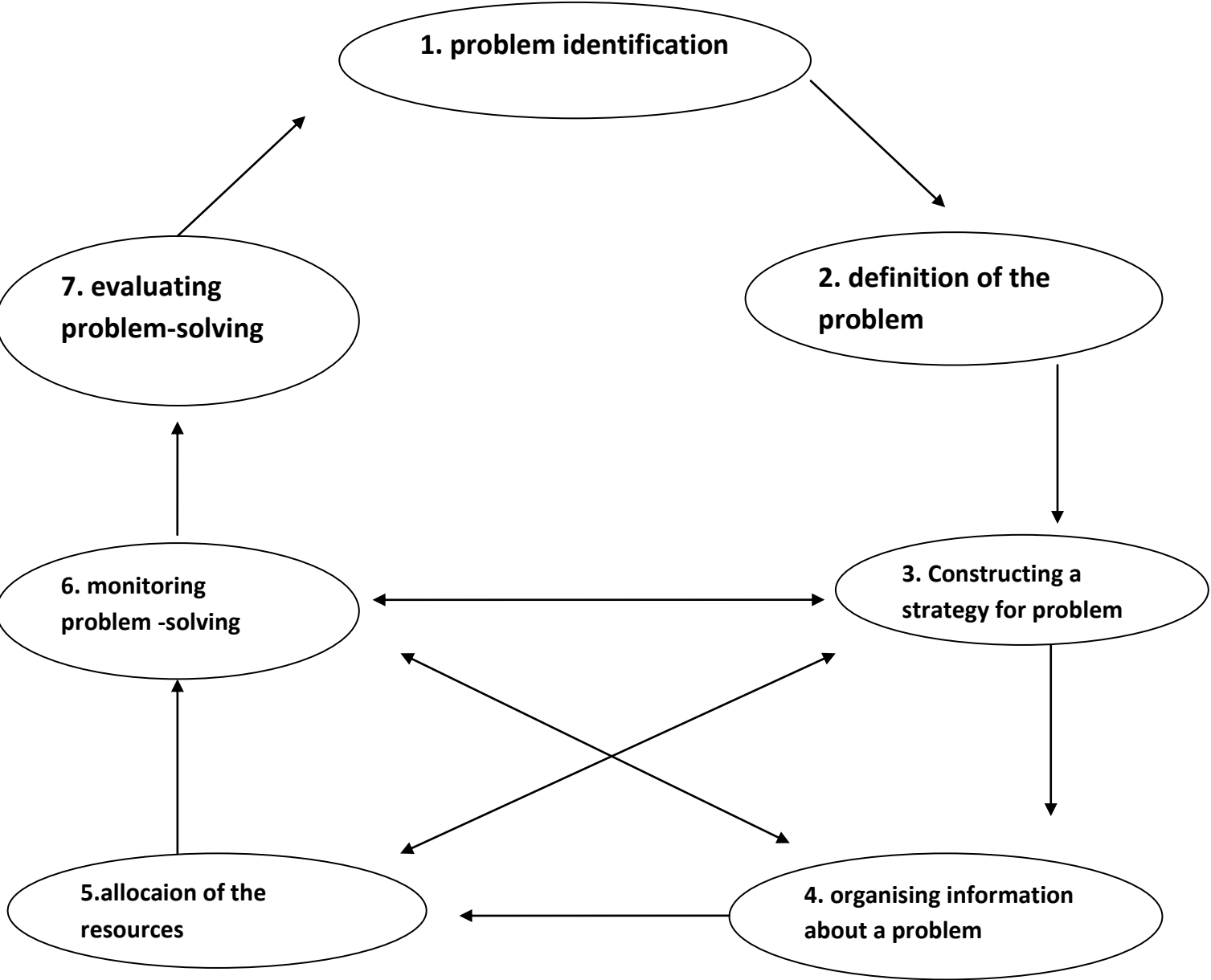
Hill-climbing heuristic is recommended, because it is a straightforward problem solving method, and step-by-step method toward the end result.

However, Hill-climbing main drawback is that it is misleading and less efficient, because while our learners are trying to reduce the distance between the initial state and the goal state, they may mistakenly choose an incorrect alternative, which appears to lead directly toward the solution, whereas in fact, it costs our learners to spend longer time performing unnecessary moves, which prevents further progress (Sternberg, 1998; Matlin, 2003).

Also, less direct alternatives (suggested solutions) can probably be more beneficial to the accomplishment of the goal state, and which are overlooked in many cases. For example, working to foster communicative skills, (i.e, the goal), our learners (the problem solvers) perform certain speaking activities (Steps), which are supposed to enhance communicative performance, yet at some point, the learners may rush into doing less effective(or ineffective) activities which are of short-term benefits. Take for instance, practice speaking in the target language when alone is beneficial to improve speaking, and vocabulary learning, yet avoiding communicating with peers or native speakers, slows effective speaking performance in the target language, therefore making again the distance between the goal state, and the current state even broader.

However, learners can avoid failure to achieve the goal by actively participating in group discussions, listening carefully to others' opinions, and responding to thought-provoking questions, through questioning and elaborating, therefore they foster high-level thinking skills, and improve effective communication in the target language at the same time. Also, learners may wish to perform both activities, that is to say speaking to oneself with the target language, and exploring vocabulary, as well as performing the aforesaid activities while interacting with the group mates (Matlin, 2003).

The Next is a figure (01) which shows the steps of the problem solving cycle used to deal with various problems in different contexts:



Source: Sternberg (2009:430)

1.5. Five types of knowledge

As it is mentioned at the beginning of the present chapter, possessing an ample amount of knowledge is extremely important to deal with problems effectively, where a lack of necessary portions of data cause an inner conflict, and prevent successful problem-solution. Five types of knowledge are said to exist, our learners need to be equipped with. one way to fulfill this aim is to call learners' attention toward the importance of 'go and get' different types of knowledge, seek multiple opportunities, such as reading, conducting experiments, and social exchange of opinions, which would actually influence not only their ability to deal with problems, yet stretch their thinking with relevance to the world of events (Anderman and Anderman, 2009).

1. The first type of knowledge is concerned with knowing all the facts, their characteristics and elements. As to elaborate on this point, we try to review a previous example about learning a new language which is considered a problem to solve. So, our learners break the problem into sub-problems, in our case, ignoring the correct use of the new language is the problem, and the desired situation is to learn the target language and master the use of both speaking, reading, listening and writing in the target language. So, our learners search for a set of language learning strategies, which are believed to aid them to learn, and make the new language their own. Yet a requisite for long-term learning is the application and practice of learning strategies. The latter are believed to enhance effective learning of the target language, maintain interest in the language learning, namely mastering the use of the target language skills; speaking, writing, reading and listening skills.

Accordingly, the fact is that language learning is not a short-term objective which ends when it is successfully achieved, and curiosity fades away,

probably when a list of language vocabulary are explored and used, or a need to go abroad has been met, yet language learning is a tool of communication used to convey thoughts and feeling, which effects thinking enhancement and increases the ability to adapt to the changes which occur in society. This view is based on the finding of several researches which hold that language learning increases attention, and encourages cognitive attendance to different learning situations. Also, language learning maintains good relationships with the native speakers of the target language. Learners can benefit from social networks in their use of technology to keep in touch with speakers of foreign languages from all over the world, to speak about life events, as well as to exchange significant problem-solving experiences with many people who have things in common, such as language learning, and building awareness of the need to cooperation to solve problems and meet goals.

Also, it is worth saying that, learning a new language is not only a cognitive, and social work, where our learners focus on activities which support effective use of language skills, but it is also an emotional experience, which influence learners' ability to interact with the environment, which is another fact related with language learning(Williams and Burden,1997).

2. Knowledge of ideas, hypotheses and principles, is the second type of knowledge which aids learners to identify relevant research methods for approaching a problem.

3. Knowledge of problem solving strategies is the third type of knowledge our learners need to be equipped with. Breaking the goal, into sub goals, to make them more approachable, analyzing and synthesizing problem components,

trying analogous cases are few instance of problem solving strategies, which provide hints for problem solution.

4. Knowledge of different procedures and formula. This type of knowledge is particularly important when statistical measurements are recommended while conducting a scientific research, in order to test the effect of a variable over another, look closer at the correlation of two or more variables, confirm or disconfirm a hypothesis, and so on.

5. The last, yet not the least important type of knowledge our learners are challenged to comprehend is considered the most difficult type of knowledge, which may require a person to spend the whole of his/her life to gain it, yet when it is fulfilled, knowledge becomes a purpose, not a sheet of paper to learn by heart a day before an exam, namely knowledge of oneself. Knowledge of the self includes a deeper awareness of one's worth to be successful, beliefs in one's potentials, which enable her/him to overcome obstacles, and interestingly, provides to her/ him enough intrinsic and extrinsic convictions to be completely in charge of her/his learning, and problem solving enhancement (Anderman and Anderman, 2009).

1.4.2. Memory

The term to memorize is used to point to the act of recalling events, which took place in the past and preserved in the memory. For instance, people remember well that Yuri Gagarin was the first astronomer who travelled to the outer space. This event occurred in the past and is still maintained in human memory as being a worldwide scientific victory, which points out to the human attempt to have power over the nature.

So, the ability to store, and retrieve previously experienced events in some manner, say through certain memory strategies, is said to be thinking. The fact that people celebrate a special occasion every year, in order to remember the change it causes, entails that they still memorize details, which are related with it.

Also, as far as problem solving strategies are concerned, acts such as understanding different components of a problem, and observing how they are related, (successful problem solving depends heavily on how we understand the problem), brainstorming a set of alternatives for solving the problem, then opting for an alternative, is a process which calls for background knowledge, along with the activation of other mental activities, such as memory. That is background knowledge which includes previously experienced problem-solving, and which is stored in long-term memory (Sternberg, 2009).

So, what is memory?

According to Slavin (2006) memory is a mental system, which is essential for receiving, and retaining an infinite number of information. In Slavin's own words, "memory is the mental faculty, which is responsible for holding memories" (Slavin, 2006:166).

Also, memory is described as the process by which information are maintained with time (Matlin, 2005). Sternberg (1999) describes memory as the means through which humans use and benefit from information which were experienced in the past.

Accordingly, in order to show that memory is used to recollect past events, let us consider the following example, which tells a story of an expert scuba-diver reporting, and stating her first steps toward her dream career:

‘Even after a couple of years, I still remember the first basic swimming techniques I had to acquire, where I was standing still near the swimming pool, unable to respond to the coach’s instruction due to panic which filled my senses, not knowing how to behave properly, revealed random moves, and staring eyes. The coach was a strict and loud person, for he never allowed mistakes...however, now I can realize that he did the right thing for me, to overcome unbearable hesitation, which blocked my progress. I could not tolerate being treated so cruel, but the light carried by the coach’s loud voice, plain words, and enthusiasm, allowed no time to complain. Sometimes he deprived me of my goggles, and armbands, when it came to underwater dance training sessions, yet he was always there, when something went wrong. At the beginning, it was not easy for me as an anxious and lacking confidence swimmer to dive, and hold my breath for several minutes under the water, and without breathing equipments; yet I was somehow motivated by my own desire to surmount this phase of training, as soon as possible’.

(The example is mine)

In the aforesaid short story, we notice that the term “remember” is apparently used to describe a sequence of past episodes, which happened in the past, and yet its effects are still lively in some way, partly for the joy it brings to the person, whenever she talks about it, as well as the lessons she learnt due to the past experiences. Also, we notice that this person was driven by the goal to be an expert scuba-diver, despite fear and difficulties. The souvenirs, which are held by the scuba-diver load her heart not only with the pleasure she experiences over and over again, whenever she recalls this event, but it allowed her to review different skills she learned then, such as holding

breath for a relatively long time, patience and the confusion she struggled to control throughout her way toward the ultimate goal.

Hence, memory indicates preserved thoughts, and feelings due to experience.

Moreover, learning environment is the place where the entire learning experience takes place, and recorded in the so called memory faculty. So, the teacher is to be careful when teaching subjects for the first time, or our learners might not be familiar with, for they pay attention much more to the way data are delivered than the knowledge itself, and this would actually influence their motivation, and even commitment to learning in the future. Hence, a rich learning environment, which is characterized with a range of various learning tools, which are intended to meet different learning styles, including hands-on learning, and cooperative problem solving, allow meaningful learning experiences, and therefore long-term retention of data.

As far as language learning is concerned, turn taking, note taking and metacognitive strategies are learning strategies, which are used to support effective learning of the target language. Moreover, it is worth emphasizing that, language learning strategies are not employed separately; the learner uses a range of learning strategies simultaneously, that is to say, she/he switches from strategy to another and back again whenever the learning situation calls for. For example, in learning new vocabulary, the learner may choose to write them down, rehearse them, and use them during a conversation, or she or he may start with using the dictionary to check different meanings and possible expressions which are associated with the word. Also, another way, she or he may read certain texts, which are rich with new words,

jot down few sentences, and review them after reading, an attempt to enrich the verbal repertoire, and gain insights of possible uses of the target language.

In the following discussion, we will explore how the past experience, which involves practices, and knowledge, as well as the learning strategies we employ to assist better storage, and retrieval of information we received, can also improve a mental functioning which involves reasoning skills.

Past events or episodes, entails a variety of stimuli we captured through our senses from the external environment, either stored for a short period of time, or for the rest of our lives (Slavin, 2006).

According to Slavin (2006), sensory registration is the first component of memory system, in which the stimulus is responded to, and maintained by some means for a very brief phase of time (two seconds).

Hence, as it can be deduced, sensory registration is the most crucial and extremely sensitive phase, which should be taken into account, for the initial interpretation, and storage of the newly captured stimulus. A stimulus can be an image, sound, or symbol etc., which is attended to by our senses (Sight, smell, taste, touch, and hearing).

Matlin (2003) claims that sensory register is the large-capacity storage system, which records a variety of stimuli, including voices, and pictures, which are captured by the aforementioned senses with reasonable accuracy.

However, the newly captured stimulus, which contains new information, is thought to be subjected to fading away within two or less second if it is not attended to. That is to say, the learners need to act upon the existing stimulus in their mind in some way in order to process it (Kincheloe et al, 2007).

Two main educational implications for the existence of sensory register were suggested by Slavin (2006), they are as follows:

First, in order to facilitate later memorization of information, which are very important for problem-solving situation, our learners should be taught to be always attentive to the deep meaning which is being conveyed. Indeed, it is very exhaustive task to attend to several details during learning, yet, being motivated by an aim in mind, aids to maintain concentration on important and relevant information. Senses such as hearing, sight and touching are focused on purpose, to act and respond to relevant aspects of information, and select to ignore irrelevant factors, which cause mental distraction, and decrease cognitive performance.

However, it is worth saying that cooperative learning may become a source of undesired disruption and prevents remembering if it is not well-structured. For this, we need to emphasize the objectives of learning through cooperative learning, including knowledge sharing, and putting up with differences, and thinking skills enhancement, so our learners make effort to concentrate on expected rewards and advantages of cooperative learning where learners can feel much more at ease, while contributing to classroom practices, within an all- win learning environment.

Second, guidance should be provided to learners to distinguish significant features, which are worth remembering. Expressions used while teaching such as, “remember that”, “bear in mind”, and “think about”, are believed to boost cognitive performance.

In addition, body language can also maintain attention for a relatively longer period of time. Bodily gestures such pointing out, eye-contact, and facial expressions play a crucial role for supporting better concentration on topics,

which are believed to be worth remembering and valuable; the learners are helped via meaningful body language to perceive that what is being said is important to remember (Slavin, 2006).

Another technique is thought to capture learners' attention to a topic and sustains their interest in it, is the use of expressions which contain emotional content. We know that learners' motivation is subjected to a continuous fluctuation, throughout learning process, where both external, as well as internal factors affect learners' attitude toward the subject matter. The use of expressions, which act on learners' emotions, should be carefully chosen, as to achieve the objective, which works for learners' success, not against it. So, let us exemplify this technique, to make it obvious; a teacher initiates the first lesson of grammar to the beginners, she or he may wish to make the subject more appealing, and interesting for learners, so instead of saying "Grammar is a set of rules", she or he chooses to say 'Grammar rules the accurate use of the target language'. That is we attempt to load the expression with an emotional content for we point out to the superiority of grammar, being the power, which controls other factors, a quality which is relatable to humans, for they are perceived as possessing the capacity to manipulate their environment for their own benefit, so, using the verb 'to rule' as grammar's main function, our learners may think of grammar as an authoritative system, which controls the correct use of the language (Slavin, 2006).

1.4.2.1. Memory and Attention

Attention is a critical aspect, which guides information processing, and guarantees a longer maintenance of the given stimuli. Consider learners who are dealing with a topic in history, and are asked to underline the exact ancient time when Egyptian antiquities were violated by the western world, using

particular system of chronology. Attention is first drawn to the word 'exact', which implies the day, month and the year, thus, our learners realize that it is not a gamble game, but they should review each era, holding the main requirement in mind, until they find out the exact information.

Schunk (2009) points out that strategic learning, which includes setting reasonable goal, underlining the obstacle, and defining the tools, which implement the plan, leads to the accomplishment of the goal. The relationship between strategic learning, and attention is plain, the former directs the latter, so, meaningful learning can only be achieved via strategic learning, which is also influenced by learners' approval, and motivation to learn, and vice versa (Schunk,2009).

In the following list, we shall display five main devices we gathered from a set of references, namely, tips which are suggested by Schunk (2009), Matlin (2003), Slavin (2006), and Willams and Burden (1997), which can be adopted by the teachers to guide learners' attention, and support the transfer of the existing stimulus, which is initially received by their senses, toward short-term memory, these are as follows:

- 1)** The first technique which is put forward is to give the learners hints, or signals that what is being taught is worth remembering.
- 2)** Moving around the class in a steady manner while presenting the lesson, to maintain attention, and manage the classroom, at the same time (Schunk, 2009; Slavin, 2006).
- 3)** Presenting a new lesson requires the concentration of all mental activities and ignoring irrelevant stimuli to the main aim. This can also be achieved via

introducing a variety of teaching tools and techniques (Maltin, 2003; Schunk, 2009).

Pritchard (2009) recommends the use of some resources to control attention, such as the use of first-hand experience, interactive materials, and dialogues (Pritchard, 2009).

4) Teaching with thought-stimulating materials with appeal to learners' Interests at some point, while presenting a lesson or debate. This view stems from the humanistic approach to teaching, and learning, which emphasizes an account of learner's inner world; their thought, feelings and incentives (William and Burden, 1997).

5) The fifth device suggested by Schunk (2009), has been used and echoed for many centuries, is called questioning. This technique does not only control learners' attention, yet it also improves general thinking skills, such as reasoning skills, memorization and comprehension. To sustain more attention on a particular topic, learners can be asked to ask many questions concerning the topic, and explain it to others using their own words. Using this technique, are learners are encouraged to display understanding, and active engagement into the learning experience (Schunk, 2009). Also, quizzes can also be used to probe comprehension of a topic, and activate learners' cognition to remembers, and induce possible answers (Slavin, 2006).

1.4.2.2. Views of Memory

The first view is proposed by William James (1890); he states that memory is of two main kinds, namely short- term memory (STM) and long- term memory (LTM) According to him, short-term memory, is a temporary storage of

information, which are attended to by the senses (sight, smelling, touching, hearing and tasting), and long-term memory, which is a memory for events which took place long time ago (in Matlin, 2003).

William James' framework has paved the way for the occurrence of another memory model, which is designed by Atkinson and Shiffrin (1968). This model is described by Atkinson and Shiffrin as a sequence of three separated operations, namely the sensory register, short-term memory, and long-term memory, each of which plays a different, yet a complementary role in the process of remembering (Matlin, 2003).

Sensory register is claimed to command the initial reception of a stimulus or information via the senses (Matlin, 2003). It is the place where the unprocessed information is first received, nevertheless, people are rarely conscious of this process (Kincheloe et al, 2007).

An important implication worth emphasizing is that the learning environment should be equipped with a variety of teaching and learning tools, which capture attention and which are conducive to remembering and learning (Williams, and Burden, 1997).

Atkinson and Shiffrin argue that only few materials are capable to pass from sensory register to the next operation, which is called short-term memory (STM), especially if attention is attracted to them with some means.

According to Atkinson and Shiffrin's model of short-term memory, an item, which enters into the sensory register, is seen as more fragile than the one, which passes to short-term memory, the latter can last only for thirty seconds, unless it is beckoned to long term memory through some means (**Matlin,**

2003). This includes rehearsal, elaboration, and organization (Williams and Burden, 1997; Matlin, 2003).

Repeating an item to oneself is called rehearsal. Rehearsal is a kind of consolidation strategies, which helps learners to retain recently received information for relatively longer time in short-term memory, compared with items which are not attended to for the first time they are captured via senses, thereby, rehearsal makes a better chance for the information to stay in long-term reservoir(Matlin,2003).

A highly recommended memory strategy, which aids an item to move from short-term memory to long-term memory, is called elaboration. Elaboration is defined as a mental process, which relates new perceived idea to a personal experience, as a way to assist others to explore significant link between the given information, and a previously experienced event; thus, thinking is triggered, and remembering is made much more easier(Anderman, and Anderman, 2009).

Items which go into active consolidation strategies are more likely to dwell in long-term storage. Creating mental linkages, regular practice, transfer, alike to several learning strategies, which provide a better chance for locating a given item (information) in long-term memory. Long-term memory, which will be discussed later, is defined as a vast storage capacity, which contains memories, which are decades ago (Matlin, 2003).

In the following, we shall display the latest views of short-term memory, which is reintroduced by Baddeley and Hitch (1974) as Working Memory (WM).

Baddeley(1986) defines working memory as a system which is concerned with the temporary storage and manipulation of information during the performance of a range of cognitive tasks, including comprehension, learning and reasoning (Holyoak and Morrison, 2005).

Accordingly, working memory is a restricted, yet an active memory system, which is responsible for the use and manipulation of different items, audio-visual and phonological items (information) within a short period of time, while a set of essential cognitive functions such as drawing inferences, regulation, and organization are taking place (Anderman and Anderman, 2009).

Furthermore, Holyoak and Morrison (2005) describe working memory as a cognitive construct, which consists of four main components which are responsible for the manipulation, and maintenance of information for a short period of time. So, the effective interaction of many types of complex thoughts, such as reasoning, problem solving, and decision making, and their functioning depend greatly on working memory.

To understand the modern concepts of working memory, let us think of it as analogous to an active office librarian, who is doing many different tasks such as categorizing, cataloging, and cross-referencing new material. The same thing for working memory ,while engaging in a learning task, many mental function are taking place beside the temporary storage of an item, yet our learners should do some cognitive effort as an attempt to consolidate early received items, in order to keep them available for the integration with the later items (Reisberg, 2001).

Baddeley's working memory construct is constituted by four main components, namely **1-** the phonological loop (P.L) which stores a limited amount of verbal information such as sounds, for few seconds, **2-**the visuo-spatial sketch pad, (V. S. S.P) holds visual items such as images, and spatial items, including distance and spaces, **3-**the central executive, which coordinates information, which are recorded in the phonological loop and visuo-spatial component, as well as the information which are retained in long term memory, and finally **4-** the episodic buffer, which is the latest suggested component in the model, is believed to be responsible for the integration of information from different sources into a single multi-faced episode(Matlin,2003;Holyoak, and Morrison,2005).

Now, we move to exploring the aforesaid components with further details:

1. The first component is called the phonological loop, which is accounted for the temporary storage of items, which hold phonological information. For example, a list of articulated words or numbers, think about friends' chat, is presented vocally, and processed (Anderman and Anderman, 2009).

The phonological loop contains two separate parts; these are called the phonological store, which holds some information in an acoustic code, seconds, and the sub vocal rehearsal process, which allows the repetition of the sounds to oneself (Matlin, 2003).

The sub-vocal rehearsal process plays a crucial role in the preservation of the verbal items, which are carried by the phonological store, and protect them from disappearance. Hence, the verbal item is supported through a process, which is known as rehearsal, and which allows the phonological item to pass to long-term memory (Matlin, 2003).

The phonological loop (PL) is claimed to be a basic portion for problem solving activity. Its importance lies in the way it keeps track of relevant verbal information, which are necessary for dealing with problem, for instance, our learners are asked to deduce the difference between speech sounds, their physiological production and acoustic qualities, hence, our learners experience an interaction of several mental activities, such as reasoning, and problem-solving, while trying to accomplish the assignment (Matlin, 2003).

2. Visuo-spatial sketch pad (VSSP) is the subsequent sub-system, which is included in the working memory construct, and is used to store visual and spatial material including pictures, maps, and gestures. Also, visuo-spatial sketch pad is capable of storing information which is first presented in verbal form. Consider for instance, while listening to radio news, we tend to create a mental presentation of what is being presented (Matlin, 2003).

Also, visuo-spatial sketch pad is described as a mechanism, through which we rehearse images, describe plans, maps, charts, diagrams, which we have seen few seconds ago, as well as, visuo-spatial pad allows us to generate a mental visualization of things we aim to achieve in the future (Anderson, 2000).

Likewise, visuo-spatial sketch pad (VSSP) can retain the visual, and the spatial qualities of a given stimulus, its shape, dimension, color, over a short period of time (Holyoak and Morrison, 2005).

Importantly, visuo-spatial sketch pad is described as an integral part of daily problem solving ,through which a person can store visual, and spatial patterns, which are thought to serve problem solution, such as performing visuo-spatial imagery task, for exemple, solving puzzles via visualizing the way or method, which facilitates goal accomplishment (Anderman and Anderman, 2009).

3. Working memory comprises another part, which is considered the ‘boss’ component, namely the central executive (CE). This component provides an executive attention, which is required for a strategic coordination of cognitive processes, as well as the items which are included in the phonological and the visuo-spatial storages, and the information which are stored in long-term memory, and which go back to decades ago. Also, by virtue of the central executive, different types of reflective thought, such as problem solving, language, and decision making, are claimed to be controlled via the central executive (Holyoak, and Morrison, 2005).

The central executive is the main player, which plays the central role in the whole game; it analyses, interprets, and finally transforms the phonological, visual and spatial information, as well as the information, which are maintained in long-term memory in an accessible manner (Reisberg, 2001).

The central executive does store no type of information, yet, it decides which information is relevant to focus on, and which is irrelevant and thus to ignore during problem solving process (Matlin, 2003).

Baddeley (1996) lists four main central executive functions as follow:

- a.** Central executive coordinates performance on two separate tasks.
- b.** Central executive is capable of switching retrieval strategies when required
- c.** Central executive attends selectively to a certain item, and prevents the undesirable distraction of another one.
- d.** Central executive manipulates information which is retained in long-term memory (Holyoak and Morrison, 2005).

Moreover, Reisberg (2001) explains that the central executive reveals the interaction of many cognitive processes, such as goal setting, planning, and attention. In brief, central executive underlies the function of cognition.

4. Finally, the episodic buffer is the latest discovered component which is comprised in working memory. It includes a storage counter part of the central executive, which is capable of combining information from several sources into a single episode (Dornyei, 2005).

Baddeley (2000) contends that the episodic buffer is the component which stands for a common multi-dimensional code, used as a key for a set of systems, each of which consists of a range of codes, as well as it provides a contemporaneous access to a code identified by the central executive.

To conclude, we give emphasis to Williams and Burden's (1997) conception of working memory as the term used to represent whatever the learners have in mind at a time while actively working on it. This view entails that learners are not deemed as passive recipients of information, but instead, they are active agents, who are busy working on an issue, as trying to figure it out, and the stimuli which are received by sensory receptors. The newly stored knowledge in working memory is intentionally linked to relevant past experiences, as an attempt to provide an explanation for a specific issue or phenomena (Williams and Burden, 1997).

Now, we move to shed some light on the last portion which shapes human memory, called long-term memory.

Long-term memory is a permanent reservoir, where a collection of information, past events or experiences are settled and maintained for long period of time (Slavin, 2006).

Accumulated evidence suggests that learning strategies and skills are preserved in long term storage. These strategies and skills are not stored there in vain, yet they are at hand to allow a person to represent facts, manipulate understanding of a given task, or even remember other people's impression of things or actions, when needed (Slavin, 2006).

Given that short-term memory depends on consolidation strategies it follows that anything that hinders short-term memories will also disrupt long-term memory.

Frequent exposure to previously experienced events, skills or information, gives learners the chance to effectively transform the initial perceived item, or idea to a more sophisticated and lasting learning experience, which is constructively retained in long-term memory and kept in an accessible way to bring it into play when it is called for.

In the followings, we will highlight important factors which are believed to be indispensable for deep encoding and retrieval of different items (information), and approved by several psychologists. These are the context and specificity, self-reference and the effect of emotions and moods on the storage of information in long-term memory.

1.4.2.3. Context and Specificity

The role played by contextual clues in the process of remembering is very significant, for they make possible for an item to be retrieved due to the similarity between the retrieval context, and the encoding context (Matlin, 2003).

The implication of this view is that learners are to be instructed useful techniques to catch a variety of relevant contextual clues, which allow better understanding and remembering.

1.4.2.4. Self-reference

This factor explains how it is possible to make an item easier to understand and remember, if it is related to the person's personal meaning making process with how she or he thinks and feels about different learning materials and disciplines.

The claim of this view is that investigating attitudes towards a subject matter with relation to the self (personal attribute) during encoding process will support later recall. The reason is that the self is viewed as a robust source of meaning, and contains rich set of intentional clues with which several items are associated (Matlin, 2003).

1.4.2.5. The Influence of Emotion and Mood on Memory

Understanding how emotion and mood can help (or hinder) information processing forges new frontiers for perceiving motivational attributes such as favorite learning styles, personality type, and emotions and their influence on choosing particular learning strategies and not another, being the bridge which links two main 'edges', what is being processed and the current emotional state.

Positive feeling (and thinking, including inner positive talk), an integral entity from cognition, supports faster retention of information and breaks undesirable emotional constraints (such low self-confidence) which hinder further progress. Accordingly, it is recommended that learning environment

should be tense-free, yielding to learners' preferred learning style, and which encourages higher-order thinking skills.

1.4.2.6. Dual Code Theory

Dual code theory which is first developed by Paivio (1991), describes long-term memory as processing information on two registers: visual and verbal. In other words, long-term retention of information in two forms, visual (pictures), and verbal (uttered letters: speech, conversation...). Thus, it is hypothesized that presenting information in both visual and verbal manner. For instance, the teacher presents visual projection of what is being discussed in the classroom, so visual information consolidates the verbal one; learning names of places while looking at pictures which correspond to them (Slavin, 2006).

Furthermore, dual code theory draws attention toward the importance of discovering possible relation between what is being said in terms of the verbal discussion, debate or lecture, and what is being projected in the form of images, or films in the projector screen (Kancheloe, and Horn, Jr, 2007). Also, trying to visualize what is being read aids learners to make sense of the ideas which are conveyed by the written words and facilitates later recall.

Memory as a cultural phenomenon draws attention to the social influence on how we construct, internalize and apply knowledge within a social and cooperative setting. The priority is given to the cooperative interaction among learners to accomplish learning tasks, for instance, formulating and testing hypotheses, where meaningful exchange of opinions and communication provide learners with a chance to perceive memory and memorization as a

social process which can be better strengthened via genuine interaction with other individuals and within a social and cooperative learning setting (Van Boxtel, 2002).

1.4. 3.Decision Making

1.4.3.1. Decision Making Defined

In fact, developing decision-making skills is a requisite demand which underlies several thinking skills such as problem solving and creativity. Consider for instance, the rules of thumb, (discussed earlier) used by problem-solvers, while tackling a particular problem. The learners switch to being a decision maker every time they struggle in manipulating different alternatives including, for instance, how to understand the problem at hand, what are the best methods for designing a plan, or which criteria are to consider for evaluating the final result, or whether there are other significant alternatives.

Actually, all ordinary people are decision makers by nature, from which book to read to which sponsors to look for (Matlin, 2003).

Decision making is about choosing a 'good enough' alternative among a variety of other options, which is believed to increase the possibility for goal attainment, and which may influence us for the rest of our life. Take for instance, a new holder of baccalaureate who seeks to graduate either in psychology or in philosophy fields, so based on her or his background knowledge, that both of these options are interestingly important areas of specialization to understand human nature, with regard to her or his long-term objective, yet she or he is absolutely aware of choosing to carry on only a single field of study at a time.

A close observation of the example above, brings into attention that decision making is accounted as a conscious mental work, where several attributes such as motivation, goal-setting and thinking skills, such as problem solving and memory, cooperate together to generate a 'good enough' selection which is thought to maximize gains, or minimize losses or both .

For McShane and Von-Glinow (2000), decision-making is a conscious process of making choices among a set of alternatives, with the intention of moving toward some desired state of affairs. In this view, a well-defined goal, or state is the path which leads to an effective decision making for it is not possible to choose 'what' if 'where' to lead is not clearly defined, particularly when constrained by the time(McShane and Von-Glinow, 2000).

For additional explanation, consider for instance that a learner who is committed to complete an assignment within a limited period of time, the teacher is to supervise her or him to achieve the goal. So, acting like a facilitator, the teacher shows the learners the most effective methods for presenting the final product in the allocated time. Time management techniques, anxiety decreasing strategies and thinking skills are presented explained and modeled, for learners to make their learning assignment easier and meaningful.

English language learning is concerned, as an experience, which requires the development of learning strategies, directed to enhance the target language skills, such as risk taking, communication and writing. It may happen that a freshman aims to learn how to compose poems in the target language, yet he or she lacks a great deal of vocabulary. The following is a list of alternatives

which can hopefully be helpful for the freshman to improve his or her language performance, so the learner should consider each alternative and opt for the most useful one(s):

- a. Reading target language references
- b. Watching movies
- c. Listening to different poets' recitations
- d. "Practice makes perfect"; speaking, writing, reading, and listening
- e. Trying new and creative methods to learn a language.
- f. Doing grammar exercises.

Given the above set of alternatives, the learner should decide which choice seems to be beneficial to satisfy her or his needs including vocabulary, motivation, learning styles. The learners' choice is actually justified by the emotional tendencies, particularly at the very beginning of their language learning experience, where learners' decisions are built on how they feel toward an alternative, which is not necessarily the best one (Reisberg, 2001).

Accordingly, the freshman may be found to switch from an alternative to another, without being totally certain about which alternative(s) is (are) suitable for enjoying poems writing, just like a crawling baby who is trying to explore the newly encountered environment, touching every objects(alternatives), building her hypotheses then testing their significance.

Moreover, it is worth emphasizing that decision-making is a deliberate and conscious response toward several alternatives that is decision-making is not an accidental process which stems from random behavior, yet it requires a

consideration of each possible view (alternatives), which is relevant to the problem.

A 'good enough' alternative is selected on the basis of its expected value. That is, the option which carry the highest advantage and utility to an individual (or group) (Reisberg, 2001).

The expected value which is associated with an alternative stems from the belief that people would like to achieve the well-thought out decision which is based on the following factors:

- The consideration of all the possible known alternatives), given that unpredictable alternatives may be available.
- The use of maximum amount of available information, given that some relevant information may not be available.
- Being careful, that is a consideration of the potential cost (risk) and benefits (gain) of each alternative.
- Be careful to calculate the probability of various outcomes, given that certainty of outcome cannot be known.
- A maximum degree of sound reasoning, based on considering all the aforementioned factors (Sternberg, 2009).

Several decisions involve, or have large effect on people's thoughts, feeling and behavior. Thus, it is preferable to include experts or those who know more in the field of interest, and who are more likely to possess sufficient insight and experience in the domain. The claim of this opinion is that looking for more sophisticated suggestions (alternatives), which can be provided by a knowledgeable person, leads to an increased quality and acceptance of the

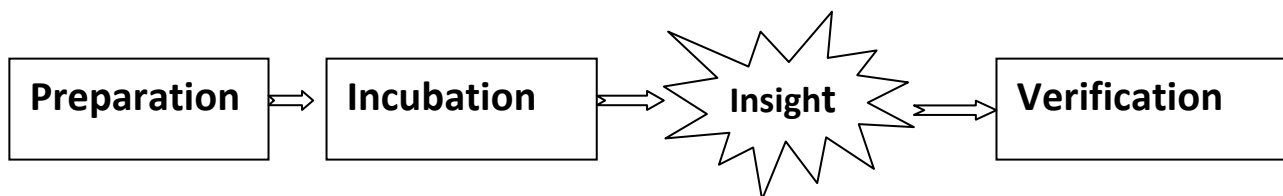
decision, which will probably influence the final outcome. So, predicting that an alternative to be of the highest advantage to the goal achievement means that it produces long-term benefits (McShane and Von Glinow, 2000).

The learners being assigned a problem to solve, should be taught to brainstorm different ideas, and then reflect on them as an attempt to figure each one out, as to reach a reasonable decision. Brainstorming is a learning technique, which involves the exploration and creation of several ideas regardless of their effectiveness, and suitability. Brainstorming is a valuable technique for exploring and suggesting, as much and diverse as possible, a wide range of alternative suggestions to solve a problem, or maximizing the utility of a particular alternative (Trenholm, 2008).

1.4.3.2. Creative Decision-Making

Creative decision making is enhanced through a sense of independence and autonomy, for we do not expect from a learner to be a creative decision maker if she or he is put under unnecessary constraints, which hinder further intellectual growth. The latter is emphasized as an educational objective, which paves the way for the enhancement of thinking skills. In other words, an engagement into creative decision making implies that learners work in teams to generate new and various ideas, which create the possibility for multiple solutions to a problem. A relaxed , and tense-free learning environment which encourages learners to feel at ease and express their true thoughts and feelings toward a given topic of discussion, not afraid of being humiliated by the opinions of others, but to actively participate in a successful group decision making; to maximize gains and minimize losses (McShane and Von Glinow,2000).

The following figure (2) represents creative decision-making in a reasonable manner:



Source: McShane and Von Glinow (2000: 350)

According to the above model, the first step toward creative decision making is preparation. Preparation involves the collection of sufficiently huge amount of relevant data, which is necessary for ‘detaching the knobs’, and understanding the problem. Furthermore, it is worth emphasizing that all components which constitute the problem have to be analyzed and reflected on as to find out how they are related.

The subsequent step to creative decision making, is related to reflective thinking skill, is called incubation. Incubation is perceived as a kind of unconscious mental work on the task even after stopping for some time. Usually the task is set aside for a while after struggling with it. Incubation suggest that learners are thinking about a challenging task they have initially spent relatively long time and effort working through it, nonetheless they failed to handle it, yet the work is not over as yet, learners actually continue to work on the task unconsciously (Woolfolk, 2004).

Matlin (2003) explains further that incubation occurs when learners confront a confusing task in which they are incapable to come to a reasonable solution; however, they are likely to succeed in handling it effectively after a break time. The implication of this view is that after spending a hard work to deal with it, yet incapable to reach a reasonable end as yet, it is always advisable to put the problem aside to allow sub consciousness deal with it; the latter is rich of data of different types that the human mind has captured from the surrounding environment, yet has not processed them deeply. The reason for this opinion is that instead of rushing into ineffective and time consuming tips, which may bring undesirable consequence, we seek help from the sub-consciousness which contains unprocessed information, and which may provide hints of creative problem-solution (Matlin, 2003).

In addition, no matter how rich and meaningful students' background knowledge in an area is, they need to keep their minds open to possible alternatives, as to stretch their mind with knowledge and skills to solve problems, explore new skills which are essential for dealing with real-life and thought-provoking issues, and help other people to do so.

Also, having rich store of information and making good enough decision are closely intertwined; that is various types of knowledge; knowledge of ideas, skills, facts, and the self should continually be reviewed and used flexibly, in order to raise the possibility of maximizing the quality of the decision we make, not to overlook the call for the continual organization and reorganization of the given alternatives in terms of their priority to successful problem-solution (Woolfolk, 2004).

The next phase for creative decision making is called insight. Indeed, insight is about the perception (instantaneous perception) that the fleeting ideas

which dwell somewhere in the incubation stage, are sudden and swift inspirational thoughts which may carry the most reasonable, and creative alternative (s) to solve a given problem. They are insights which can rapidly disorient, or plow out of sight if no action is made to save them, as immediately as possible. Thus, it is strongly recommended to keep a notebook nearby to jot down whatever new ideas, which may come up one's thinking, and which may never be caught again (McShane and Von Glinow, 2000).

In addition, insights are not deemed as trouble-free servants who can obediently undergo a fixed schedule, yet they are unexpected and swift flashes which come into the mind after long hours of hard mental work on an issue. To set a learning environment which encourages creativity and thinking, the learners should be trained to remain cognitively alert as to capture startling ideas and jot them down as fast as possible, before vanishing, this can be done through directly instructing learners to act upon unusual ideas, ask questions, and explore things via reading, hands-on experiences, and cooperative interaction with group-mates (McShane and Von Glinow, 2000).

The last step to creative decision making involves checking the validation and utility of the selected alternative on the basis of special scientific methods such as evaluation and experimentation (McShane and Von Glinow, 2000).

1.4.3.3. Decision-Making Heuristics

In the following discussion, we shall attempt to highlight decision-making heuristics, which are much more adopted to solve a wide range of problems. These heuristics are well-known as **1**-the representativeness heuristics, **2**- the availability heuristics, and **3**- the anchoring and adjustment heuristics, then, we

shall end up this discussion with highlighting the importance of framing and context and their influence on decision making.

1.4.3.3.1. The Representativeness Heuristics

In terms of conducting a scientific research, it is empirically conventional to select a sample which contains similar characteristics which seem to exist in the whole population. The sample is said to be representative if:

- ✓ It is taken at random to ensure its representativeness of the entire population;
- ✓ It is large enough: a large sample is statistically more likely to represent the true proportion in a population;
- ✓ It contains most of the characteristics, for instance colors, sex, occupation which are said to be found in the entire population.

Making judgments about conceptual categories involving different objects such as animals, furniture, fruits etc... For instance, we may be presented with something which sounds like a wood, smells like a wood, burns like a wood, easy to be cut by the saw, just like the wood, thus, we can assume that it is more possibly believed to be the wood.

However, representativeness heuristics may lead us astray, when judging more complex categories such as human beings. For instance, a woman who belongs to an aristocratic rich family can be labeled, in one occasion as free-spirit, athlete and social volunteer but considering that all her family members as fitting such characteristics, is actually considered an error (Matlin, 2003).

1.4.3.3.2. The Availability Heuristics

Availability heuristics are used to estimate frequency and probability in terms of how easy to think of patterns of something.

For instance, we may be asked in an occasion about how many researchers exist in the department of English language. We may not identify the exact number of the researchers, yet we may be pretty sure about the available teachers who have recently held the post-doctoral degree. Perhaps, we can recall the number of the studies and researches, and the names of the doctors who have conducted them, etc...

Availability heuristics are useful for making judgment and decision about frequency; nonetheless it can be influenced by the recency of occurrence of an item, and its familiarity, leading to inappropriate decisions (Matlin, 2003).

1.4.3.3.3. The Anchoring and Adjustment Heuristics

According to these heuristics, the learners begin with a first approximation (anchor), for example the first information they received concerning a chosen topic, then on the basis of further information, they can make an adjustment, which may influence their future decision making(Matlin,2003).

1.4.3.4. Framing and Context

The way a problem question is phrased or stated, as well as the context within which the choice is made influences decision making (Matlin, 2003). Accordingly, our learners may be misled by the possible gains, or losses of a given alternative, which may not be considered correct or even possible, hence ending up with negative results or less effective decision, which was originally caused by the framing effect.

Let us consider the following example, which shows how phrasing can have effects on a decision:

A freshman (this example is referred to it in the beginning of this section) is asked to consider several suggestions for writing correctly in the target language. Hence, if she or he opts for grammar exercises, she might probably choose to make use of her background information, that is all what she knows about grammar rules, while writing a piece of poem in her or his own words; however, if she or he is informed that Grammar is a far from being creativity-stimulating subject, which may not be of help or less useful for her attempt to enhance her creative writing, she may be influenced by this framing, that is she may focus on the possible losses which may be brought by opting for Grammar, and overlooks the undeniable gains, such as improving accurate use of the target language, either in writing or in speaking, therefore, the decision which is made will dramatically be ineffective.

Thus, we can conclude, that the use of the language has an importance effect on problem understanding, which can lead us either straightforward to problem solution, or take us astray to unnecessary directions

The next are two main points which have to be remembered:

- ✓ Background knowledge and phrasing (framing) influence learners' decision making.
- ✓ Our learners should focus on rephrasing the description of their decision and question their feeling about it, for they decide to pursue the choice they take, or to switch to looking for another one which may be better for producing gains, more than losses, and which can lead to goal achievement (Matlin, 2003).

1.4.4. Metacognition

Thinking about thinking itself is another aspect of thinking, which is called meta-cognition (Anderman and Anderman, 2009). Metacognition is thinking which requires an awareness of, and deep mental reflection on the cognitive processes while doing problem-solving task, that is it is knowledge about the cognitive processes (Matlin, 2003). Hence, the aforesaid definition of meta-cognition explains the reason behind considering it as one of the most important keys to the enhancement of thinking skills. Understanding something if it is really understood, making sure that attention is sufficiently paid to something, questioning the relevance of information, and knowing one's cognitive potentials are instances of meta-cognitive activities which improve performance.

Metacognitive ability is indispensable for our learners to unlock their (full) learning potentials, and aid them to understand deeper and reflective on past events, as well as everyday happenings and act accordingly, evaluate and improve their performance on the basis of what might be better done for getting better results, all of which are due to monitoring one's thinking processes.

Metacognition involves the executive management processes such as planning, monitoring, and evaluation of many types of learning performances in a variety of domains. Meta-cognition, entails going beyond one's cognition, such as meta-understanding, which is understanding our understanding, meta-memorization, which goes beyond memorizing an item to whether different memory strategies we use to store an item are actually useful, meta-concentration, or concentrate on one's concentration, and question whether our concentration is really at its best etc..., in brief, metacognitive activities are

limitless yet, they aid in furthering awareness of different thinking processes (Burke, 2009).

In addition, metacognition is explained in terms of raising awareness of the mental processes, and directing one's understanding and application of the requisite skills, which are indispensable for learning different subject matters. In Pitchard's words, metacognition is defined as the active "monitoring, regulation, and orchestration of cognitive processes and ways of learning" (Pitchard, 2009:27).

Interestingly, various aspects of students' functioning including learning styles, personality, motivation, and cognition are essentially overlapping and interact with learners' developing awareness and control over their cognitive processes (i.e. meta-cognition). Consider for instance, whether learners are extrovert, or introvert, self-reliant or easily swayed, skeptic, or laid-back, these personality traits would actually effects their regulation of their own thinking skills. So, as teachers, we are to pay attention to the crucial need for emphasizing goal setting process from the very beginning of the school year, and make sure of asking our learners to vocalize and write down their long-term goals, as well as short-term goals. This process aids learners to maintain their concentration on learning, and foster their willingness to devote much time and effort, in order to achieve their ultimate goals they set at the beginning, in so doing, our learners are more likely to increase their self-regulation skills, including planning and time management, and controls over their overall academic performance during the school year.

In an attempt to shed some light on the importance of enhancing metacognition which is a very crucial educational goal (among other goals), learners' increased metacognitive awareness can be representatively resembling to a 'journey' into one's own potentials, nonetheless a journey which is in fact not much cherished by many learners, partly because they believe it as an extremely demanding task, which may exhaust them at the expense of completing their assignments, for they have to sit quietly and reflect on a task trying to spend time training themselves to go beyond their thinking, and learn to foster their thinking aspects. The latter are subject to wither away or stifle if they are not utilized regularly (Use it or lose it), or alternatively, our learners might be used to act as passive recipients of knowledge for many years, without paying enough attention to the importance of getting involved into serious cognitive work.

Hartman(2001:33) argues that metacognitive awareness plays an important role for inducing and enhancing thinking skills, he states:"the use of metacognition[...] has an important role in thinking and problem-solving" (Hartman,2001:33).

Also, learners should be taught to use metacognitive skills, in order to improve their learning outcomes. Hartman (2001:35) suggests "teaching needs to emphasize metacognitive skills".

Meta-cognitive skill can also be increased through the followings:

- Asking learners to talk explicitly about skills and strategies they use to solve a problem.
- Ask thought-provoking questions which allow learners to reflect on their actual understanding.

- Ask learners to elicit the main ideas from a particular text.
- Raise learners' expectation of their metacognitive performance.

Furthermore, it worth saying that teachers are not to be concerned with 'what' students think, but with helping them to find out how they can possibly use their thinking skills, such as meta-cognition, problem-solving and decision-making, which are particularly perceived as important to improving and monitoring academic performance, as for succeeding to understand and handle future world's critical issues (Burke, 2009).

1.6. Conclusion

Indeed, an essential goal of education as pointed out and highlighted by several educators such as John Dewey (1910) and Sternberg (1996) is the enhancement of thinking skills, such as problem-solving skills. Active involvement into activities which require the activation of different thinking skills has an undeniable positive and promising influence on different thinking aspects. Thinking as an inner enterprise, which is observed through external behaviors, and which is fostered and modified through social and cooperative interaction, highlight the human developing ability to improve their performance through being actively involved into thought-provoking experiences, and cooperatively interacting toward the achievement of a common goal. Our learners learn to solve problems, which demand the application of particular rules and methods, they learn to apply problem-solving strategies, rehearse information, suggest alternatives, make decisions, and communicate their findings with group mates, within a learning environment which emphasizes cooperative problem-solving.

Chapter 2

Reasoning

2.1. Introduction

Attempting to understand the reasons behind some circumstances, which occur in certain period of time, will inescapably involve reasoning. For instance, being recommended by a coach to read self-development books, while continuously being in stressful situations, a conclusion may be drawn that the situation is somehow hard to handle, and the books would probably be of help. Reasoning is the most complicated mental faculty, which is distinguished by the overlap and interrelation of several cognitive processes, such as problem-solving, and memory, as to make sense of the environment.

2.2. Reasoning as a Human Phenomenon

Indeed, what we are constantly doing during many daily activities is drawing conclusions from a set of propositions, and phenomena (Sternberg, 1995; Matlin, 2003; Pillsbury, 2012).

Moreover, the importance of drawing a conclusion from a set of premises may appear impossible until we check their reliability, that is to say, drawing an inductively reliable conclusion from a set of premises which are true with regard to the real life phenomena or situations (Matlin, 2003).

Also, we may fail to reach reasonable conclusion, partly due to linguistic ambiguities, a sentence may convey a completely different message than it may appear to show, a point which brings into our sight the importance of the structure of a problem, a sentence or a paragraph, as well as the effect of the deep processing and shallow processing of information on effective reasoning; trying not to understand a given information in depth would prevent accurate

comprehension to take place, and consequently leads to ineffective reasoning(Matlin,2003).

Psychologically speaking, being uncertain about necessary information may result in a stressful state of response during reasoning process, which brings about negative effects on learners' ability to draw sound conclusions, a case which may lead our learners to take a totally undesired and hazardous turn in their attempt to find out a clarification for the ambiguous propositions (Matlin, 2003).

Actually, reasoning skills, such as problem-solving skills, are a hallmark of human beings, which characterize their ability to survive and adapt to the tremendously different and changing living circumstances, and continue to improve throughout human history and civilization, starting from the day human species had unexpectedly discovered the relationship between sharp-edged stones and being wounded, up to the current human civilization which is distinguished by the various technological inventions.

Indeed, reasoning is an essential cognitive faculty for almost everything we do. It is a type of thinking which involves the application of reasoning skills, in order to draw reasonable conclusions. In other words, reasoning entails the process of drawing inferences on the basis of a set of premises (Overton, 1990; Matlin, 2003; Sternberg and Leighton, 2004).

For further illustration, let us consider the following situation:

Given a set of data, the learners may think to manipulate a mental representation of the given data into a completely different form, she or he transforms the spoken word into a more concrete object, such as an image, for instance to represent the word 'Laptop'. The learner draws a picture which

represents the idea of the laptop, using a pen or any device; in so doing, the idea of laptop is brought to light through drawing. This process aids learners to identify relevant information which characterize the object, its color, shape, screen, mouse, webcam, while sketching the object (the laptop). Baddeley's central executive system of working memory(discussed in the previous chapter) is central in this phase, for it controls different types of information, coordinates performance on two separate tasks (phonological and visual), and prevents the distraction of unnecessary items(Baddeley, 1986).

According to Anderman and Anderman (2009), reasoning is considered as an advanced mental quality, which aids in the construction of new knowledge, and organizes the existing one. Reasoning necessitates certain basic research tools which are required for effective reasoning task; observation, data gathering, hypothesis formulation, hypothesis testing, etc....Also, reasoning calls for the ability to organize existing information; one way is to break data into smaller components, then explore each part separately, and to figure out how they relate, therefore making sense of knowledge, and using it when necessary, to deal with complicated questions, explain events, and face up daily challenges (Anderman and Anderman, 2009; Hughs et al, 2009).

Sternberg and Leighton (2004) argue that reasoning to humans is as" breathing to the mind" (Sternberg and Leighton, 2004: 06) for human brain cannot function adequately if it does not receive enough oxygen, the same for reasoning ability, humans are unable to act well, or adapt to the surroundings, if they are unable to use their reasoning skills.

Additionally, the importance of reasoning skills lays in the possibility to maximize mental competence to understand and act upon knowledge, and adapt to the rapidly developing technologies, for learners of 21st century

cannot avoid a constant interaction with various new inventions, and technology.

2.3. Problem-Solving Skills

The heart of this chapter is of two folds; it discusses two main types of reasoning, which are indispensable for problem solving, and are widely known as problem solving skills, namely deductive reasoning and inductive reasoning.

2.3.1. Deductive Reasoning Skills

Thinking deductively or deductive reasoning reveals the ability to connect certain propositions as to draw a conclusion. More explicitly, deductive reasoning implies that learners are given two (or more) propositions or premises, one premise is the major, and the other is the minor, and then learners are asked to draw a logically valid conclusion from the given premises. Required to think this way, means that the conclusion being drawn is necessarily valid. In brief, the truthfulness of the premises entails the validity of the conclusion (Wilson and Keil, 1999; Sternberg, 2009; Holyoak and Morrison, 2012).

In the following discussion, we shall discover different types of deductive reasoning:

2.3.1.1. Conditional Reasoning

Let us consider the following example:

- If you can stand still for a long time, you would win.

The statement above involves the relationship between conditions as shown in the major premise through the 'if' statement, and the consequence, which

would necessarily take place if 'if' statement is not fulfilled, and which can be stated as follows:

- If you can stand for a long time, you would win. → major premise
- You cannot stand for a long time. → minor premise
- Therefore, you would not win. → conclusion

The three-term series, presents one of the most accessible kind of deductive reasoning, which is known as conditional reasoning (Matlin, 2003).

Hence, conditional reasoning is necessary to optimize the core of reasoning for It involves the 'if...then' relation, which leads us to elicit certain suppositions for whether 'if' is met, what could be 'then', is the consequence which necessarily follows (Sternberg,2009).

Conditional reasoning is used to unveil the types of the conditional relationship which brings together two obviously stated conditions (or premises), thus, it is suggested that 'if...Then' relationship sheds much light on the dependency of the minor premise upon the major premise, the learners' main role is to infer the conclusion and highlight its validity(Matlin,2003).

Moreover, the importance of the four classical inferences which are associated with the conditional reasoning, is approved by many cognitive psychologists, including Sternberg (2009) and Matlin (2003), these are **(1)** Modus Ponens (MP), **(2)** Modus Tollens (MT), **(3)** Affirmation of The Consequence (AC), and **(4)** Denial of The Antecedent (DA) (**Matlin,2003; Sternberg, 2009**).

P and **Q** are the main parts which make up the conditional 'If...then' proposition. **P** is the first part, which is called the antecedent, and **Q** being the second part of the proposition, known as the consequent event.

P and **Q** can be formulated as: 'If **P**, then **Q**. **P**. therefore. **Q**'

It is suggested that the learner who employs conditional reasoning, which is based on the antecedent '**P**', and its consequent event '**Q**', can also draw a well-inferred conclusion. So, in the aforementioned example 'if you can stand still for a long time', is to be fulfilled, in order to guarantee the future occurrence of the consequent event 'you can win'. As a result, the logically followed conclusion 'win', from the antecedent **P** is deductively valid (Sternberg, 2009).

Furthermore, it is worth remembering that unless the set of premises are said to be true, the conclusion remains always deductively invalid. In fact, it is not possible to judge an argument as being logically strong deductive argument as based only on the truthfulness of the proposition in relation to real world phenomenon. Therefore, deductively valid argument is not dependent on the factual reality, and the premises are exclusively accepted as true for the structure of the argument (Kellogg, 2003).

Let us consider the following example:

- If she can jump, she can invest in agriculture.
- She cannot jump, then,
- She cannot invest in agriculture.

Looking at the example which is stated above, we may be inclined to create a mental visualization of a person whose ability to jump high as to catch the

floating clouds next to the edge of the bridge is excellently displayed, yet this imaginative picture can only take place in fiction, but cannot be associated with the real life events; to be more precise, the idea which suggests that the person who is able to jump high does not necessitate that the same person possesses the necessary skills for cultivating a soil, and vice versa. That is, with regard to the aforesaid example, the ability to jump is necessarily considered as indispensable condition for investing in agriculture, and this is in fact not bound to reality.

Notwithstanding, the conclusion seems to be logically followed from the propositions, it is worth remembering that in deductive reasoning, the emphasis is put on the logically sound structure or the form of the argument, whereas the meaning of the premises with regard to the real-world situations, does not matter a bit (Kellogg, 2003; Hughs et al, 2009; Sternberg, 2009).

In the following discussion, we will explore some inferences, which are based on conditional reasoning, and which lead to a well-inferred conclusion, and are deductively valid. These inferences are called the Modus Ponens (MP), and the Modus Tollens (MT).

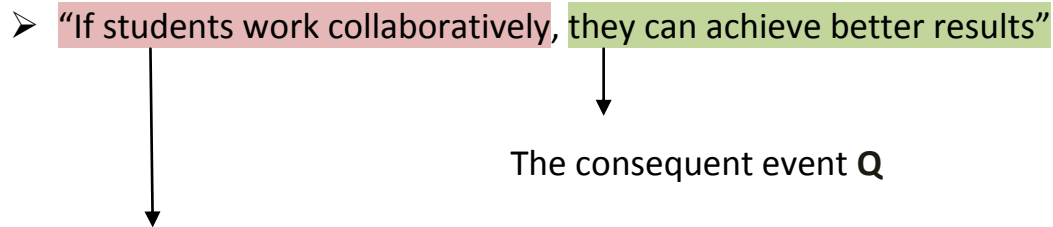
Additionally, Affirmation of the Consequence (AC), and Denial of the Antecedent (DA) are considered the two classical inferences, which cause deductively fallacious arguments (i.e. invalid).

If **P**, then **Q**. **P**. therefore **Q** structures, the modus ponens argument in which the antecedent **P**, which is considered the major premise in the entire argument is to be affirmed. Consider the following example:

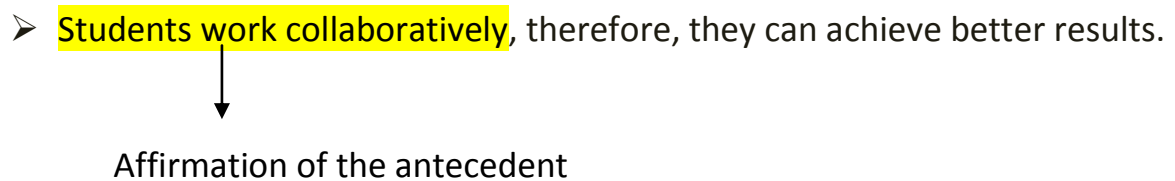
‘If Loubna can stand still longer, then she can win. Loubna can stand still longer, therefore Loubna can win’

This set of propositions and the inferred conclusion present the modus ponens argument (MP).

Let us consider another example:



The antecedent **P**



If the antecedent is affirmed, the consequent event follows too to be confirmed.

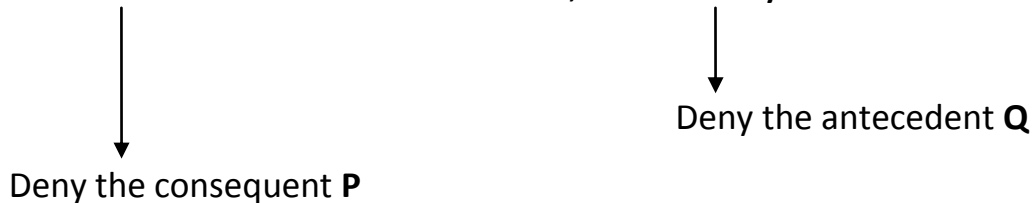
It is also contended that it is possible to draw a well-reasoned conclusion from a conditional proposition, suggesting a totally different proposition that is denying the consequent:

‘If **P**, then **Q**. Not **Q**, therefore not **P**’ (Sternberg, 2009:500).

Given the same example, yet modifying the second proposition of the argument that is denying the consequent event:

➤ If students work collaboratively, then they can achieve better results.

➤ **Students cannot achieve better results; therefore they do not work collaboratively.**



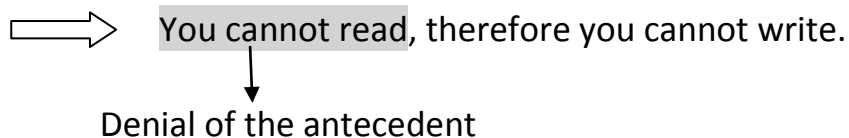
The above set of propositions and its conclusion is named the modus tollens argument (MT), which is considered as a deductively valid argument.

Some fallacious arguments can be done, namely deductive fallacy or invalid arguments, which are based on denying the antecedent, or affirming the consequent (Sternberg, 2009).

Let us shed light on this claim through the following examples:

✚ Argument based on denying the antecedent

➤ If you can read, you can write.



Obviously, the idea which is conveyed by this example, suggests that in denying the antecedent **P**, which is 'you cannot read', then **Q**; 'you cannot write' does follow necessarily.

Nevertheless, we can simply put that 'you can write', even though 'you cannot read, or make sense of what is written down. In other words, not

every person who is familiar with the Latin languages' alphabet is also capable of spelling them correctly. Take for instance the following Italian proverb:

La verità ha una buona faccia, ma cattivi abiti !

A native speaker of English language may be unable to understand the meaning of the Italian proverb which is stated above, and pronounce the words incorrectly.

Also, the view which contends that such denial of the antecedent does not produce an unquestionable conclusion, the person should also think about several causes which may lead to the same conclusion. Consider that if **P** is deemed false, then the rule as it is stated 'If **P** then **Q**', would not be applicable, because it was originally based on the fact that **P** is true (Kellogg, 2011).

Moreover, Kellogg (2011) explains how people commit deductive fallacies through affirming the consequent, for they assume that if **Q** is true, then it necessitates that **P** is true.

✚ Argument based on affirming the consequent

- If you can read, then you can write
- You can write, therefore you can read



Affirming the consequent

The inference rule 'If **P**, then **Q**' does not inform us that the consequent **Q** must be true, or logically possible even when the antecedent **P** is viewed untrue (Kellogg, 2011).

Sternberg (2011) attributes both deductive fallacies to the inferences, which follow from normal discourse comprehension of conditional phrasing.

The discussion above bring into attention that being working on conditional reasoning, the learners are beckoned to explore the performance of two acts; first, to affirm part of the sentence, contending that it is true; second, to deny part of the sentence, stating that it is false(Matlin, 2003).

Matlin(2003) suggests that by combining the two parts of the sentences with the two acts, we can notice four possible conditional reasoning situations which can emerge:

- 1) Affirmation of the antecedent $\rightarrow P$ is true \rightarrow the conclusion is valid
- 2) Affirmation of the consequent $\rightarrow Q$ is true \rightarrow the conclusion is invalid
- 3) Denial of the antecedent $\rightarrow P$ is false \rightarrow the conclusion is invalid
- 4) Denial of the consequent $\rightarrow Q$ is false \rightarrow the conclusion is valid

Notice that the aforesaid example, the antecedent 'If you can read', is true, hence what follows (the consequent event) is necessarily true, and the conclusion is deductively valid.

Also, denying the consequent **Q** entails that 'then' part of the sentence is false, therefore, it can be logically deduced that 'If' part of the sentence must also be false. This type of conditional reasoning is derived by modus tollens, which is stated as 'if **P**, then **Q**, not **Q**, not **P**' (Matlin, 2003).

In the following we will attempt to shed the light on the cognitive factors, which influence deductive reasoning.

Matlin (2003) suggests that people are subject to two main difficulties, which effect the accuracy of their conditional reasoning tasks, namely, difficulties due negative information, and difficulties with abstract reasoning problems(Matlin,2003).

1. Difficulties with negative information. This factor suggests that in assigning a conditional reasoning task, the learners may tend to focus on the propositions, which contain no negative form (not, do not, etc...), because these sentences are viewed to confirm, more suggestive and less challenging.

Let us consider the following example:

- If you are not a rigid upholder of the law, then you do not owe to the clinical character of Sherlock Holmes
 - ✓ You do not owe to the clinical character of Sherlock Holmes
 - ✓ Therefore, you are not a rigid upholder of the law.

Many researchers argue that people are subject to misinterpret such task, and spend unnecessarily longer time trying to check the correctness of its components. Also, researchers state that working memory becomes particularly burdened when the task requires the denial of both the antecedent and the consequent event (Matlin, 2003).

2. Difficulties with abstract reasoning problems. This factor illustrates well the negative impact of abstract and theoretical problems on learners' deductive reasoning. These problems contain abstract items, which are ambiguous and lead to low performance on the task (Matlin, 2003).

Consider the following issue:

- If it is multiplied with an odd number, then the result is going to be an even number.
- The result is not an even number
- Therefore, it is not multiplied with an odd number

Apparently, the items “even number, and odd number” are not stated, that is their value is not provided (Ambiguous).

2.3.1.2. Syllogism

Another kind of deductive reasoning relies on the use of syllogisms; it is called the syllogistic reasoning (Matlin, 2003; Sterberg, 2009).

Syllogisms were originally developed by Aristotle, whose logic has ruled out the logical analysis for hundreds of years (Manktelow, 2012).

By convention, syllogisms comprise a major premise, a minor premise and a conclusion. Here is an example:

- ✓ Some politicians are talkative → the major premise
- ✓ Some talkative are reliable → the minor premise
- ✓ Therefore, some politicians are reliable → the conclusion

According to Bunnin and Tsui-James (1996) the syllogisms are deemed to form the basis of logic. The latter is concerned fundamental to deductive reasoning, and the condition under which that an argument is said to be valid or invalid (Bunnin and Tsui-James, 1996).

Syllogisms begin with quantifier expressions, such as all, some, lot, many. These terms make syllogisms easy to notice, and analyze the relation between the propositions (Manktelow, 2012).

Learners can use letters such as **a**, **b**, **c**... to indicate the premises, instead of rewriting the premises. For instance:

- Premises: some **a** are **b** Some **b** are **c**
- The conclusion: some **a** are **c**

Hence, the syllogisms illustrate the relation between two premises, the end terms **a** and **c** are kept, whereas the middle term **b** is dropped out (Manktelow, 2012).

Moreover, Sternberg (2009) describes two types of syllogism; the categorical syllogism and the linear syllogism.

a) The Categorical Syllogism

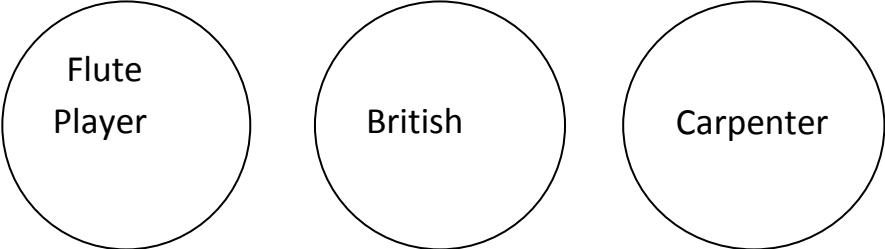
The categorical syllogism like other types of syllogisms is viewed to contain two premises and a conclusion. Each premise comprises two terms. One term should be common to both premises and located in the middle. The categorical membership of the terms determines which class the terms belong to, and both linked via this categorical membership. In other words, one term is found to be a member of a certain class, necessitates that the other term is also a member in the same class. The class of the term **1** is included in the class of the term **2** (Cooper and Patton, 1946; Sternberg, 2009).

Let us consider the following categorical syllogism:

- ✓ No flute player is British
- ✓ No British is carpenter
- ✓ Therefore, no flute player is carpenter

Both premises suggest that none of the members of the category of the first term are members of the category of the second term.

This idea is displayed via the following circle diagram:

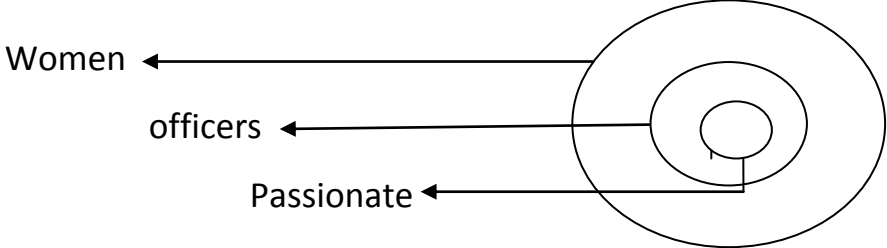


Accordingly, we can notice that one class excludes the other classes, because they have no member in common.

The next is an instance of the categorical syllogism which consists of three classes:

- ✓ All officers are women
- ✓ All women are passionate
- ✓ Therefore all officers are passionate

Putting it in the circle diagram, we will get:



Viewing the above example, we notice that the first premise suggests that the class of officers is included in the class of women. The second premise

shows that the class of the passionate is included in the class of officers. Therefore, the class of passionate is included in the class of women (Cooper and Patton, 1946).

Nonetheless, in the categorical syllogism, it is argued that drawing a logically valid conclusion from two negative premises is not possible. Take the example 'no flute player is British' and 'no British man is a carpenter'. These premises do not tell us whether the British flute player and the British carpenter is the same person or not, we just do not know. Also, "some men are rational", "some rational are honest". Clearly, the premises cannot lead to a valid conclusion that is to say, we cannot conclude that the same men are honest; the men, who are rational, may not be the same honest men (Sternberg, 2009).

b) The Linear Syllogism

Linear syllogism comprises two premises and a conclusion; the major premise, and the minor premise which are supposed to determine a specific relationship between two items. One item is suggested to be common to both premises. The common term must be put in the middle.

As the name indicates, the linear syllogism is concerned with the linear relationship between the terms.

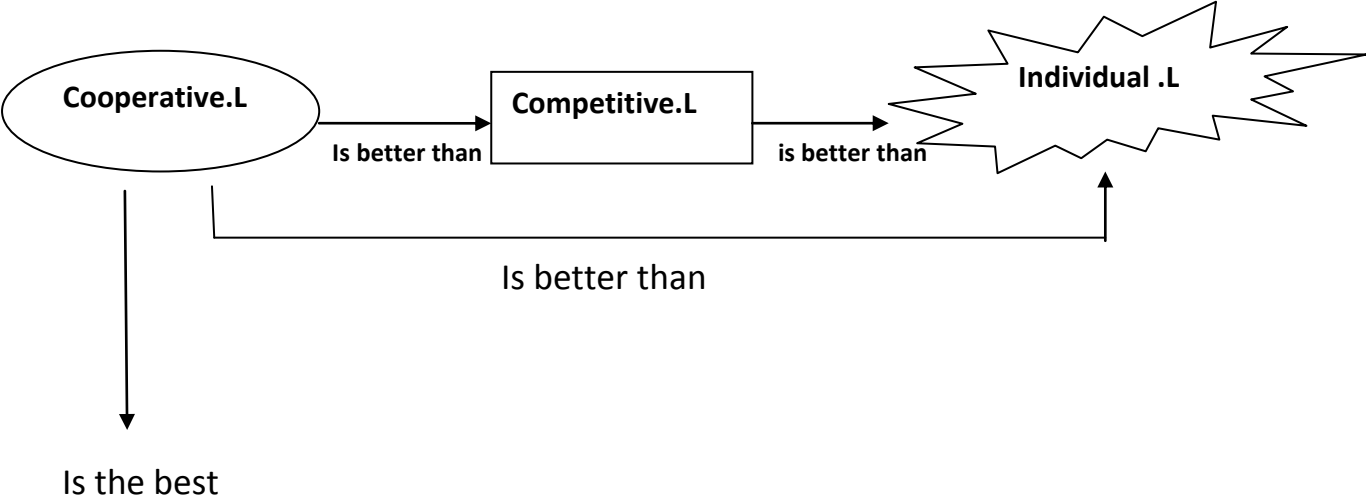
- ✓ Cooperative learning is more effective than competitive learning
- ✓ Competition learning is more effective than individual learning
 - Which one is the most effective?

Hence, from the linear syllogism, which shows the relationship between the given items(the premises), we can infer that cooperation is more effective for

boosting performance, than competitive learning, and competitive learning is much favored than individual learning, which lead to occurrence of undesired consequences and failure. At the end, we deduce that among the three terms, cooperation is more effective (Sternberg, 2009).

A closer look at the linear syllogism example, poses a provoking question, which is how can learners solve this type of syllogism?

Many attempts are devoted to investigate the way people solve linear syllogisms. One view suggests that learners can solve linear syllogisms through a mental presentation of linear continua. Learners can simply imagine a visual image, which presents the items, which are spread on a vertical linear continuum. This is shown in the following figure (3):



An entirely different view excludes the use of images, and suggests instead the semantic model for solving linear syllogisms. Thus, learners are to combine the semantic propositions. So, the example above can be presented as follows:

[Cooperation is more effective (competition, indifference)]

Another view for solving linear syllogism combines the aforesaid views. It states that learners begin with the propositional representation of each premise, and then spatially lay them out on a vertical linear continuum (Sternberg, 2009).

2.3.1.3. Deductive Teaching Approach

As far as, language teaching is concerned, Grammar Translation method (GT) overemphasizes the use of deductive reasoning, for it focuses on the general principles to reach specific instances (Brown, 2007).

The basic distinguishing features of Grammar Translation method are described by Richards and Rodgers in relation to deductive reasoning (Richards and Rodgers, 1986).

- Grammar Translation method is displayed via teaching by presenting and illustrating a particular grammar rule. For instance, presenting comparative and superlative degrees: faster than, the fastest. so, , through direct instruction , the learners are taught to use “er” and “the-est” with all one-syllable adjectives and adverbs, such as small, sweet, smart etc... (Richards and Rodgers, 1986; Hogue, 2003). The learners deduce that the rule is applicable to all single-syllable adjectives and adverbs (Richards and Rodgers, 1986).
- Richards and Rodgers (1986) put an emphasis on deductive approach to teaching grammar rules, which are followed by practices. Hence, grammar teaching, which is based on Grammar Translation method is systematic and enables learners to know every detail of grammar rules.

Similarly, Tomlinson et al (2009) state that deductive teaching approach is used to help learners learn several concepts and propositions. The

teachers are to explain the similarities and differences among the concepts and principles and provide sufficient examples, which comprise evidences and elements, which facilitate the transfer of the previously learned skills and knowledge to the given task (Tomlinson et al, 2009).

In this section we have seen that the learners are subject to experience inaccurate performance of abstract reasoning problems, as well as, the effect of negative information on their deductive reasoning, which may lead to ineffective reasoning.

Hence, due to the aforesaid reasons, some learners become uninterested in dealing with this kind of problems (deductive reasoning tasks), others may be seen to continue to work on them (Matlin, 2003).

However, learners' deductive reasoning seems to rely on the chance factor that is, deductive reasoning tasks are regarded much like as expectation-based, rather than inference-based. Other learners may demonstrate the use of illicit conversion, that is, they mistakenly convert part of the problem into another incorrect form; they think that 'if **a** is **b**. **a** is true, therefore **b** is true' is the same as 'if **b**, then **a**' (Matlin, 2003).

2.3.1.4. Limitation of Deductive Reasoning

Our discussion of deductive reasoning unveiled its 'rigid' inference rules, which produce logical arguments regardless of the relationship between the propositions and their relevance to the real world events. Also, factors such as negative information and ambiguous information decrease the accuracy of deductive reasoning tasks.

Learners deduce from a set of propositions a conclusion, and say that the argument is deductively and logically sound (or valid). This process helps learners to organize new information into an accessible whole, which is made available when it is called for. Yet, deductive reasoning brings nothing new to the world, because learners being assigned deductive reasoning tasks are not allowed to go beyond the given propositions, in short, our learners stick to the limited universe of the premise (Anderman and Anderman, 2009).

The problem with deductive reasoning is that it focuses on drawing conclusions which are to be logically structured from the given premises, where the latter may not be related to the world's norms, which are actually being experienced in the real life situation. In brief, thinking deductively means thinking according to inference rules.

The meaningfulness of deductive reasoning tasks depends on how to direct learners' attention toward, and maintain their interest in the ideas, which are conveyed by the premises; this can be done through asking learners to explore the relation between the premises either by research, or by experimentation.

2.3.2. Inductive Reasoning

In contrast to deductive reasoning which depends on the application of inference rules to reach logically valid conclusions, keeping abreast with relationship between premises, in inductive reasoning our learners enjoy more freedom to explore and investigate the ideas suggested by the premises through observation, data collection, generalization and testing; In Holyoak and Morrison's terms (2005) "inductive reasoning in an activity of the mind that

takes us from the observed to the unobserved” (Holyoak and Morrison, 2005:95). Inductive reasoning allows learners to extend and revise their schemes of the world (Schunk, 2009).

Inductive reasoning involves drawing general conclusions from specific information (Anderson, 2000; Reisberg, 2001; Matlin, 2003; Sternberg, 2009).

However, while dealing with inductive reasoning tasks, a problem-solver cannot guarantee an absolutely true conclusion, which is based on what is observed, tested and supported by evidences. All what is attained is said to be probably true conclusion, and may change in the future through further examination and findings (Anderson, 2000; Reisberg, 2001; Matlin, 2003; Sternberg, 2009).

In inductive reasoning, the learners are not interested in the sound structure of the argument *per se*, yet they are concerned with reasoning from specific cases to predict what would most probably be the case in the future. Let us explore further how induction works through the following inductive arguments:

Argument 1

- Observed instance: here in Constantine, people celebrate Achoura every year.
- Conclusion: people in Constantine are going to celebrate Achoura this year.

Hence, on the basis of several observations, learners are able to predict that people are going to celebrate the same occasion for the same reason this year too.

Argument 2

- Observed instance: all the teachers who like coffee were in the meeting.
- Conclusion: all the teachers were in the meeting.

In the example **2**, concluding that all teachers attended the meeting can be untrue. A closer observation may change the entire conclusion that not all the teachers who attended the meeting like to drink coffee. Hence learners may be told to consider several probabilities and events which may lead to the same conclusion, or to a totally different one. So, the person can only assume that the teachers, who are observed to hold the teacup before the meeting, might have just joined other teachers, consultants, or students who were already in the meeting. Also, she or he assumes that few teachers have not come as yet, and are on their way to the meeting room. So, in inductive reasoning task, we cannot guarantee definitely unquestionable conclusions; in short the number of probabilities is endless.

The strength of inductive reasoning as a process of learning lays in its emphasis on deriving new knowledge, and reveals the implications of what is already known. For instance, to take into account the effects of social beliefs on learners' self efficacy, (the latter is perceived as one's belief in her or his potential to reach a goal (Olson and Hergenhahn, 2009), can only be discovered through the application of inductive reasoning skills. The conclusions are judged as reliable, or unreliable, persuasive, or not persuasive, or high in their probability, but not certain (Hughes et al, 2009; Cooper and Patton, 1946).

2.3.2.1. Types of Inductive Reasoning

Formulating hypotheses, determining the cause and effect, and arriving at an inductive generalization are some forms of inductive reasoning; we will discuss them in this section with some details. It is worth mentioning that every type of inductive reasoning is disposed to its own flaws (Olson and Hergenhahn, 2009).

2.3.2.1.1. Formulating and Testing Hypotheses

Prior to conducting a scientific research, our concentration should be focused on the following questions:

- 1.** First, what is a hypothesis?
- 2.** Second, why it is very important to formulate a hypothesis?
- 3.** Third, why is it true that a well-formulated hypothesis is considered the basis of a scientific research?
- 4.** Forth, what are the basics of hypothesis testing, which are necessary to support (or reject) the research hypothesis?

So, let us start our discussion by the first question, which is posed above, namely, what is meant by the research hypothesis?

1. What is a hypothesis?

A hypothesis is perceived as a tentative expectation (which stems from a set of observations of certain instances), which can be confirmed or rejected through testing (Olson and Hergenhahn, 2009). A hypothesis is an assumption which can be empirically tested (Schunk, 2009).

Accordingly, to hypothesize means to assume that something is likely to take place, if certain conditions or variables are provided. For instance, we

hypothesize that one's positive expectations, enhances higher performance, and we write it this way:

If she believes in her ability enough to do good job, then, she would perform better.

Or

Positive expectation improves performance.

So, a hypothesis is a statement which comprises carefully chosen propositions, which are known as variables (independent variable and dependent variable). The relation between variables can be analyzed via data collection and analysis, which provide the evidence to confirm (or reject) the suggested hypothesis.

In the aforesaid example, assuming that positive beliefs in one's abilities would have a noticeable influence on performance, our learners collect a set of qualitative data from reliable references, such as books, and articles, as well as, quantitative data, which are collected through quantitative data collection methods. So, the literature review covers the nature of the variables which are suggested in the hypothesis, and the results, which are obtained through the conduction of the scientific experiment, would determine the relationship between variables.

2. The Importance of Hypothesis in Scientific Research

A careful and systematic observation of certain events, which reoccur in the environment, results in formulating a tentative guess or a general idea that the occurrence of something leads to the occurrence of something else. The

problem which occurs due to certain causes, for instance, learning deficiencies affect learners' performance. So, the hypothesis suggests that providing specific treatment (independent variable) may decrease the negative influence of the undesired situation (in our case learning deficiencies is the cause) So, the research hypothesis gears the whole research.

Another example: one's belief in her or his abilities to succeed promotes her or his performance in the workplace. So, formulating hypothesis is not constrained by the academic and research milieu.

Notice that 'Positive expectation effect performance', a research hypothesis which is limited by two main variables, namely, (1) the positive expectation, and (2) the performance. Hence, the research hypothesis directs the research toward finding possible explanations of the reoccurrence of certain events, and displays their effect on the environment. Also, it may suggest a set of implications which may serve as possible solutions to deal with the problem in a methodological way (Manion et al, 2007).

Accordingly, the basis of any scientific research lies in framing a tentative research hypothesis, which keeps the researcher (the learners), focused on the direction of her or his research. Hence, a hypothesis is a powerful research tool, which directs attention toward the ultimate goal that is explaining events and suggesting solutions to the problem, which is stated in the research (Manion, 2007).

3. Characteristics of a Good Hypothesis

A tentatively formulated hypothesis entails a thoughtful attempt to figure the reoccurring events out. So a research hypothesis may be characterized as a mental manipulation of the current events (variables), which take place in a particular context, and identify which relationship exists between them.

Fellows and Liu (2003) in their investigation of different research methods have listed three major common requirements for a hypothesis:

- ✓ A hypothesis should be testable. In the light of the obtained evidence, the researcher accepts the hypothesis as being highly significant, or refute it.
- ✓ A hypothesis should be positive, that is, it should state what can be the solution to a problem, not what ought to be the solution to a problem.
- ✓ A hypothesis should be presented in a clear and understandable language.

4. The Basics of Hypothesis Testing

So, after formulating a research hypothesis according to the aforementioned requirements; that is its testability, suggestibility and clarity, and keeping abreast with the research goal, the task is subsequently pursued via the next step which rests upon hypothesis testing.

The researchers (and the learners as well) initiate their investigation by formulating a research hypothesis, and then they move to explore in-depth the literature review of the given variables, which are involved in the hypothesis, to reveal their importance to the research. The subsequent step is to narrow down the research topic into a specific area. Consider for instance, investigating the effect of self-efficacy on learners' academic performance, so, the research is limited by two main variables namely, self-efficacy and

learners' performance. Analyzing the relationship between the positive beliefs which are held about oneself, and the scores which are obtained in the test will demonstrate the significance of the intervention, or otherwise. Introducing the independent variable, in our example is an intervention, which may be presented in the form of aiding learners to increase their self-efficacy beliefs through positive confirmations. Hence, the hypothesis can be formulated as follows "If the learners are positively reinforced (positive confirmations), they would display higher sense of self-efficacy" (Babbie, 2010).

The subsequent step is hypothesis testing, that is finding out specific operations in measuring the variables (Babbie, 2010).

Accordingly, engaging into assessing the effects of positive reinforcements on learners' performance and response to learning tasks, the researcher can observe and analyze learners' performance on a task, just after being positively reinforced. Learners' responses are likely to be positive and demonstrate the effect of positive reinforcements on learners' academic performance (Schunk, 2009).

A questionnaire is another research tool, which is used to measure the relationship between the suggested dependent and independent variables in the hypothesis. Given the aforesaid example, the researcher specifies the operational definition of self-efficacy in the form of a question such as: 'do you think that being assigned hard work to finish within a short period of time, without being equipped with the necessary research tools, would have any negative influence on your ability to succeed?'. So, learners' belief in their

ability to succeed points out a deep sense of efficacy .This is a possible item which can be included in the questionnaire. 'Not at all, very much so, and somewhat' are some possible instances of the answers which can be opted for by the participants. The participant should respond to the choice which she or he believes more appropriate.

The relationship between the variables can possibly be examined via another technique, which is called correlational technique. Taking the aforesaid example, we correlate positive expectations with the test scores. The results which are obtained are called response-response law (R-R response) (Olson and Hergenhahn, 2009).

While finding out the correlation between two or more variables, the researcher is to operationally define her variables. In our example, self-efficacy can operationally be defined as the positive self-talk, emotional intelligence, self-confidence etc..., and the high scores represent performance improvement. So, the researcher correlates the obtained results in the achievement test, with the results which are attained from positive self-talk, emotional intelligence, and self-confidence test (Olson and Hergenhahn, 2009).

However, the main drawback of correlational technique is that it is unable to give clear identification of which variable is truly dependent on the existence of another. In our example, a question is posed about which variable is dependent on the occurrence of another; in fact it is not easy to assume that self-efficacy increases achievement, or that higher achievement

leads to greater self-efficacy . We just do not know for sure, which has control over the other, and which variable causes the other to arise (Schunk, 2009).

Determining the cause and the effect is another form of inductive reasoning.

2.3.2.1.2. Reaching Causal Inference

An inductive approach for analyzing the cause-effect relationship of two or more variables is called causal inference (Sternberg, 2009).

The causal inference approach is concerned with clarifying how people come to judge whether something really causes something else to happen (Sternberg, 2009).

Moreover, Sternberg (2009) describes heuristics, which were first suggested by John Stuart Mill (1887), and which are widely used to investigate how people actually make causal judgments (in Sternberg, 2009).

Heuristic principles are defined as a set of canons or methods which can be used to rule the type of judgment (Sternberg, 2009).

In the following, we move to discuss a canon which is known as the canon of agreement.

In the canon of agreement, the learners engage into a systematic discovery of certain factors, which are found to be common in a number of events, so as to say that the common factor(s) causes the events to arise. To exemplify how this canon works, let us suppose a group of learners who have participated in

a training program, which is aimed to increase the use of certain writing techniques. The learners might be observed to make the same writing mistakes (such as, the misuse of punctuations) which lead to lower test scores. So, in this case, the investigator counts the occurrences of the factor(s) which may be the reason behind learners' poor writing performance (Sternberg, 2009).

However, the canon of agreement suggests that an investigator is to consider a list of several possibilities, which may probably cause her or him to misuse the canon of agreement. Factors such as tiredness, anxiety, misunderstanding etc.... then, the investigator reckons the number of the occurrences of the given causes, to safely say that the one, which occurs more repeatedly, is apparently the specific cause. The rest of the causes are eliminated (Sternberg, 2009; Hurly, 2011).

Another method which is suggested by John Stuart Mill (1887) in inductive reasoning is known as the method of difference. In this method, the researcher identifies a single factor which occurs in one event, and which does not occur in the other events. To exemplify this point, we assume that two kindergarteners are given a set of colorful pencils, and then are assigned to put each pen in the box which is of the same color. One of these kids is noticed to carry one left pencil, for she could not find a box with the same color. Which box is missed? The answer can be found out through the method of difference (Sternberg, 2009).

So, the two kindergartens stand for the two occurrences and the letters **a**, **b**, **c**, which represent the colorful pencils, the numbers **1**, **2**, **3**, are the boxes with the same color.

To say that all conditions which took place are the same, except one condition, which apparently differs in a single condition (a) and which is not attended to it.

Mill's (1887) method of difference is of a paramount importance to most scientific researches which seek to find out at least a factor, which differentiates between two seemingly similar objects. Take another instance, a group of students who received the same treatment (say for instance, problem solving games). So, an investigator may have noticed that the learners, who have received the same treatment during a period of time, say during the school year performed better in the final test compared with their performance before being given the special treatment (in Sternberg, 2009).

Moreover, the method of difference allows the investigator not only to explore the difference between the performance before and after a treatment, but also during the intervention, hence the investigator may notice, for instance, that some students might be incapable to handle the problem-solving games while the rest of the students have found almost no difficulty to deal with them. In this case, the teacher (the investigator), would straightforwardly induce (inductive reasoning) that something is going on to bring about the differences between the performance levels (Sternberg, 2009).

Now, we move to discover another form of inductive reasoning, which requires the knowledge of the world, it is called the inductive generalization. This kind of inductive reasoning suggests that some observed instances of the

kind **A**, have the quality, or property **C**, to finally conclude that all **As** contain the quality or property **C** (Cooper and Patton, 2007).

2.3.2.1.3. Inductive Generalization

Inductive generalization is believed to be the simplest, and the most common type of inductive reasoning, which is concerned with a systematic process of drawing general conclusion from a set of observed instances.

Consider, for example, the number of female students who report the negative influence of high-temperature on their learning performance. **S** represents the students:

S₁ high-temperature reduces concentration.

S₂ high-temperature influences motivation to learn; she feels lazy due to high temperature

S₃ high-temperature makes her less eager to participate

S₄ high-temperature causes skin allergy, which (obviously) distract her attention

.

.

.

N → stands for the number of female students who have reported the effect of high-temperature on their performance.

Gathering such information about the participants, leads a researcher to conclude that probably all the students are unable to perform better, due to

the unbearable high-temperature, which caused undesired consequences (low performance).

Likewise, the following is another illustration of how inductive generalization is used to explain a set of observed instances of responses, which produce the general conclusion (i.e. the inductive generalization):

‘Unstoppable global warming has raised awareness of performing necessary and immediate procedures to reduce its detrimental effects on human living. So, attempting to recover the ozone layer, led a number of activists to increased people’s commitment to green renaissance, by getting them involved into broadening green spaces, as well as focusing on the use of renewable energy, which is provided via the wind farms, sea waves, and solar energy. These are few suggested solutions to the damages (global warming) which are caused by the depletion of natural resources, greenhouses effect, the effect of nuclear testing on enlarging the ozone hole’.

(The example is mine)

Hence, with regard to all the above observed occurrences, an investigator (a researcher, a learner, a problem-solver etc...) draw a general conclusion that people have become more and more aware of the detrimental impact of the modern natural phenomenon, which is called the global warming.

In both examples, the inductive generalizations seem to derive from several pieces of information on the main issues, which are stated in the examples (the effect of high-temperature on the performance of the female students, and the effect of raising awareness of global warming on people daily activities as to reduce its dangerous impact on human life). However, it is worth remembering

that these inductive generalizations are not deemed reliable until they are supported by sufficient and relevant evidences (Manktelow, 1999).

Statistical generalization is another type of inductive generalization, which is, as its name suggests, statistical in its nature (Holowchak, 2007).

To illustrate statistical generalization, let us consider the following example:

- 60% of the times I have been in the jungle, I got headache
- So, 60% of the times I go to the jungle, I will get headache.

The general form of the statistical generalization is written as:

X% of observed **S_s** has attribute **α**

So, % of all **S_s** has attribute **α**

Accordingly, **X** per cent stands for any number from zero (0) to one hundred (100), and **S_s** is the number of the observed instances, which led to the occurrence of **α**. The latter represents the general conclusion.

After revising two main principles (or standards which serve to measure the degree of the significance of the inductive generalization) the inductive generalization is accepted as being true. These two main principles are called the principle of sufficient variation, and the principle of sufficient size (Holowchak, 2007).

1. By sufficient variation, it is meant that the sample, which is intended to be studied, should be taken randomly from the whole population. One may ask

why randomness of the sample is crucial if we are to focus on studying some (or all) characteristics of the entire population. The crucial importance of random sampling is justified by the fact that randomness guarantees that all members in the population is given equal chance to be chosen.

2. Concerning the size, it is important to make sure that the sample is closely related to the population in terms of its size. For example, given that twenty (20) balls is the number of the whole population, from which the sample of about four (4) or five (5) balls is taken at random. The numbers four or five are merely suggested to be approximately the representative sample of the whole population (Holowchak, 2007).

Taking randomly a representative sample from a population, means that the researcher (the learner) will perform scientific experiments on the sample to elicit significant information on the population. In other words, the researcher analyses important aspects in the population, such as problem-solving ability, memory, and learning styles. In Walliman's (2001:93) terms, "to test, control, and measure the variables".

When choosing a representative sample, the researcher has to take randomness into account, then she or he concentrate on the application of conventional research tools, in order to elicit and analyze necessary information from the given sample. The obtained results are said to be probably applicable to the whole population (Salmon, 2007).

The researcher cannot choose the whole population to gather and analyze its characteristics, because trying to deal with every single subject, item or participant in the population generates a massive bottleneck of data which consumes time, and hinders results finding and interpretation (Salmon, 2007).

The next discussion will be focused on another type of inductive reasoning, which is concerned with learning via experimentation, which is discovery-based learning, followed by shedding some light on the most commonly useful procedures for conducting an experiment.

2.3.2.1.4. Conducting a Scientific Research

To begin with, we attempt to specify what the word “experiment” is meant by. Experiment or experimentation is a scientific method which involves a systematic manipulation, of the independent variable to examine its effect on and control over the dependent variable. Thus, the researcher wishing to conduct a scientific experiment attempts to determine cause-effect relationship; she or he compares between what happens exactly before and after introducing the independent variable. In a nutshell, the experimental stimulus is being manipulated to find out its effects on the environment (Babbie, 2009; Schunk, 2009; Olson and Hergenhahn, 2009).

Furthermore, the experimenter hypothesizes that if learners (the sample) are equally rewarded for acting appropriately in the classroom, they would develop higher sense of self-worth. The independent variable is presented in the form of the rewards, which are given only when the desired behaviors appear (Schunk, 2009; Olson and Hergenhahn, 2009).

To present an operational definition of the rewards, they are the statements of encouragement, which boost learners’ extrinsic motivation, and foster their sense of worth. Hence, the independent variable is indicated in the statements of encouragement for appropriate behaviors, which would affect learners’ classroom performance (Olson and Hergenhahn, 2009).

The purpose of conducting a scientific experiment is to test the validity of the research hypothesis. This allows the researcher to provide the participant (are sample), with specific treatment (or intervention), in order to highlight the causal relationship between variables. Scientific experimentation is reasoning which sheds light on the stimulus-response relationship between the given variables (Babbie, 2009).

However, what is identified as independent variable in one experiment, and which stands for the cause, may also be found to be the dependent variable in another, that is the effect; for a variable to be marked as the cause or the effect depends on the research purpose or orientation (Olson and Hergenhahn, 2009).

Conducting a research experiment can be an emotionally confusing experience, especially when learners are not completely certain about what, how, when, and where to begin their scientific experimentation.

In the following discussion, we shall attempt to highlight the basic list of steps or methods, which are necessary for an effective conduction of a scientific experimentation:

a) - Define the problem. The research problem is said to be the result of accumulating questions, which stem from being constantly exposed to a number of stimuli. So, the researcher seeks answers to the questions she or he asks about the surrounding environment, searching for supporting evidences to the hypothesis she or he suggests, she or he observes, tests, analyses, interprets and evaluates her or his findings. Yet, all of the aforesaid acts (observation, testing, analyzing, interpreting and evaluating the findings etc) depend on a well-defined problem.

b) -Operational definition of the given variables. For the purpose of controlling and measuring the variables, the researcher needs to determine exactly what her or his variables are. This requires the operational definition of the variables. In the aforesaid example, the relationship between social rewards and self-worth enhancement, the researcher should be precise about the meaning of the social rewards in her or his research, so, he may specify them as the statements of encouragement stated to the learners when they show good behaviors in the classroom, and the increased sense of worth being the positive self-image the learners develop after being rewarded (Olson and Hergenbahn, 2009).

Babbie (2009) states that the systematic observations of behaviors during data collection plays a major role in determining the operational definition of the suggested variables.

c) -Develop a hypothesis. (Look back in the formulation and testing hypothesis)

d)-Explore the literature review. This will provide the researcher with an extended capsule of background literature review, as far as the suggested variables are concerned.

e)-Select a research design. This step includes two basic types of testing, namely, pre-testing and post-testing which are mainly designed to analyze the cause-effect relation. Pre-testing is intended to measure the sample's the level of their performance before being treated, trained or exposed to external factors. The next procedure is to expose the participants (the sample being studied) to a special treatment (the cause), which may cause the desired change (the effect).

So, post-testing serves to measure the results after receiving the special treatment to compare them with the pre-test scores, in order to find out a significant difference and highlight the effectiveness (or ineffectiveness) of the intervention(Miller,1984).

f) -The conduction of the experiment and data collection. Once an approval is given by the faculty administration, the researcher will be allowed to administer her or his testing procedures, and collect data.

g)-Analyze and interpret the data. After conducting the experiment(s), data which are collected during experimentation are to be interpreted and analyzed to find out whether the conclusion actually corroborates the research hypothesis. This is achieved via statistical techniques, though a comprehensive discussion of them is beyond the scope of our research aim, it is worth emphasizing that mastering the use of inferential statistics, which are required for random sampling and data analysis is crucially important (Olson and Hergenbahn, 2009).

Notwithstanding its crucial significance for supporting the hypothesis, and clarifying the nature of the cause-effect relation between variables, the experimental research cannot go beyond the suggested variables. The researcher is to commit to her or his own research aim, tries to minimize (or maximize) the effect of one variable over another depending on the experiment objective, and then seek out effective techniques to exclude any extraneous variable, which may bring about undesirable influence (Schunk, 2009).

In the following, we center attention on the topic of learning strategies, which are used to facilitate learning and aid problem-solution.

2.3.2.2. Learning Strategies

Reasoning tasks tend to be highly demanding in terms of their involvedness. Performing a set of thinking skills, such as problem-solving strategies, memory, and decision-making require a focused mental effort on the problem-solving task. Also, identifying problems, gathering data, organizing and synthesizing information, maintaining concentration and effective communication of findings seems to be extremely mentally challenging tasks to learners.

Moreover, difficulties to understand thought-challenging situations (the effect of framing and context on reasoning) may arise, as well as the learning obstacles (such as forgetting, low motivation, and concentration) which hinder effective processing of relevant information to a problem-solving task. In this case, our learners should be instructed to use a set of learning strategies, such as memory strategies, cognitive strategies and metacognitive learning strategies, which are described by Oxford (1990) as tools which are consciously used to deal with difficult learning and problem-solving situations more effectively (Oxford, 1990).

Accordingly learning strategies are perceived as “tools” which are used to facilitate problem identification and problem-solution, and the manipulation of the environment to learn. So, learning strategies are used when there is a problem to solve, a goal to attain, and a need to fulfill (Oxford, 1990).

Also, Schunk (2009) defines learning strategies as plans, which are directed towards successful performance of learning tasks (Schunk, 2009).

The aforesaid definitions of learning strategies as being cognitive equipments which are used to facilitate learning, put forward that problem-solvers(learners) to be equipped with necessary learning tools(including learning strategies used to attain knowledge and communication strategies) to use throughout problem solving tasks.

Memory strategies are learning tools, which are used to increase retention. They include rehearsal, elaboration and the use of mnemonics, which are believed to be of a paramount aid for retaining and retrieving the required information for problem-solving tasks (Oxford, 1990).

Metacognitive learning strategies are said to regulate ones performance. They involve strategies for self-regulation, monitoring, and planning (Schunk, 2009).

Moreover, other learning strategies are suggested to lower anxiety, and its negative influence on retention and reasoning. Strategies such as talking about concerns, worries and expectations with a close friend, or with an expert, breathing exercises, and cooperating are some instances of strategies, which may decrease negative thoughts, encourage positive learning atmosphere, and boost motivation.

Importantly, learning strategies (such as those discussed above) and problem solving skills are not used separately, for they are both important for improving learning outcome, and enhancing thinking skills.

Moreover, raising awareness of the importance of learning strategies may not guarantee that learners will employ them in different learning situations. Yet, getting them involved into exploring and applying learning strategies is deemed significant ,and very effective to ensure long-term retention of knowledge , as well as the learning strategy which was used to attain it. The same point applies to problem-solving skills, that is to say, our learners are to

be involved into tasks which require the use of problem-solving skills, which foster both their thinking skills, and learning outcomes.

2.3.2.3. Partially Guided Instruction

Partially guided approach to teaching problem solving skills is particularly efficient for learners who have possessed an amount of knowledge, and skills from previous learning experiences.

Partially guided instruction prompts learners to investigate concepts, and question their pre conceptions of what is already known. The teachers' role is to facilitate the process, via providing clues or hints (Schunk, 2009).

Moreover, another significant reason for integrating partially guided instruction into problem solving teaching, and learning is that its emphasis on goal setting, social interaction, and the manipulation of learning materials to unravel ambiguous issues (Schunk, 2009).

2.4. Conclusion

Problem-solving skills are indispensable for enhancing comprehension of the world, and increasing learning outcomes. Deductive reasoning skills and inductive reasoning skills cannot be used separately. Deductive reasoning skills help learners to organize a vast amount of information into a whole structure, whereas inductive reasoning skills are used to explore different parts of the structure in relation to the real world situations. So, both skills are crucially needed to learn and make sense of what is being learnt.

Chapter 3

Motivation

3.1. Introduction

Motivation in education is well known for its power to fuel forward the 'wheels' of one's progress and achievement. According to Brophy (2004) motivation can simply be illustrated as the driving force, which draws learners toward the accomplishment of a goal, maintains focused attention, and allows the accumulation of all learners' concentration on the target, and willingness to engage in lessons and learning activities, a process which outstandingly improves the intellectual devotion to the goal achievement.

Learners are not expected to attend to particular information, if they lack the true motivation to do so, therefore, motivation can be illustrated as an "internal process that activates, guides, and maintains behavior over time" (Slavin, 2006: 317).

Viewing its significance to push learners to learn, to cooperate with each others, to explore, and develop personal awareness of the importance of comprehension and application of knowledge (procedural knowledge), motivation is actually indispensable for boosting learners' achievement.

This is so, because highly motivated learners are viewed to have more potential to participate in the classroom discussion, and have an impact on low motivated learners, who lack genuine motivation to pursue learning tasks or engage into classroom discussions (Motivation is contagious).

Importantly, Cooperative interaction which is encouraged during classroom discussions, triggers learners to invest their time and effort in improving their cognitive skills, and communication skills .Hence, they decide to meet more

frequently, learn to communicate their findings effectively, and together investigate a topic of research, leading to a boosted academic achievement, and therefore increase their self-esteem and motivation even more (Kagan, 2009).

Before moving to discussing different views of motivation, we make a distinction between extrinsic locus of control (extrinsic motivation), and intrinsic locus of control (intrinsic motivation). So, having internal reasons for performing certain acts, for example learners wishing to improve their mathematical competence (the aim), seek to benefit from any opportunity for learning how to solve mathematical issues (acts), because they find mathematics interesting and for each of them (i.e. for each of the learners) personally meaningful (the reason), this is called intrinsic motivation; whereas, having external reasons for acting in a particular way, for instance seeking social approval, is said to be extrinsic motivation. Consider for instance, that learners wishing to achieve their parents' will (e.g. teaching English language at an orphanage school), in this case, learners opt for specializing in English language, and master the use of the various skills of the target language, in order to help orphans learn it too; hence learners are extrinsically directed to act in particular ways, in order to meet social (parent) expectations (Williams and Burden, 1997).

Additionally, it is worth remembering that both extrinsic and intrinsic types of motivation are important, that is "motivation from extrinsic sources is complementary and additive to motivation from intrinsic sources" (Heneman, 2002:262). Both external and internal factors (extrinsic and intrinsic motivations) are intertwined, to trigger off a person to act in a particular way. Hence, extrinsic motivation may play an important role for learners to be

intrinsically motivated and vice versa (Williams and Burden, 1997; Schunk, 2009).

Later in this chapter, we will attempt to add more details of both extrinsic and intrinsic motivation; now we focus on shedding some light on different views and perspectives on motivation. We start by displaying the behaviorist views, and the influence of conditioning and reinforcement (positive and negative reinforcement) upon learners' behaviors and attitudes towards persistence and continuation of learning, then we deal with the cognitive perspective on motivation, which explains how thoughts and beliefs influence learners' behavior (motivation), and we end up by underlining the social constructivist views, which describe the role played by the dynamic interaction between the teacher, the learners and the task to maintain learners' motivation.

3.2. Behaviorist Views of Motivation

Behaviorism is a school of thought which is established by John B. Watson (1878-1958), which points out the behavioral changes of an organism (human or animal) due to experience (learning) (Jordan et al, 2008; Olson and Hergenhahn, 2009).

Behaviorism approach to learning views learning as a form of conditioning, that is, Stimulus-response relation (S-R) in which an organism (human or animal), are conditioned to respond to a set of stimuli, under certain optimal conditions. The behaviorists postulate, that being stimulated by certain stimuli, which produce specific desired reactions or responses (Olson and Hergenhahn, 2009).

A reaction or response, the behaviorists argue can also be generated by introducing another stimulus simultaneously (Olson and Hergenhahn, 2009, Schunk, 2009).

So, according to the stimulus-response relation, an organism's behavior (man or animal) is determined by which stimulus is structured or presented (Williams and Burden, 1997).

Hence, learners' motivation to perform certain activities (led by their goal to achieve), is revealed through the way they behave, that is their behavior is entirely controlled by the external factors (influences). Put it in a nutshell, learners are externally triggered to behave in a particular way to meet their 'basic' needs.

To understand more clearly the effect of conditioning on an organism's behavior, consider for instance that a student (an organism) is asked to read a story to get better understanding of some thoughts (the need), the teacher asks the student to read the story over and over again, while the teacher constantly provides positive encouragements or feedbacks (e.g. words of praise), which encouraged the student to read more. This behavior (response) is being positively reinforced by showing appreciation or any sort of feedbacks (conditioning), and ensure the occurrence of the behavior in the future (Schunk, 2009; Olson and Hergenhahn, 2009; Anderman and Anderman, 2009; Slavin, 2006; Williams and Burden, 1997).

However, it is worth noticing that an excessive dependence on external source (stimuli) to behave in a particular way leads to generating more like machine students, unable to act properly and thoughtfully, which would undoubtedly hinder their progress toward self-regulation, and problem-solving which are necessary for boosting academic achievement. This is due to the

negative effect caused by preventing learners' own capacity to explore their internal strength, and think for themselves about personally meaningful reasons for carrying on a particular task. That is, a total dependency on external factors (looking for social approval or any desired status) to learn would in a way or another 'enslave' one's capacity to learn and to think. Hence, conditioning constrains learners from exploring and fostering their cognitive and social skills, for they are controlled by the given amount of stimuli, which minimize their ability to investigate, understand, and generate new knowledge.

Hence, rewards, grades, or verbal praises should not be given unnecessarily, because such conditioning reduce genuine interest in exploring undiscovered knowledge, and increase dependency on external influences which stimulate them to behave in a desired way and control their responses.

However, positive reinforcement is strongly recommended, that is and is to be provided moderately, particularly when desired behaviors take place. In this case, positive reinforcement is meant to be an indication of approval, and encouragement support learners to learn more. In so doing, learners effort are not discounted, yet encouraged as to inquire for personally meaningful value of a given task, and motivation to persist in their studies.

Moreover, providing learners with reward (e.g., recognition) when they act properly, or work collaboratively to achieve a task plays a central role in maintaining a positive attitude toward appropriate learning behaviors, and maximize better performance. This can be revealed in learners' willingness to ask questions, provide support to less able group mates, and communicate their ideas, which also involves their persistence of learning.

Additionally, Schunk (2009) contends that learners are motivated due to prior positive reinforcement, associated with active involvement into activities; they also expect to be reinforced for the same reason (Schunk, 2009).

3.3. Cognitive Views of Motivation

The cognitive views of motivation describe motivation in learners in terms of having determination and control over the way in which they behave. That is, learners choose to behave in a specific way to achieve a goal; they chose to do so, in order to feel satisfied toward the choice they made. Thus, the effort which is devoted for achieving a goal is expected to increase because of the learners' motivation to get a control over learners' behaviors to achieve a goal (Anderman and Anderman, 2009).

In Williams and Burden's own words (1997:119) "from a cognitive perspective, motivation is concerned with issues such as why people decide to act in certain ways, and what factors influence the choice they make" (Williams and Burden, 1997:119).

In terms of the cognitive process, motivation is believed to stem from of a person's thoughts and cognition. Trying to explain how thoughts and beliefs influence our behavior; cognitive theories of motivation will be discussed in the following section which spotlights different cognitive views of motivation, mainly, expectancy theory, goal setting theory, social learning theory, and equity theory (Williams and Burden, 1997; Slavin, 2006; Anderman and Anderman, 2009).

❖ First, expectancy theory, which is suggested by Vroom (1994), states that motivation is a conscious choice process. It explains that learners opt for

doing something because of its expected reward. As a matter of fact, learners' judgment of whether their effort for doing something will lead to a successful accomplishment is conceived as learners with 'high expectancy'. In contrast, learners with 'low expectancy', that they have low confidence in their own ability to succeed, which will bring about negative effect on their performance and prevents them to boost their academic achievement(Slavin,2006).

Moreover, it is worth emphasizing that learning to behold the value of a particular task, leads to producing high quality performance. Thus, learners need to be taught to focus their attention on the outcomes which can probably brought by the given task (e.g. improve comprehension of knowledge).

Also, learners are to be taught to explore the meaningfulness of any learning task, and concentrate on the deep meaning conveyed by a piece of information, and its relevance to real life situation, as to make sense of knowledge, and rethink their own ideas while interacting with the environment, as a way to maintain their attention and increase motivation. This is so, because once learners lose their enthusiasm due to failure to value the task or believe it to be meaningless , their improvement is just 'paralyzed' and learning can be said to wither away (use it, or lose it)(Williams and Burden,1997).

Perceiving the time and effort devoted for the accomplishment of the task will eventually bring about positive (or negative) consequences will increase learners motivation, that is the expected outcome pushes learners to learn more (Lower or higher performance) (Werner and De.Simone, 2009).

- ❖ Second, goal-setting theory is the second cognitive theory that attempts to explain motivation. In this theory the claim is posited to highlight the significance of determining which direction to 'walk', or which aim that energized learners to perform in a certain.

According to Werner and De.Simone (2009) goals influence learners' intentions toward which goal to be committed to. They state that this commitment will aid learners to maintain focused attention on the given task toward the achievement of the goal, or opting for another choice (goal), and reject the former goal. The teacher's role is to provide a feedback which aid learners to set effective goals (Wener and De.Simone, 2009).

- ❖ Third, the subsequent cognitive theory is called social learning theory. It is developed by Bandura (1971), who suggests that outcome, self-efficacy and expectations have impacts on the learners' current performance. Accordingly, high self-efficacy which is defined as a person's judgment of her or his capacity to perform a certain task, that is "yes, I can do it" sort of belief, which leads to a boosted academic achievement, and builds positive attitudes toward possible future challenges. This encourages learners to enhance their problem-solving skills and cooperative learning skills (Bandura, 1971).

- ❖ The last cognitive theory that attempts to demonstrate motivation is known as equity theory, which is developed by John Stacy (Slavin, 2006).

Equity theory of motivation is based on the learners' perception of equality, and teachers' fairness of treatment they give to learners who have made the same contributions. In so doing, learners are likely to be highly motivated to attain rewards, which are expected from their contributions

(performance). The implication of equity theory of motivation is that for learners to foster their motivation, they have to be given equal opportunities to perform specific tasks, and to be evaluated on the basis of what they have achieved so far (Daft and Marcic, 2010).

3.4. Social Constructivist Views of Motivation

Before we go through the constructivist views of motivation, we shed some light on the term constructivism. In its essence, constructivism focuses on how learners construct their understanding. That is, learners struggle to build their understanding of a given idea, information or a concept as they make a connection between a newly introduced information, and the previous one (assimilation), and correct misconceptions by removing the discrepancy between what they know and the newly introduced information (accommodation) (Aderman and Anderman: 2009).

Accordingly, learners are motivated to resolve these discrepancies, (or cognitive conflicts) which are caused by the occurred difference between what is already known, and what is being experienced, in so doing, learners actively use learning strategies to fit the previously experienced information with the newly introduced one, a process which will finally bring about a deeper comprehension of the given information, and therefore resolves the cognitive tension, and produce learning (Williams and Burden, 1997).

Moreover, it is worth emphasizing that while providing learners with information, learners' prior knowledge, previous learning experiences and interests in the topic should be taken into account. In so doing, learners are more likely to be interested and motivated to learn a topic which triggers their curiosity, and which is personally meaningful. This is a key principle of constructivism regarding how to help learners be informed and motivated.

Social constructivist views of motivation describe a dynamic interplay between the teacher, the learners and the task; that is an interaction which emphasizes mutual interaction toward an aim (Williams and Burden, 1997).

The significance of many factors, including cooperative learning environment and the context within which problem-solving tasks take place, where learners are encouraged to communicate their opinions, support each other and help each other to learn would help them to develop deeper sense of worth, and foster many skills such as problem-solving skills and cooperative learning skills simultaneously, therefore learners grow not just like active learners, but as effective problem-solvers.

Thus, based on the constructivist views of motivation, learners' high (or low) motivation can be enhanced (or decreased) through cooperative social interaction. Mutual exchanges of opinions and previous learning experiences, provide learners with a variety of contextual clues, which aid long-term storage of information, and boost their confidence as to apply their knowledge once they need it (e.g. to solve a problem).

In addition, learners' ability to maintain high motivation and interest in a topic depends heavily on their beliefs in their ability to succeed. Hence, learners with high self-confidence will be better at performance, whereas, learners with low self-confidence seem to be hesitant and avoid risk taking. This feeling of high or low self-trust can be explained by the previous successful (or unsuccessful) learning experiences, where sufficient (or insufficient) support and feedback were provided, and where significant others attempt to reinforce or weaken specific behaviors, which continue to effect learners' beliefs in their ability.

According to the constructivist perspectives on motivation, the teacher is a facilitator who is able to perform different skills and actions, such as providing support, resources, and creating an effective learning environment, which appeals to learners' motivation, and provokes deeper thinking.

More importantly, a teacher as a facilitator is actively involved into learning and cooperative problem-solving tasks. That is she or he constantly emphasizes a dynamic and cooperative interaction between the learners, the task, and the learning environment. Also, the facilitator helps learners to understand that improving thinking skills is more likely to be achieved when they get involved into tasks, which are designed for this purpose, as well as the facilitator makes clear that her or his learners are able to find out more about the given task, when they interact with the significant others, including teachers, experts, and peers (Williams and Burden, 1997).

Moreover, social constructivism suggests that every learner is motivated to learn in a different way, that is she or he figures out different tasks in a way that makes sense to her or him. For example, introvert learners may be viewed to delay immediate response till they completely understand the suggested solution to a problem, and make it personally meaningful; they are motivated by their need to make sense of knowledge before they state their opinions.

Williams and Burden (1997: 121) propose a model of motivation which constitutes three stages, it is as follows:

- 1) Reasons of doing something**
- 2) Deciding to do something**
- 3) Sustaining the effort and persistence**

According to the model, the first two stages suggest that learners decide to reach an aim because they have reasons for doing so. For example, extending knowledge (an aim) of chemistry, learners decide to perform certain activities which aid them to succeed in understanding chemistry. The last stage is associated with ability to maintain the same amount of energy and time directed to the goal achievement, that is persistence. This can be done, for instance through reminding themselves of the advantages of understanding the importance of chemistry for improving the ability to apply methods of inquiry.

Moreover, the perceived value (intrinsic and extrinsic values) of the task, keeps learners actively engaged into it. This is so, because perceiving the value of the task (e.g. the end result) increases learners' motivation to learn, and keeps them committed to the given task through conducting an investigation, searching for reliable sources, seeking hands-on learning experiences, interacting with the environment. According to Williams and Burden (1997), the more the activity is appreciated, the more attachment to the task, and therefore the highly motivated learners are. The teachers are to choose tasks which are meaningful, motivating and thought-provoking (William and Burden, 1997).

In the following discussion, we attempt to reveal some factors and strategies which are believed to effect learners' intrinsic and extrinsic motivation.

a) Setting Challenging Tasks

Setting tasks which are neither unachievable, nor easily to accomplish is thought to challenge learners' thinking and raise their intrinsic motivation. Successful accomplishment of the challenging task boosts self-confidence and increase learners' beliefs in their ability to overcome challenges which may occur in the future. Challenging learners with such tasks, pushes them to

resolve the discrepancy between what is already known and what is being experienced , therefore they take advantage of the tasks as being a learning opportunity which enable them to use and enhance their problem-solving skills.

Vygotsky's (1962) notion of the zone of proximal development (ZPD) refers to the distance between learners' actual problem-solving ability (what they can do), and their potential problem-solving ability under guidance (Vygotsky,1978; in Williams and Burden, 1997).

Vygotsky's notion of ZPD suggests that working with significant others, such as teachers, researchers and class mates who share the same interest is likely to reduce the distance between the current independent problem solving abilities and the potential development or the challenge, that is they gradually get control over their learning, they become much more skilled at solving problems, obtaining knowledge, distinguishing between relevant and irrelevant information, and applying inquiry methods appropriately as a result of the social interaction with the significant others (Anderman and Anderman,2009;Dornyei,2009; in Williams and Burden,1997).

b) Using Proper Strategies of Assessment

Assessment of learning product and performance in the classroom is regarded a fundamental tool used to motivate learners to improve their performance in the future.

Group discussion, performance assessment, question-response are some forms of assessment tools, the teacher uses to assess and boost learners' motivation (Sinagatullin, 2009).

In the following, we shall attempt to examine the major theoretical explanations, which emphasize motivation as being a dynamic power, which is influenced either by personally meaningful reasons, or by the mutual interaction between the learners, the instructor and the task which explains the persistence and continuation of efforts.

In the previous discussion, we attempted to reveal the effect of high motivation on increasing the amount of effort toward the achievement of a goal, and we tried to distinguish between intrinsic motivation and extrinsic motivation, that some learners deem a given task as being personally significant, others may be steered by external influences to perform a task. Indeed, learners possess intrinsic or extrinsic motivations or a combination of both of them for acting in a particular way.

As already stated in the previous discussion, intrinsic motivation describes anything internal, such as curiosity and excitement, which induces learners to learn and search for opportunities to achieve their goal, simply because they find it personally meaningful and enjoy doing so.

Intrinsic motivation prompts learners to explore and discover new dimensions of knowledge, in order to obtain new skills, and broaden their comprehension or even to avoid feeling guilty by not working hard on a given activity. Hence, if learners' attempts are met with disapproval or are not positively reinforced, the occurrence of such behaviors, according to operant conditioning view of motivation are likely to disappear or become less frequent (Fontana, 1995).

However, learners with strong desire to do something, are self-regulated, and able to pursue their aim under external negative influences, that is they have clear vision of their direction (aim) and they recognize how they can

ultimately (operations) achieve their aim, as well as they are very selective concerning which stimulus to attend to, and which one to ignore, that is they are intrinsically motivated (Slavin, 2003).

Accordingly, Ryan and his colleague Deci (2002) argue that intrinsic motivation has to do with the relationship between the learner and the task she or he is striving to accomplish, and that, Ryan and Deci (2002) illustrate, what motivates a group of learners, may not be the same which boost the motivation of the rest of learners (Deci and Ryan,2002).

In the following, we try to describe theories that are put to sustain and enhance intrinsic motivation.

- 1.** Self-determination theory is developed by Deci and Ryan (1985). They focused on what is considered a motivation construct which enhances learners' intrinsic motivation, and affects their performance (Deci and Ryan, 2002).

Deci and Ryan (1985) describe self-determination as an important motivator which goes hand in hand with intrinsic motivation. In other words, learners experience control over their action, in their attempt to reach a desired situation (Deci and Ryan, 2002).

When learners are self-determined, their choices of activities are viewed more appealing to their needs for competence and autonomy. So, they act out their choices, and decide to manage their surroundings effectively, including their choice of learning tools, and inquiry methods.

An approach of evaluating learners' intrinsic motivation involves observing learners' maintained intellectual effort to accomplish the task, and whether they enjoy doing something (Deci and Ryan, 2002).

2. Providing feedback is viewed to affect intrinsic motivation. According to Deci and Ryan (1985) positive performance feedback increases learners' feeling of competence, whereas negative performance feedback prevents learners from achieving farther progress, as a consequence of a decreased sense of competence (Deci and Ryan, 2002).

Accordingly, intrinsic motivation can be influenced by environmental events. For instance, constantly praising learners for doing something may weaken learners' intrinsic motivation and decrease their ability to perceive the true value of learning, or the reverse, leaving learners' accomplishment and efforts unnoticed or unreinforced repress learners desire to participate or to pursue learning, and produces negative attitudes toward making any contribution.

Learner's intrinsic motivation is not only the result of being internally drawn toward learning, or having personal interests in learning, and the expected rewards that are gained after successfully overcoming a particular learning obstacle, there are other external events, which play a crucial role in enhancing learners' motivation and boosting their academic achievement that is extrinsic motivation.

Teachers may have noticed that not all the learners really think that all tasks are interesting and personally meaningful. For instance, given the conditional type of deductive reasoning, where learners are required to affirm an antecedent and deny the consequent, or the reverse, some learners may be viewed to search for external reason to tell that the given task is really significant, that the conditional propositions aid them to organize thoughts, through categorization.

Slavin (2003) asserts that not all the topics being learned are inherently interesting, or deemed useful to all to learners. In this case, **Fontana** (1995) suggests that the recourse must be made to the extrinsic motivation.

According to Deci and Ryan (2002), extrinsic motivation is a construct that pertains whenever an activity is done to attain some separable outcome. That is, learners are motivated to work on a task, because they have enough external reasons for doing it. These external factors range from failure avoidance (e.g. social resentment, and face-threats) to gaining high grades and recognitions (Deci and Ryan, 2002).

Therefore, extrinsic motivation is regarded as the power that is fueled by the anticipated reward from the external environment. Positive performance feedback plays a crucial role in the enhancement of extrinsic motivation, so, learners may be viewed to exert extra effort, because they believe that the given task is useful, and rewarding. In others words, learners who regularly receive positive feedbacks when doing good they feel much more confident, that they can always achieve better, and make progress, and that the mistakes they make are believed to be essential for their effective learning.

As we have noticed above, that sometimes learners engage into activities which less appealing and personally insignificant. However, extrinsic motivation should not be dismissed, especially at the very beginning, that is the value of the task and its long-term advantages should be made explicitly obvious to learners, so, they can maintain their motivation to accomplish the given task. This can be made, for instance through modeling, drawing pictures, or mentioning real-life events.

The following is a list of strategies that are considered useful for fostering both intrinsic and extrinsic motivation:

- Creating a positive learning atmosphere, that is regained relaxing and encouraging.
- Varying teaching techniques to keep learners interested, and actively involved into group investigation, group discussion and project-based learning, and which are best appealing to trigger active engagement, deeper thinking and cooperative interaction.
- Learners should be made aware of the result, they have achieved so far; how well they did, and how better they can do, to raise their sense of efficacy.
- Choose activities and topics that are relevant with the real situations; the concepts, ideas and alternative solution are to be related with the real-life situations to increase motivation and allow deeper thinking about the ideas in relation to real life. Take for instance, presenting the an issue, which concerned with the climate change, the learners are required to search for particular areas in the world, which are be badly affected due to climate change.
- Another suggestion is to emphasize collaborative learning to understand and employ new learning strategies, and enhance their problem-solving skills within cooperative learning environment. Though, some learners may not be immediately keen to adopt cooperative learning ,they might be taught to integrate more importance and value in the collaboration activities, when they recognize that successful accomplishment of the task can be better guaranteed when many learners are working together to achieve it. The teacher is always there to provide support when needed.
- As far as group investigation is concerned, the topic of investigation should be divided into subtopics, as to give the learners the opportunity to get out

of their shell, and be responsible toward completing their share of the work, and provide support to their group mates.

3.5. Cooperative Learning and Motivation

In **Brophy's** (2004:32) terms, a teacher can increase learners' motivation, through "attending to [...] students' social goals, as well as their academic goals". She contends that it is through the creation of learning setting that encourages all the learners to learn, and most importantly, cooperative learning environment which highlights the importance of goal achievement and learning via collaborative efforts (Brophy, 2004).

Teachers facilitate cooperative learning via providing support and guidance when it is called for. Supportive and constant responses to learners' drawbacks and failure during problem-solving task boost their confidence and persistence in pursuing solution. Thus, tools such as providing feedbacks which aid them to modify their cooperative performance help learners review basic criteria to evaluate the effectiveness and level of their cooperative learning. In Brophy's(2004) opinion, it is the assessment of the learners' effort that emphasized informative feedback, but not grading or comparing students (Brophy, 2004).

3.6. Motivation and Self-regulation

Self-regulation explains learners' ability to choose among a set of activities to attain a goal. Self-regulated learners use a variety of learning strategies such as strategies to organize information, rehearse information, and strategies to evaluate the current achievement, and problem solving strategies during cooperative problem-solving, and which are deemed to increase academic achievement (Woolfolk, 2004).

Also, self-regulated learners, understand the impact of anxiety on performance, therefore they learn to use anxiety lowering strategies, when confronted with learning difficulties such as low motivation to perform a task for instance talking about learning obstacle and seeking advices from an expert, doing regular breathing exercises, and listening to music are instances of anxiety lowering strategies.

The social constructivist, whose name is Vygotsky, claims self-regulation, is tightly linked with enhancement of thinking skills (Vygotsky, 1978; in Anderman and Anderman, 2009).

Vygotsky describes self-regulation as a process, which includes the coordination of the cognitive processes such as memory, planning, evaluation within a social context (Anderman and Anderman, 2009).

So, cooperative social interaction provides learners with an abundance of opportunities for improving and applying deductive reasoning skills, as well as inductive reasoning skills, so they deal with real-life problems, generate new assumptions, and possibly correct misconceptions during social interaction. This interaction pattern emphasizes communication, language, reflection and zone of proximal development.

A couple of mechanisms come to influence learners' self-regulation, namely, language and the ZPD (Schunk, 2009).

✓ Generally speaking, language is illustrated as a tool of communication, which is used to convey meaning, exchange information, and to monitor and direct one's thinking. Self-regulated learners make sure to reflect on and review their thoughts, before vocalizing them; for instance asked to evaluate the groups' performance, learners anchor on a group performance

and adjust for the performance of the other groups. Hence, the entire process (anchoring and adjustment) is performed in the internal world of the learners, after that, learners use the language to explain and communicate their findings.

- ✓ The Vygotsky's notion of ZPD, proposes that learners make a transition from being teacher-dependants, to self-regulated agents in a social context (Schunk, 2009).

As previously mentioned, the zone of proximal development (ZPD) explains the distance between learners' current potentials, and what they can achieve with the guidance and assistance of the significant others. It implies that learners are challenged with tasks that are beyond their actual level, and by the help of the significant others, they reduce the distance between their current level, and the desired one. So, until the learners achieve some progress toward the desired level (potential) the significant others gradually leave learners on their own to enhance higher intellectual potentials, and self-regulation. Scaffolding as synonymous with the ZPD, aids learners to overcome possible learning problems and obstacles, for it entails providing learners with assistance when they need it (assistance may be an explanation, guidance, giving hints etc...)(Anderman and Anderman, 2009; Schunk, 2009).

According to Woolfolk (2004) self-regulation strategies can be learned, and improved through direct instruction, modeling, coaching and practice.

Prior to training learners to use learning strategies, the teacher observes her or his learners, and tries to get to know them as individuals, who possess different learning experiences. In so doing, the learning environment becomes more comforting and relaxing, which prompt to learners to communicate their

true opinions and point at possible learning difficulties confronted with while interacting with each other.

In the followings, we try to shed the light on the importance of the fostering positive self-concept, which plays a major role in self-regulated behavior.

Self-concept is defined as the amalgamation of all perceptions and conceptions about one's self, which give rise to the sense of personal identity. It is the beliefs in their abilities, their importance, and the role his or her plays in the community (Williams and Burden, 1997).

Self-concept and motivation are tightly related, in the way learners interact with the learning environment, and their increased awareness of their intellectual capacity, as well as, their acquired social skills they use to influence the environment successfully.

Moreover, self-concept is partly determined by one's social relationships. That is, the nature social interactions (including classroom interaction) have an influence on how learners perceive their ability to learn and solve problems.

Learners' perceptions of their ability to overcome challenging tasks, help them to develop positive self-concept due to succeeding to perform and accomplish the given task competently and successful.

Maintaining positive self-concept is dependent on how firm beliefs were formed in the very beginning of development that is repeatedly experiencing successes enables positive self-concept to flourish.

Self-concept can also be fostered through speaking to one self positively. Repeating positive affirmations such as, "I am special", "I am talented", "my expectations of myself are very high", "I can definitely be successful problem-

solver” build positive self-concept .Learners are to be instructed to state them repeatedly, because once positive affirmations are believed learners would act accordingly.

3.7. Conclusion

Having high motivation is crucial for learners to be able to explore and apply problem-solving skills throughout their learning. This is so, because learners with low motivation are rarely viewed to commit to learning tasks for a sufficiently long time. Creating an effective learning environment which encourages positive interdependence, self-determination, hands-on experiences, and cooperative problem-solving, boosts high motivation, and maintain a positive attitude toward learning.

Indeed, a significant motivational tool which provides learners with hands-on problem-solving experiences is called field trips. Field trips is particularly motivating because it allows learners to spend time together, building healthy social relationships with others, exploring relevant information and gain more comprehension of problem-solving skills, and enhance their communication skills away from their classroom.

Relating what is being taught with real-life situations is an excellent motivational method, which increases both intellectual ability to solve problems, and maintain high motivation, that is learners try to find out an analogy between what they are actually learning and what is going on outside of the classroom. Observing instances, formulating and testing research hypothesis, conducting scientific experiments, and effectively communicating findings do not take place away from the environment, so real- life events trigger learners, and help them to enhance high-level thinking while interacting with the social setting.

Chapter 4

Cooperative learning

4.1. Introduction

Several reasons have drawn our attention toward the application of cooperative learning in this research. Throughout the literature review, we have observed many advantages which are associated with the use of cooperative learning methods, including STAD, TGT, Jigsaw, and Group Investigation. The latter is of our main interest, developed by Sharan and Sharan (1992), which permits an interaction and encourages learners to act upon different information from many sources, so as to achieve a common learning goal. Cooperative learning boosts learners' academic performance, because it provides them with limitless opportunities to interact with and obtain information from a wide range of references while cooperatively interacting with their group mates.

“In groups that focus on higher order problem solving or complex learning, roles should encourage thoughtful discussion, sharing of explanation, and insights, probing, brainstorming and creativity”.

(In Woolfolk, 2004:495)

With regard to the above extract, in cooperative learning setting, learners are provided with genuine opportunities to expand their perceptions of knowledge and previously encountered experiences along with correcting misconceptions which effect learning and prevent deep understanding of knowledge (e.g. unreliable or invalid research methods). The roles of the teacher vary, yet the most important and central role is to raise learners'

awareness of learning to cooperate and cooperating to learn to reach a common goal.

4.2. Cooperative Learning Defined

Learning to cooperate and cooperating to learn entails that both learning and cooperation are tightly interrelated. That is, learners team together for the purpose of investigating, analyzing, and problem solving, and providing feedbacks and support during problem solving task.

“Cooperative learning refers to a variety of teaching methods in which students work in small groups to help one another learn academic content”.

(In Slavin, 2009:2)

Millis (2010) developed a definition of cooperative learning as being directed toward enhancing students' thinking. She states that cooperative learning is a highly structured form of group work that focus on the problem solving that when directed by an effective teacher can lead to developing[...] thinking and genuine paradigm shift in student's thinking”(Millis,2010:05).

The emphasis is put on the social nature of learning, that is to say, acting upon knowledge with the assistance of peers.

According to Slavin (1995), the application of cooperative learning methods leads to an increased academic achievement, as well as, it ensures improved social relationships due to the mutual assistance during learning, with regard to the time together working on challenging tasks; usually our learners are instructed to stay as much as they can, as teams doing activities together for weeks, or months (Slavin, 1995).

Slavin (1995) builds on this opinion to advocate the role played by cooperative learning to increase learners' self-esteem; that is one's evaluation of her/his own worth due to past experiences. It is believed that the higher self-esteem, the better is performance, hence, self-esteem is unavoidably determining factor of academic success (Slavin, 1995).

"[learners] with high self-esteem tend [...] to have high academic achievement".

(In Myer, 1999:22)

The hallmark of cooperative learning is its support for an integration and application of knowledge and skills including cooperative problem solving skills, skills for directing and maintaining effort and, skills for motivating oneself and the other group members toward completing a shared goal, as well as, developing positive attitude and tolerance for differences, as to make divers opinions a reference rather than a problem (Slavin, 1995).

4.3. Key Elements of Cooperative Learning

David Johnson and Roger Johnson (1999), two advocates of cooperative learning, suggest a list which consists of five main elements which gear to an appropriate application of cooperative learning in almost all contexts, they are as follows:

- Face –to-face interaction
- Positive interdependence
- Individual accountability
- Collaborative skills
- Group processing

The list of cooperative learning elements suggests that cooperative learning works better when each learner is actively involved in doing their share of the problem solving task; all group members are held with the responsibility for their own learning and the learning of their group mates. For this reason, our learners are to be trained specific social skills which are indispensable for facilitating collaboration, and ensuring that all the group mates are actually stepping forward to complete the task, and review the outcomes (Woolfolk, 2004).

Currently, research findings are viewed to point out to the use of cooperative learning methods in many educational contexts. Consequently, cooperative learning, and based on a number of research evidence, is used to explore and tackle the most challenging tasks in superior education, viewing increased thinking skills, and healthy peer relationship the basis on which academic success is established (Millis, 2002).

Generally, teachers who adopt the traditional teaching methods in their teaching, such as lecturing, may have noticed that a continuous occurrence of the negative attitude held by, particularly unmotivated learners toward learning, in a learning setting which tend to be less encouraging. As a result, frequent absences, passiveness and low scores occur, and which are deemed the straightforward predictors of failure, and abandoning the university.

In cooperative learning environment, learners are encouraged to contribute to a shared goal achievement. They are viewed as committed to their group mates' effective performance as their learning due to a developing awareness

of the positive interdependence, which necessitates the participation of all group members.

4.4. Solving Problem via Cooperative Learning

Cooperative learning can resolve several types of problems, including low motivation, communication deficiencies, and misconceptions in different domains. However, many problems can take place during learning cooperatively.

Slavin (1995) reports a list of six main issues which may occur during cooperative learning, and suggest ways to solve them, they are as follow:

- 1.** Failure to get along
- 2.** Misbehavior
- 3.** Noise
- 4.** Absences
- 5.** Ineffective use of team practice time
- 6.** Too wide a range of performance level.

Failure to get along is about learners who are regarded unable to cope with cooperative learning, and vehemently favor being on their own. This problem can be dealt with, through reminding learners, that sitting unaided, most of the time, will not guarantee positive change in the behavior due to effective learning, and understanding, on the contrary, learners may face serious learning obstacles which may be kept unstated to others, who can provide help and support and save time particularly, when the task or activity is to be handed over in a restricted time (Slavin, 1995).

Also, it is worth saying that positive interdependence which will ensure the contribution of all members to goal achievement, can create a huge pool of references for one another, and that cooperatively interacting to explain, elaborate, organize and explore further knowledge frontiers which actually make a positive difference in learning outcome. Slavin (1995) argues that cooperative learning allows students to explore any idea, or concept from different perspectives.

Misbehaviors may also happen during cooperative problem solving. Mocking others and refusing to share findings are some instances of inappropriate behaviors which can take place in the classroom, and which can be tackled through constantly reminding learners of the intellectual outcomes which can be brought about due to cooperativeness ,and encouraging them to improve positive attitudes toward cooperative learning. Also, it is worth saying that well-behaved learners will receive recognition from the teacher (Slavin, 1995).

The subsequent issue in Slavin's list of problems which can occur during cooperative learning is the noise which is caused by the spontaneous and mutual exchange of opinions to arrive at a solution or a consensus about which method to solve a problem or which reference to rely on can produce an undesirable noise which comes from a beehive-like classroom, and which hinders effective listening to one another's points of view, and annoys other classes. In this case, the learners are asked to tone down their voices as much as they can during discussion, and avoid unnecessary disputes which consume time and distract attention (Slavin, 1995).

Furthermore, if the initial procedures have not worked out, Slavin (1995) suggests a backup plan for solving noise problem, namely, making the noise level a criteria for earning extra points.

The subsequent issue which is reported by Slavin (1995) is absenteeism. Absences, either justified or unjustified, both are frowned upon by the teachers who wish to adopt cooperative learning in their teaching (Slavin, 1995).

In the department of English language at the University of Constantine, a considerable efforts and procedures are made to decrease absenteeism during each teaching semester. Learners are disallowed of exceeding a specific number of absences; unless the absence is justified being under unexpected circumstances, and reasons, such as illness, death, accidence and travelling, otherwise, the learners would be subject to permanent exclusion from the class.

Slavin (1995:142) argues that “the solution to this problem is somehow easy”. He suggests one way to decrease absences is “to divide the team’s score by the number of students [who attend regularly]”. However, if the absences are repeatedly reoccurring, particularly if more than two students are constantly absent, Slavin (1995:142) states “poor attenders should be distributed evenly among teams”.

The following problem which may appear during cooperative learning is the ineffective use of team practice time. Slavin (1995) explains that during learning, learners are being concerned much more with problem identification and solution and goal achievement, rather than cooperation, for they are trying to employ reasoning skills to solve a problem, and sometimes unconsciously ignoring different collaborative skills such as cooperative exchange of information and arguments which may save time for solution finding not considering whether their teammates have actually understood what is being dealing with (Slavin ,1995).

To handle effectively the aforementioned issue, Slavin (1995:142) suggests the following procedures:

- Provide each team with only two worksheets.
- Make flashcards with questions on one side and their answers on the other side.
- Make sure that all group members drill and vocalize the question and its possible answers, and then ask them to put the correctly answered items in one pile, and the remaining ones in another one. Then, once again, the learners are required to try to solve the remaining items. Finally, a revision of the whole question and their answers is needed for learners can adjust their understanding and recapitulate the whole task (Slavin, 1995).

The last problem stated by Slavin (1995) is about different performance levels. This means that learners come from different cultural and social backgrounds have also dissimilar intellectual capacities which necessitate more efforts to support low achievers in their attempt to increase their learning performance.

4.5. Cognitive, Motivational and Social Explanation of the Positive Outcomes of Cooperative Learning

4.5.1. Cognitive Explanation

The integration of cooperative learning as a valuable teaching and learning method is given a substantial amount of attention and emphasis, in order to meet certain educational needs. For example, improving the quality of academic performance, independent thinking, and collaborative skills, are

considered to be the main requirement and aims of the 21st century education to fulfill a common goal, which can be enhanced via cooperative learning; taking into consideration different learning requirements, learners can be oriented to explore the possible outcomes, including educational and intellectual benefit, which can be brought by investing in cooperative learning, for all learners participate in problem solving tasks.

The importance of enhancing problem-solving skills has been proved to be an educational goal which is crucial for heightening the quality of the academic performance. Cooperative learning encourages learners' active contribution to solve challenging tasks. Hence, learners feel more confident to get involved in problem solving tasks, once they are instructed that their responsibility is not particularly centered on solving the given problem as such, yet on enhancing their problem solving and learning skills as well; an aim which can hopefully be reached via cooperative learning.

Thus, cooperative learning enhances intellectual abilities, such as memory, and problem solving. One explanation is that while engaging in cooperative problem solving, learners' thinking is stimulated in the presence of others trying to make sense of different points of view, employ problem solving skills and relate real life situation to the given question as well as, wondering whether teammates are actually are making a substantial progress(Ashman and Gillies,2003).

Moreover, learners are challenged to elaborate on and each other's points of view, and restate the problem and its possible solutions in their own words (Crawford et al, 2005).

In addition, performing information processing activities, including encoding, and rehearsal, prior knowledge and understanding are activated in the presence of other teammates, as long as the attention is maintained on solving the problem. Thereby, deeper understanding and commitment to learning are supported (O'Donnell et al, 2011).

4.5. 2.Motivational Explanation

Motivational reasons highlight the requirement for employing cooperative learning methods. The positive outcome of cooperative learning; cooperate to learn and learn to cooperate, shows that the constant assistance and encouragement learners display during cooperative problem solving tasks, reveal an increased effort to achieve the desired goal state.

Also a growing sense of personal worth and competence stems from a continuously attempting to evaluate data and elaborating on different perspectives, not to disregard the pleasure people feel when they provide support to other (Killen, 2006).

4.5.3. Social Explanation

Cooperative learning prepares learners to learn and use collaborative and social skills. Mutually providing support, showing admiration for each other, participation and striving for elaborate communication are some skills learners develop during cooperative problem solving tasks.

4.6. Effective Team Organization

The most significant aspect which is noticed in cooperative team is its commitment of every student to achieve a common goal. In Cooperative learning, all group members are assigned a task to complete; gathering data,

other analyzing, evaluation and checking progress, learners divide the task in subtasks to facilitate learning and economize the time for each member is responsible for successful fulfillment of the task .

Three main guidelines for optimizing team cohesion and therefore eliminating dysfunctional aspects of groups, are described by Millis (2002).they are as follows:

- Group size should remain small. In order to achieve cohesiveness in groups, it is necessary to arrange students in each group, for every group should contain three to four members as an optimal number. Group members can bring diversity and meaningful collaborative exchange to group discussion. This group formation helps teammates to brainstorm different alternatives, make decisions and get actively involved in problem solving task.
- Teacher-selected heterogeneous groups usually function better than randomly and student-selected groups, for the latter, learners have a natural tendency to opt for their friends. A hallmark of heterogeneous groups is allowing students to engage in challenging tasks with members from different backgrounds and thinking styles.

Moreover, it is reported that cooperative learning teams should be heterogeneous (Stein and Hurd, 2000). In other words, cooperative learning allows a variety of abilities meet together to accomplish a task.

Moreover, heterogeneous grouping gears toward preparing learners to get acquainted with individual differences. Take for instance, introversion and extroversion which are two dimensions of personality; introvert tends to think

for herself, and deeply concerned with her inner well being, whereas extrovert tend to learn better by sharing ,compassionate and much more concerned about communicating her feeling and thoughts to others.

Learners who are aware of the individual differences are better at arriving at consensus and arrangement when conflicts or disagreements arise between group mates. Thereby, learners are to learn social skills which enable them to deal constructively with people who belong to different social and intellectual backgrounds. Take for instance; cooperative learning long-term objective is to render learners Capable of giving equal opportunities to other to contribute and to communicate their true thinking. This positive attitude appears to be an outstanding outcome which stems from cooperative learning methods which are used as a teaching and learning method to help learner learn and cooperate to learn.

Additionally, learners are to be encouraged to learn together as cooperative groups, mainly to solve the problems, make decisions, and set a common goal to achieve.

Moreover, social and communicative skills are indispensable for effective cooperative learning. Skills which help in establishing positive working relationships are also required to assist learners develop deeper understanding of group commitment to a given task, and that one's success depends unavoidably on the success of the other group mates. Also a sense of belongingness to a group increases when learners are allowed to spend enough time together reading and discussing findings and opinions, as well as, learners learning to signal each other's knowledge, skills and pitfalls too and to learn to

use effectively different learning strategies due to constant support and insights provided by group mates (Millis, 2002).

4.7. Interpersonal and Communicative Skills Training

Effective communication entails the ability to use communication and interpersonal skills as to convey intended messages, and facilitate dynamic social interaction. These skills are prerequisites for successful cooperative learning and motivation.

As far as interpersonal skills and motivation are concerned, consider for an illustration, that learners' motivation is increased when they are asked to listen attentively to others dialogue and respond accordingly. This means that teachers' direct instruction plays a crucial role for enhancing both motivation and attention level to learn and to act upon what they know to understand what is being discussed.

Interpersonal skills, in a global sense are defined as the skills which are employed while interacting with other participants, including skills to listen actively, responding to a conversation, or explaining one's point of view, as comprehensively and accurately as possible (Hargie, 2011).

Furthermore, insufficient recognition of the requirement for interpersonal skills training will have detrimental influence on the value of group interaction. This view is emphasized by Johnson and Johnson (2009) to improve cooperative learning and classroom interaction.

One method of how to train learners the necessary interpersonal skills to deal with learning difficulties is via modeling; the teacher explains a certain interpersonal skill, presents proper examples and most importantly pushes the learners to practice the skills with her or his group mates, being put to the test to find out whether they actually mastered the correct employment of the skill.

Johnson and Johnson (2009) explain that previous to coordinating team efforts to achieve a common goal, learners must be able to:

- ✓ Get to know and trust each other
- ✓ Communicate accurately and unambiguously
- ✓ Accept and support each other
- ✓ Resolve conflicts constructively

In addition, regular feedbacks are to be provided to improve performance and increase motivation, for learners should be informed how often they employ different interpersonal and communication skills, and how well they have performed them as well while interacting with each other. Feedbacks are important remarks presented by the teachers of the current interactive performance and learning as to encourage learners to modify their future performance and explore more skills to orchestrate a dynamic learning environment.

The following interpersonal skills are suggested by Gillies and Ashman (2003):

- Actively listening to each other during group discussion;
- Considering the other person's perspective on issues;
- Stating ideas freely without fear of being mistaken or of derogatory comments;

- Being responsible for one's own behaviors;
- Critiquing the ideas presented.

Moreover, Gillies and Ashman (2003) described a set of interpersonal skill which can be used in small groups to facilitate an active participation in cooperative problem solving. These skills are valuable for they help learners to establish more positive interpersonal relationships as to overcome possible group conflicts, or even avoid them, when learners are made aware of the significance of the aforesaid skills to increase learning toward all-win class.

- Taking turns to present ideas and share sources;
- Sharing tasks equitably among group members;
- Resolving differences of opinions and conflicts;
- Ensuring decisions that affect the groups are decided democratically (Gillies and Ashman, 2003).

The above skills are assumed to be of great importance, for they are highly flexible and applicable to non-classroom conflicts too, such as those disagreements which may occur during outdoor investigation or in a roundtable discussion.

4.8. Meaningful Communication via Language

By communication, team members show greater assistance and knowledge needed to complete challenging tasks, while providing more input to each other.

Language is the tool through which we convey our thoughts, feelings and more importantly, we survive because of it.

A basic skill of communication via language is known as explanation. Explanation is described a mental act which is expressed via words (behavior), to reveal the value of a topic (Hargie, 2006).

Explaining is perceived as an attempt to provide an understanding of an issue, a concept or a problem to make it clearer to others as to facilitate acting and solution finding. This may appear as showing necessary details of a particular task, or bringing reasons behind opting for a choice etc... (Hargie, 2006).

In addition, exploring further the meaning of explanation, which evolves out a comprehensive understanding of information due to a concentrated cognitive attempt to analyze and evaluate given data, and which is empowered through putting them into practice. Also, Explanation entails exploring possible relationship between what is being communicated and the prior knowledge. Hence, it is worth emphasizing that the learners should be told to make constant effort to clarify, and explicate their findings and opinions via adding essential details and data to help group members better understand what is communicated (Hargie, 2006).

Moreover, to fulfill better comprehension and aid others to understand an idea, it is essentially important to the explainees to recognize that something is not understood, or unclear to her or his peers ,hence her/his working memory is being activated to recall the stored schemata in long term memory in search for additional information(Hargie,2006).

4.8.1. Three Main Types of Explanation

- 1.** Interpretive explanation which is concerned with interpreting the central meaning of a sentence or a text or ideas. Interpretive explanation explores “what”.
- 2.** Descriptive explanation which focuses on figuring out “how” the whole affair works. For instance explaining how to employ skimming and scanning reading procedures.
- 3.** Reason-giving explanation which defined as the explainees’ attempt to present justification which explain “why” doing something; it constitutes persuasive answers for “why” question. The reason can be provided as evidence, analogy and rationalization or even a combination of reasons to corroborate one’s explanation (Hargie, 2006; Browne and M.Keely, 2007).

Furthermore, it worth saying that a comprehensive explanation should contain all the three types of the aforesaid types of explanation. Consider for instance, a learner tries to explain how, what and why formulating a hypothesis is crucial for carrying out a scientific research. Hence, the learners have to figure out and interpret the relationship between the given variables which form a research hypothesis; that is what, why and how they correlate in certain context (Example: reading comprehension, questioning and cooperative learning relationship) (Hargie, 2006).

Effective communication among team members will provide learners with a valuable opportunity to obtain confidence in their potential to learn and express their true thoughts and feeling with other teammates. The ability to present elaborate explanations, and reasons for thinking or acting in particular way, and respond constructively to teammates suggestions during group

discussion increases attention level while applying previously acquired knowledge, principles and problem solving skills. Thus, learners are active agents who are capable of using their cognitive functions such as reasoning, memory and decision making while interacting with others (Wood, 2011).

4.9. Dynamic Cooperative Learning Environment

The aim behind designing a cooperative learning environment is to help learners to develop a positive attitude toward a mutual learning and social interaction to learn and to accomplish challenging tasks.

It is contended that cooperative learning is of a paramount advantage for it encourages hands-on experience, and search for learning tools which help them to learn effectively, hence, cooperative learning is appropriate for triggering learners throughout the process of solution finding to share their opinions and skillfully elicit comprehension and indication as carried by a research finding and methodology, wherein interactive learning makes the whole learning affair worthwhile and motivating.

Moreover, in cooperative learning environment, learners can gain insight about the exact reason behind being involved into cooperative problem solving tasks. That is learners recognize that they devote additional yet fruitful effort to do a job and get rewarded, for all learners are placed in an all-win atmosphere; cooperative learning environment meets learners' cognitive, social and affective needs, in other words, problem solving skills and motivation can be fostered via cooperative learning (environment).

However, the essence of designing an effective learning environment relies on the teacher's structured implementation of cooperative problem solving tasks. This includes presenting the assignment as clearly as possible, stating the objective of the assignment as to maintain higher attention on it, emphasizing group discussion and displaying communicative and interpersonal skills, and finally, evaluating outcomes and the quality of thinking skills displayed in group products.

Nevertheless, learners overall performance is not evaluated in comparison with each other, yet it is assessed regarding their achievement level compared with their previous performance as to increase self confidence which stems from a supporting, not a competitive learning environment.

4.10. Fostering Problem-Solving skills via Group Investigation

Group investigation (GI) is remarkable cooperative learning method. In group investigation, learners are placed in groups to cooperatively investigate specific research topics (Slavin, 1995).

Group investigation was originally established by John Dewey (1970), whose main thoughts were centered around "education for higher-order thinking", group investigation is highly recommended for enhancing learners ability to deal with "complex problems of life in democracy"(Slavin, 1995:112).

Nevertheless, group investigation is considered as the most difficult cooperative learning method to implement, which requires learners to begin their investigation by choosing a research topic of their interest that is a field of

research which stimulates their intellect and continue to trigger their motivation to progress. Next, the learners are to develop a planning and finally end with cooperatively implementing the investigation (Killen, 2006).

Outstandingly, group investigation can mainly be designed to provide learners with a variety of learning tasks and tools which improve their thinking skills, and enhance their motivation. Take for instance, the case whereabout one investigates the possible effects of mental aptitudes on first language acquisition; group members are to identify critical research questions such as do, how often do mental aptitudes and vocabulary acquisition correlate in a particular learning context. Hence, learners are to investigate mental aptitudes, definition, perspectives and recent findings, and first language acquisition mechanisms. This in-depth research aids learners to understand the relationship which exists between cognitive abilities such as intelligence and first language acquisition.

Therefore, learners may get confused with a tremendous amount of information which is needed to cover the research, thus they may be inclined to work collaboratively with others, to eventually reach a reasonable conclusion.

In group investigation, learners are directed to make sense of what is being learned, namely, understanding information gathered will pay important role for solving a problem, and the necessary tools required throughout problem solving process, for learners can be expected to be able to employ knowledge, skills and learning strategies if they do not understand them accurately.

Additionally, going deep into understanding knowledge, requires meta-cognitive skills which are essential for managing learning and progress on the task, this includes skills such as planning, evaluation and goal setting.

Hands-on learning is equally significant to increase understanding and boost motivation. This is most likely to be undertaken by group investigation method. Hands-on learning triggers learners to investigate new dimensions and develop problem-solving skills.

Active engagement in a task is improved when the task is plainly presented, references are shared, and elaboration is continuously stretched through cooperative exchange of opinions, and findings, as well as, providing an encouraging learning environment which maintains better motivation and recovers attention; motivation is increased via conveying empathy and support particularly to less achievers.

Moreover, the advantage of working cooperatively with groups is to uncover an area of research following scientific research methods. For example, the learners investigate a research topic, they identify which conventional research methods are available, which aspects are important to investigate, what is known, what is unknown, which relevant information are to be compiled into a report to present to the whole class and so forth.

Notice that the topic which is intended to be investigated should be narrowed down for a topic has various dimensions, for instance, if learners are to investigate the effect of learning environment on learning, they have to limit

their research to investigate a particular aspect of learning environment and language learning.

Group investigation necessitate active engagement into learning, hence, learners are not mere recipients of knowledge, but knowledge-seekers and analyzers of information, as to achieve long lasting memorization and understanding of the topic, and even be able to generate new knowledge due to the mental effort devoted to solve problems.

4.10.1. Teachers' Roles and Decisions

The hallmarks which are tightly associated with group investigation are interaction, investigation, interpretation and intrinsic motivation (O'Donnell, 2011).

Accordingly, the teachers are to provide sufficiently motivating reasons for investigating a research topic, and make sure that learners are willing to cooperate with each other to identify the research problems, tools, and learning strategies which are needed to interpret knowledge, evaluate the progress, and interact with the surroundings as effectively as possible.

Furthermore, it is worth paying attention to which topic of investigation is to be searched for. The research topic should be selected on the basis of its relevance to learners' learning and which yields to their main interest and educational expectations (O'Donnell, 2011).

Also, learners are to foster their problem solving skills via search, share findings and group discussion throughout the problem solving mission. Thus, self regulation abilities including the ability to interpret information, and organize them and most importantly applying previously mastered skills, to deal with various difficult learning situations. Hence, concerning learners' effective learning, pre training program of cognitive learning strategies, as well as social learning strategies is thought out and managed.

The role played by teachers during the conduction of group investigation is on no account dismissed; the teacher is a resource provider, who gives learners adequate and reliable references which direct their investigation, and possibly would answer the research questions.

Sufficient time is allowed for learners to exchange and discuss their findings, and reflect on the significance of the topic being investigated and its relevance to real life situations. Consequently, learners act like investigators who gather data, examine their relevance and make sure to identify whether the information are inductively probable, and deductively valid, as obviously as possible, and finally, communicate their final report .Nonetheless, the work never ends, for learners continue to receive feedbacks on their work to develop their future performance.

As far as language learning is concerned, speaking skills entails an ability to use a language correctly, that is grammatically accurate and conveying the intended message while speaking. Accordingly for learners to promote an optimally fruitful group discussion, where turn taking is encouraged and

cooperation is emphasized, they are instructed to use the target language as much as they can while attempting to figure the task out.

Helping learners to understand the view that language learning is not simply filling one's mind with enough vocabulary, and grammar rules, but it requires one's manipulation of his or her surroundings which provide contexts and opportunities to interact with other people as to ameliorate language use and enhance thinking skills. Group investigation yields to fulfilling the aforementioned learning aims.

It is worth paying attention to the importance of clarifying the concept of group investigation to learners, that is previous to asking learners to be a part of an investigative topic, it is indispensable to introduce them to tips of conducting an investigative topic; being the first phase of group investigation.

Therefore, our learners should be prepared to undertake an investigation by instructing them directly different research tips as to carry out an investigation. Also, it recommended holding a roundtable conversation with the whole class, or with small groups, for illustrating the process, and correcting, or building on learners' preconception about group investigative project. It is possible to feed off prior understanding, and refine misinterpretations concerning cooperative learning to foster problem solving skills; some learners may continue to attach to the idea of spending less effort and letting others carry out almost all the task.

Now we move to discuss learners' main roles to conduct group investigation:

4.10.2. Learners' Roles and Responsibilities

Group investigation suggests that all the participants play a particular role and have responsibilities for completing a group project. Learners work in small groups to solve a problem, gather data, share results, make decisions, and provide support. Also, they help each other maintain attention on the assignment; demonstrating a need to solve the problem engages every learner to communicate their knowledge and perception of diverse concepts and skills, therefore each learner is given the chance to "assimilate" as to make sense of the given information, and "accommodate" existing schemes, to respond to a new learning situation (Woolfolk, 2005).

Consider for instance, that a learner may have achieved a comprehensive understanding of particular concept or strategies due to previous learning experience; she may be able to display analogous cases as to exemplify the appropriate application to her group mates, therefore different skills including thinking and speaking skills are triggered during group conversation, not to overlook the positive effect of group investigation as a method to boost motivation and sense of worthiness.

A wide range of guidelines listed below, were organized by Slavin (1995) and are accessible for learners to engage in group investigation:

1. Identifying the topic and organizing pupils into groups

- ✓ Students scan sources, propose topics and categorize suggestions.
- ✓ Students join the group studying the topic of their choice.

- ✓ Group composition is based on interest and heterogeneous.

2. Planning the learning task

- ✓ Students plan together
 - What do we study?
 - How do we study?
 - Who does what?
 - For what purpose or goal do we investigate this topic?

3. Carrying out the investigation

- ✓ Students gather information, analyze the data and reach conclusion.
- ✓ Each group member contributes to the group effort.
- ✓ Students exchange, discuss, clarify, and synthesize ideas.

4. Preparing a final report

- ✓ Group members determine the essential message of their project.
- ✓ Group members plan what they will report, and how they will make their presentation.
- ✓ Group representatives form a steering committee to coordinate plans for the presentation.

5. Presenting the final report

- ✓ The presentation is made to the entire class in a variety of forms.
- ✓ Part of the presentation should actively involve the audience.
- ✓ The audience evaluates the clarity and appeal of the presentation according to criteria determined in advance by the whole class.

6. Evaluation

- ✓ Students share feedback about the topic, about the work they did, and about their effective experience.

- ✓ Teachers and students collaborate in evaluating students learning.
- ✓ Assessment of learning should evaluate higher-level thinking

Source: Slavin (1995:113&114)

The above guidelines are claimed to be highly applicable in various learning environments and classroom conditions, in other words, both learners and teachers are able to adopt the abovementioned list of tips to handle group investigation in almost any research topic (Slavin,1995).

Moreover, learners being motivated to investigate a research topic are more likely to improve thinking skills including problem solving skills due to constant practice of research tools to carry out group project. For example, measurement procedures, which are essential for hypothesis testing.

Throughout group investigation, learners seek to know more about the research topic, which helps them to expand their intellectual potentials, whenever their minds are stretched to understand a particular idea. Thus, learners try to review different fields of research which are relevant to their research topic, as an attempt answer research questions as to confirm (or disconfirm) the research hypothesis.

Nevertheless, given a set of alternatives to consider, in order to complete an investigative project, some learners might be intolerant with new ideas which seem unusual or unconventional to them, and become apprehensive of stating their thoughts. Hence, to help learners interact effectively with each other, we need to distinguish between two main personality dimensions, namely extroversion and introversion. Extroverts are social communicators who are

able to convey their opinions and better at allowing others to embrace new thoughts no matter how irrelevant they may appear. This learning attitude may seem to be trivial for extroverts accept to embrace every single thought without in-depth searching for its adequacy. Yet, in reality, extroverts do not risk their individuality when faced with a tremendous amount of opinions, for they are open-minded to differences and accept their own thinking style as well. Whereas, introverts are less inclined to speak about their own opinions(at least when they are not ready to do so), they prefer to think for themselves less motivated to engage in group discussion, and rather prefer to spend more time alone to reflect on thought-provoking ideas.

In fact, a learner may be found to possess both personality dimensions, that is to say she may be inclined to work on her own at times, and collaborate with her teammates at other times.

Furthermore, it is crucial to ensure the participation of all group members in group project, through demonstrating the overall contribution of each learner (Schunk, 2009).

4.10.3. Shared Cognition in Group Investigation

Being a member in a problem-solving team, learners benefit from investigating a research topic, for they are more likely to seek various learning experiences and tools which help them accumulate and use information from a variety of references, therefore, pertaining to each subtopic of the investigation. Problem solving skills are fostered, that is formulating hypotheses from a set of observations, then search to find out how variables correlate in a context, reviewing plenty of relevant sources to get an

understanding of the research topic, then presenting the final report to the whole class and receiving feedback, would contribute to enhancing problem solving skills.

Learners' attention is drawn to sharing and communicates their opinions and discoveries with their group mates, for they should be informed about everything which is concerned with their group investigation. Thus, further insights and explanations are provided during the mutual exchange of opinions and findings, not to overlook the role played by peers to boost motivation and enthusiasm.

Communication in groups is described as a unit which makes data available to group members including the language they use to convey knowledge.

In Trenholm's words (2008:180): "Groups provide more input than do individuals".

Also, Trenholm (2008: 180) elucidates the phenomenon for the effectiveness of groups for shared cognition as follows:

"Something extraordinary happens to people when they work with others: their output surpasses what it would have been if they had worked alone. People working in groups can pool information, share perspectives and use one another's ideas as springboard. They can also motivate and energize one another to keep searching for a solution" (Trenholm, 2008: 180).

Let's consider the following example:

If the lands are overused, and jungles are deforested, then landslide may occur.

The aforesaid supposition, presents a hypothesis which is formulated as a result of several observations in the field. Learners needs to differentiate between cause and effect relation, namely, the concept of causality which refers to what may happen(effect) due to what (cause) that is to say land overuse and landslides occurrence relation, and deforestation and landslides relation, and finally land overuse, deforestation and landslide occurrence relation.

Accordingly, problem solving team makes sure to investigate the effect of over cultivation and deforestation on the land, to find out whether landslides occur due to the aforesaid causes. The learners share their conceptual understanding with their teacher and teammates which will create dynamic classroom interaction.

Enhancing problem-solving skills is much more likely to take place through repeated acts of searching, evaluating, and communicating discoveries to teammates, and correcting misconception and receiving feedbacks which are allowed via group investigation.

Moreover, it is worth emphasizing that working cooperatively with others requires learners to understand and perform of the following practices:

- Learn to listen, as well as to speak
- Respect the views of others and understand that criticism of views of others is not a personal slight
- Prevent anyone from dominating the discussion or activity
- Ensure that everyone is given space to give their views

Source:McMillan and Weyers (2006:115)

4.10.4. Evaluation of High-level Thinking Skills

Learners' ability to utilize problem solving skills, is fostered particularly when their awareness is raised about their significance, then learners are actively engaged into doing problem solving tasks, for they are provided with hands-on experiences, problem to solve and research tools to find out a reasonable conclusion .

A continuous evaluation of learners' performance during investigating a research topic effects learners' thinking skills; receiving feedbacks on the investigation project, helps learners to refrain from using irrelevant tricks as to ameliorate their thinking skills, and their ability to manipulate their environment in way which enhances understanding and engage them in active conversation with their teammates and teachers, hence effect their learning positively.

In Slavin's words (1995:117) learners' thinking skills should be evaluated via "a cumulative view of individual work during the entire investigation project" (Slavin,1995:117).

Another approach to evaluate learners' thinking skills and learning is through continuously conversing with learners while investigating a research

topic, asking them thought-provoking question, and observing their responses which indicate their understanding, thinking and learning achievements. Thus, how well learners use resources, analyze and synthesize information, and manipulate their environment to their learning benefits reveals how well learners have enhanced their thinking skills (Slavin, 1995).

The subsequent approach which necessitates that both the teacher and the learners collaborate to formulate an exam, which includes questions to stimulate learners thinking, for the entire class has been investigating the topic of interest which covers different issues the learners need to be familiar with in order to be able to answer the questions. Also, it is worth emphasizing that analyzing and synthesizing the information attained during group investigation, discussing suggested questions and unveiling possible solutions. Hence cognitive processes such as memory, reasoning and problem solving are enhanced due to frequent employment.

Another approach is worth paying attention to, and which can be used to evaluate all individuals' contribution to group investigation. This includes writing down their share of the investigation what is done so far, as to display how the participation of every learner contributes to goal achievement, and how the success of one's work relies on the success of another's.

Slavin (1995) points out that learners being a consequence, develop their own critical perspectives of problem solving skills, and progress, while carrying out a research topic or investigative project (Slavin, 1995).

4.10.5. Project-Based Learning: Going Beyond Group Investigation

Project-based learning is a dynamic learning approach through which learners engage into learning through exploring real world challenges which widen their understanding and foster their problem solving skills through the process of exploration; Project based learning is learning through projects.

Project based learning is claimed to promote learners thinking skills and creativity, for they are allowed to select a topic, or a problem which raises their curiosity ,motivate them to investigate it in- depth ,and encourages them experiment how different variables effect each other in a context.

A key feature which characterizes project-based learning method is its focus on answering driving questions, which cause disequilibrium in learners thought and captivate their motivation, a situation that pushes them seek sufficient data and cognitive tools which extend their perception, and promote their ability to act on information, and cooperate with others(Anderman and Anderman,2009).

Project-based learning allows learners to learn to do the following skill:

- ✓ break complex task into subtasks
- ✓ plan and manage time
- ✓ refine understanding
- ✓ develop skills specific to collaborative efforts

Now we move to uncover the aforesaid skills, which are developed through project-based learning with more details:

1. Divide complex problem into subtasks skill demonstrates that learners acquire the ability to break a problem which may sound challenging and requires focused effort to get a solution into small elements, can be rendered easier to understand and more approachable. This kind of decomposition, aids learners to make every element out separately, then try to make sense of how they are related then find out possible solutions, that is “divide and conquer” to approximate answers, as to bridge the distance between the current situation (the problem), and the desired state (the solution).
2. Plan and manage time help learners to stick to their main concern that is problem solution. Project planning maintains attention on seeking out answers to the questions which have driven learners to engage into looking for insights through project-based learning approach. The role of the teacher is indispensable, for she or he assists learners to plan for the project provides them with some reliable references, and makes obvious to learners that the project has to be completed within timeframe, typically with clearly defined stages. Hence, planning and time management helps learners to set their own priorities, stay organized, and motivated.

In addition, being aware of the goal state, learners are to manage their time to reduce increased anxiety which may affect learners in an undesirable way. The work is more likely to be completed via a process called prioritization; that is determining which subtask is given more value over another subtask with regard to its relevance, the time allocated and the research tools available.

3. Refine understanding; a continues effort made to get answers for the research questions, results in attaining a relatively large amount of

information from a variety of references which will ultimately influence one's perception, understanding, and behavior she/he developed in the past; in short, learning takes place. Reflective thinking plays a crucial role during this phase, for it takes learners beyond the preconceived ideas, to evaluate their understanding and eliciting possible implications and insights from the project.

4. Develop skills specific to collaboration. One way to develop collaborative skills, it is important for learners to remain focused on the project while working cooperatively. Thus, learners are directed to try various learning strategies such as turn taking, anxiety reduction, and providing explanation. Project-based learning aids learners to minimize the inclination to work alone, and gets them more involved into life issues, through cooperative problem solving, in groups where cooperation is highlighted.

Skillful communication entails the ability to use the language effectively to transmit different forms of information which are relevant to the topic of investigation in way which is understandable and which can be approached by the participants. Effective communication also means improved speech quality, as well as, the ability to motivate others to identify their incentives and set goals, and increasing mindfulness to the feeling and needs others may hold toward a subject.

4.11. Conclusion

In this chapter, we tried to shed some light on the desired gains which are related with cooperative learning teaching and learning method. Learning to cooperate and cooperate to learn enhances learners' intellectual, social and

affective skills, and renders them more active learners to meet their learning needs and others' as well, not mere recipients of information who passively fill their minds endlessly with pieces of knowledge, they actually do not make sense.

Cooperating to accomplish problem-solving tasks, learners appear to exert their effort the best they can, particularly when genuine interaction is given emphasis during task completion.

In cooperative problem-solving learners learn to participate, contribute, communicate, and solve problems, and show empathy during group investigation.

A shared goal is much likely to be reached owing to the assembled abilities to handle problem solving tasks, for every single contribution is viewed a stepping stone to goal achievement. Learners are constantly reminded of focusing their cognition on fulfilling the task, and avoid irrelevant distractions which delay the accomplishment of the desired situation (solution). For this purpose, it is worth saying that interpersonal skills and cognitive strategies training is indispensable for students effective learning.

Group investigation is highlighted, being a form of cooperative learning which enhances learners' higher order thinking including problem solving skills, for it requires learners to look for opportunities where they can experience a variety of research tools and points of view.

Group investigation basic components are known as the four Is, namely interaction, investigation, interpretation, and intrinsic motivation each of which encourages high level achievement. Learners learn that there is “no royal road” to knowledge, for they struggle hard in order to explore new and relevant ideas to their research topic, help each other to overcome learning difficulties, and synthesize information, not to overlook the satisfaction and trust which stem from a genuine cooperation to fulfill problem solving task, and training their mind to act upon knowledge instead of blindly absorbing it, are long lasting acquired skills which are aroused in students.

Chapter 5

Research Design

5.1. Rationale

This chapter is devoted to the experimental design. We seek to present and analyze data we gathered through classroom observation and testing. The test is administered to see the effect of exposing learners to a training program on their problem solving skills and motivation. The training program consists of a combination of certain activities, which are organized for helping learners to improve their ability to learn (for reasoning is learning, which includes drawing conclusions that are based on a set of premises), as well as triggering cognitive faculties believed to be responsible for memorization, problem solving, and decision making, all within a cooperative learning environment.

For our research we have asked four (4) key questions:

- First, can deductive and inductive reasoning skills be promoted through an educational program of three months duration?
- Second, is it possible to stimulate learners both intrinsic and extrinsic motivation via cooperative learning and teaching approach?
- Third, is it possible to assume that enhancing learners' capacity to think deductively and inductively, i.e. being trained to practice problem solving skills, may 'guarantee' to a great measure a boosted level of motivation to apply problem solving skills when a situation calls for?(Knowledge boosts confidence).

-Fourth, can learners be trained to adopt group investigation as a learning method to uncover and understand the world?

Based on the previous questions, the hypothesis can be stated as follows: learners would better promote their problem-solving skills and motivation if they adopt cooperative learning as a learning method.

In other words, getting learners involved into cooperative problem-solving tasks increases their academic achievement.

The ability to do group investigation breeds better cognitive performance, partly owing to an interaction with learning materials, such as E.book, articles, videos and websites which includes relevant geological ideas, and research tools which guarantee hands-on learning mainly prepared to “engage learners in problem solving to make a discovery”(Anderman and Anderman,2009:265), as well as, with the teachers’ assistance pushing them forward to construct their own understanding of the material, not to overlook the role played by communication, verbal and physical; because learners sometimes fail to find appropriate words, they use gestures while conveying findings, skills which hopefully pave the way for project-based learning.

So, through this research experience we aim at showing that our learners would hopefully be able to abandon the reliance on ready-made information provided by the teacher, which led to the occurrence of passive recipients of information. The latter is a phenomenon which is fed partly by a classic learning environment, which necessitates learners to stand still listening to lectures, yet rarely we are , as teachers acquainted with what is going on inside their minds.

Thus, group investigation aids learners to develop both: 1-a deeper consideration of knowledge outside in the classroom and outdoor as an indispensable tool to bring about a continuous progress to their learning and 2-effective communication a process which requires great effort to realize.

The following is a presentation and analysis of a testing which shows the effect of the educational program on learners' problem solving and motivation. Educational program is established to raise learners' awareness of the importance of problem solving skills for their learning, and most importantly, to get learners actively involved in activities which are mainly chosen for this purpose.

Cooperative learning which stands for the independent variable (IV) is hypothesized to achieve significantly positive results to the enhancement of learners' ability to understand and apply problem solving skills. Deductive and inductive methods of thinking presented as dependent variables (DV), which are integrated in our research hypothesis, are hypothesized to be enhanced via learning to cooperate (and cooperating to learn) for we suggest that in this way learners acquire a combination of necessary cooperative learning skills, such as goal setting, research tools identification, adopting supportive attitudes towards classmates, in order to achieve a common goal.

Hence, for effective cooperative learning, team members are organized and assigned roles , research tools are identified based on the common goal, the plan and plan implementation, where all learners' efforts are brought into play to reach the goal, then last, yet not least, the process is concluded via essential procedure in cooperative problem solving, called assessment; the product is evaluated in terms of high thinking (Slavin,1995),and the ability to apply

problem-solving skills which can fundamentally be fostered through a dynamic learning (i.e. cooperative learning).

The exploration of the topic being investigated cooperatively, necessitates the skills to induce conclusions from a set of data and evaluate them in terms of their deductive validation, learning is then displayed via a change in the behavior of the learners (i.e. learners' attitudes toward the topic investigated, group investigation, and the end results).

In addition, a change in behavior can be displayed in the following: learners develop an awareness of the research tools used to investigate a research topic, and the importance of communicating to others their finding (which was noticed after a period of awareness building as to learn how to use conventional scientific methods e.g. hands-on experimentation, and emphasize the importance of sharing information and learning experiences with groupmates).

Also, learners are constantly encouraged to try to find out and devise their own methods whenever they are inspired to do so. Hence, without losing sight of the common goal, they learn acceptance of diversity and learn to avoid making random judgments while conducting a scientific research.

Cooperative learning as a second important independent variable in our research can integrate motivation when it comes to boost it (somehow like manipulating it) in such a way that it can affect positively learners' desire (either positively or negatively) to engage into cooperative problem-solving tasks. This is so, because learners may possess intrinsic, as well as extrinsic motivations which push them to perform a task.

5.2. Subjects' Population and Sampling

The population, which comprises of sixty six (66) subjects, represents the total number of learners preparing the master 1(M1) grade in the department of geology at the University of Mentouri in Constantine, and from which the sample of twenty (20) participants is randomly drawn.

In the department of science of earth, the number of students is much less, compared to the huge number of students in the department of foreign languages. This relatively small number of students ,in the department of geology is a great advantage for both students and teachers, in the sense that students can effectively participate in the course (through questioning, practice,etc.),and the teachers will find it easy to make sure that students are understanding, participating and having initiatives.

Regarding the present sample, learners are specializing in the environmental geology; a field of study which is concerned with different layers of the earth as well as the ecological phenomena which occur in the earth, including earthquake, volcanic eruption, landslip, and draught, and the effect they bring to the surface of the soil and human living conditions. Hence we took advantage from real world geological problems which consistently echo in the social media, as one may have observed, to encourage problem solving activity on relevant issue.

Our choice to work with this sample is justified by the high expectation we hold for post graduate students 'willingness to engage in problem-solving activities, that is activities which are relevant to their field of study and which pose before them a problem to solve, (such as climate shift and landslide, as

worldwide concerns) and their awareness of the value of cooperation for coordinating efforts and boosting motivation which can optimistically be fostered via the educational program.

Furthermore, we investigated with the aid of some teachers in the field of geology, the previous teaching methods our sample experienced, most answers ranged from the emphasis on integrating group work, and project-based learning into classes. Our ultimate aim is to draw the attention to the importance of cooperative learning as learning (and teaching approach too), for learners need to work on a final project to get their master degree.

However the data gathered about our subjects should not take us astray from perceiving the need for the educational program which is particularly organized to enhance both problem solving skills, motivation strategies and collaborative skills; some educators call them the 21st century skills or requirements, the main aim of the present research.

In our research, the sample has been taken randomly from the population, that is to say we adopted probability sampling, a method which is strongly emphasized by the scientific experimentation. The subjects of the study are between 22 and 27 years of age, the differences in terms of age, especially for this category (22-27) do not represent a serious problem, for we hold the constructivist view of education for adult learners which says that any learner can be taught any material, as long as the material is well structured. (Cooperative learning is included within this view).

However, it is worth mentioning that possible fluctuation in motivation level and the occurrence of learning difficulties (e.g. absent-mindedness, inability to join the groups, etc..) may constrain an optimal cognitive flow into the problem solving and cooperative activities, and which also would delay the regular

course of the training program. Learners' ability to commit to the tasks for a relatively long time and to maintain a focused attention on the goal can be attributed to the individual differences (e.g. interest in the tasks, cognitive aptitudes, study habits, etc..) which continue to interfere throughout the research.

Furthermore, other attributes such as gender, learning preferences and motivation which are thought to intervene into our treatment time (the period during which our sample is exposed to the training program). For example, during sampling process, we noticed that the number of females, which is 14, exceeds the number of males which is constituted by 6 boys.

However, the impact of gender on classroom performance is less important, for we emphasized the value which is carried by every attempt to orchestrate the learning task; so, we tried as much as we can to highlight the contributions of all the participants to the goal achievement , and learning in general terms, in spite of the differences among genders and learning preferences, also, that risk taking is not adhering to a gender over another, yet learners are taught to concentrate on the common goal to accomplish, and try to exert an effort to benefit from all sorts of learning materials, in order to meet it .

In an optimal learning condition, learning preferences are expected to create a melting pot where various ideas gather to diversify ways of increasing understanding that is, making each individual experience counts as far as learning is concerned. For this purpose, the learners are provided with opportunities to reflect on any signal idea or words which may further their learning, and are told to put their ideas together in journals in a way which is personally significant to them to allow remembering and revision later on, thereby our learners are kept alert to each other's suggestions.

Also, learners were informed that cooperative learning is of multifaceted advantages which, expectantly, continues to bring about constructive outcomes; intellectual, social and motivational advantages throughout their learning career in the next years and blossom elsewhere far from the educational terrain mainly in the future workplace and social interaction which are believed to be inevitable nowadays. Hence, cooperative learning is illustrated as being a long –term business where gains are obtained wherever cooperation is emphasized and permitted for ‘many hands make light works’, no matter what the environment is either for a learning goal or work goal.

As far as motivation is concerned, we notice that thought can be manipulated to influence learners’ behaviors. That is our positive expectation which is held for our learners to achieve success, brings a profound impact on their self-efficacy, and belief in their own capacities to achieve a desired goal, a procedure which is used throughout our treatment time, this also includes that our participants should not view themselves as mere recipients of information, but as active agents who purposefully act on knowledge to elicit from it the best they can.

To ensure a better commitment to learning, learners are encouraged to try to act like coordinators of endeavors for every single try to find out a solution, understand an issue or explain an idea to someone else, play games such as ‘pick up a card and do what is written in it ’ game, actually led to increased motivation to learn . Thus we expect to great extent, that training learners to behold the value behind discovering knowledge for themselves, then stretch their understanding from different perspectives on the basis of cooperative learning environment, leads to increased academic performance and

motivation; In brief, learners having an inner reason to learn which is fostered via outer influences .

Hence, since our learners are postgraduate candidates, we believe that they seek a collection of learning experiences they have developed a combination of both intrinsic and extrinsic motivations for choosing to carry out their learning career.

Also, learning preferences can be considered a major issue that we encountered throughout our experiment, although we mentioned previously their benefit for our learners to enjoy diversity of ideas. In spite of the earlier exposition to group work during their preparation for the license degree, some learners show more resistance to cooperative learning and argue that they are more productive when the task requires individual effort. Nonetheless, our responsibility is to emphasize the benefit associated with cooperative learning, one way, is to display how learning turns out to be thought-provoking and enjoyable when it is taken cooperatively.

5.3. Subjects and Training Program Situation

Subjects (learners) are introduced to problem solving skills, motivation strategies and cooperative learning. The principles which steer our training program are those which set a starting point for our research, they are as follows:

- First, can problem solving skills be enhanced through cooperative learning?
- Second, can motivation be influenced by cooperative learning?
- Third, can learners be trained to adapt cooperative learning as a learning basis for their thinking enhancement?

- Fourth, how well, we can hope for the interaction of all the aforesaid variables as a network, can be said to cooperate to improve learning and performance?

Accordingly, we would be on the territory to notice the effect brought by introducing cooperative learning into developing subjects' performance and motivation, and see how getting them involved into improving their thinking skills (deductive and inductive reasoning) and standing by their groupmates to learn, for we think that one of the most excellent methods of learning something is showing others how ,and what is it, leads to incomparable positive outcome with regard to the traditional instruction, which is based on expounding knowledge to learners and lecturing.

5.4. The Design of the Training Program; Problem Solving Skills and Cooperative Learning

5.4.1. Pre Training Program Requirements

First of all, according to the pr assessment of learners' ability to handle a learning task, we noticed a virtual lack of English vocabulary and the correct use of the language as well. This is true, because our participants received their Environmental and Geology studies in Arabic and French languages throughout their college learning experience. However, this fact does not mean that our learners suffer a sever lack of understanding of the target language, for there are several similarities between French and English languages, including the meaning and use of the terms used, for example : "Résolution de problems" in French and "problem solving "in English language, also, "Programme de formation" in French and "training program" in English .Hence, to minimize the

influence of this problem, we tried to use a collection of teaching techniques, such as the first twenty minutes devoted for talking about topics of the learners' own interest, for we specify a number of two to three learners during each time to express any thought or feeling which comes up their mind about things they truly interest them with an emphasis on using English language. Thus our learners benefit from immediate feedback which help them recognize the appropriate use of the target language, all together with five vocabulary learning; spelling, pronunciation and meaning, for learners to learn necessary vocabulary they will, almost certainly, need to know and use during training program.

As can be noted by the reader of this research, the task is being twofold, for we attempt to teach our learners the appropriate use of the target language, which is English language, viewing it as a problem to solve, and problem solving skills through cooperative learning as being a part of our main commitment to this research.

Prior to engaging into the educational program; problem solving skills and cooperative learning, learners are asked to gather, read and understand the facts which are presented in various scientific texts that contain information about a geological phenomenon known as the landslide, or land slip, climate shift, and earth layers one justification for this requirement is to be able to discuss it later and to encourage long-term storage of information. The aforesaid topics are regarded as problems which needs to be dealt with in many areas in the world (except earth layers which is a pedagogical condition for learners needed to learn terminology linked with the earth sciences) including Algeria for they cause detrimental damages to human beings, the main victims of this natural phenomenon and to the infrastructure through

which societies function). Thus, learners are required to do some pre research or a kind of preparation for the main problem as to be capable of identifying the problem and then trying to establish a framework for the problem solution.

Problem Solving Training Program Focuses on the Following Areas

- ✓ Problem identification
- ✓ Problem understanding
- ✓ Brainstorming
- ✓ Choosing among different alternatives
- ✓ Collaborative problem solving skills.
 - team building
 - positive interdependence
 - effective communication

Through a set of learning activities which focuses on cooperation, problem solving and motivation strategies, the educational program will play a major role for bringing about positive influence on both learners problem solving skills; deductive and inductive thinking, and motivation, hence, being engaged into different cooperative learning skills which are the steering key that will encourage increased thinking performance and motivation (extrinsic motivation in particular), where learners are triggered toward effective cooperative problem solving skills. The following are some examples of classroom activities which are administered under the educational program heading.

5.4.2. Team Building Games

In order to build groups which are capable of carrying out problem solving tasks successfully, it is necessary to build motivating teambuilding games our participants will need to get involved in and which are aimed to train them to trust each other, and feel comfortable when they participate in group conversation. The following is an example of teambuilding activities which is managed in the classroom as being a part of the program. Additionally, the teambuilding activity is pursued by an introduction of cooperative learning its importance and instances of its advantages:

1. Helium Roll

- The material : one roll of duct tape for each group
- Group size : five students for each
- Rules: (or procedures)
- The objective : to build trust and cooperation between the learners
 - ✓ physically circle each group into enclosed form; learners are told to stand shoulder to shoulder
 - ✓ all group member are asked to stretch their index fingers toward the helium roll as though they are pointing out to something
 - ✓ we made sure that the helium has to be somewhat heavy; the heavier the helium roll, the harder to keep it tightly high therefore more collaborative effort is being focused on; the participants should look carefully at the helium roll as not being distracted by other factors.
 - ✓ Learners are told that the task cannot be achieved without the participation of all of them, i.e. every member does his or her share of the work, in order to solve the problem.

In fact, this activity is theoretically thought to be easy and quick to handle, yet it has profound implication for future cooperative problem solving and boosting motivation. Learners learn to consider**(1)** the importance of every straw of effort made to accomplish the given task, **(2)** that each learner is working on her or his part to achieve the end result, and**(3)** that one's success effects his or her group mates' success and vice versa. Last but not least, our learners are told to take into account that their attention should not be distracted by unnecessary or irrelevant activities. This is clearly displayed when learners extend their index fingers toward the goal that is all should go after it.

5.4.3. Survival Scenario

- ✓ Provide a context
- ✓ The task time: two hours
- ✓ The objective: trigger different thinking processes such as imagination and problem solving

Learners were told the following situation:

“You are in the classroom, and suddenly you felt that the ground is moving. Alas, an earthquake of 5.7 degrees according to JMA scale (Japan Meteorological Agency seismic intensity scale) is shaking the area. Your classmates and you have to react rapidly to prevent possible damages and to survive...how and what would you do?”

The entire class was organized according to cooperative learning requirements; all learners work in cooperative learning groups; face-to-face

discussion, provide and receive support, participate in the discussion to discover possible survival tips from different perspectives, and employ collaborative skills when needed. In brief, all learners are asked to take part in the problem solving task.

The answers which were exchanged by students during the discussion time are reported to the entire class which are, as we noticed, thought to be earthquake safety tips. Each group reported possible survival tips regardless of their appropriateness, and the rest of the groups were required to interact with the findings through questioning and asking for clarification. The following list contains some responses to the question:

For learners, in order to survive an unexpected earthquake, they should:

- ✓ Turn off the gas , and electricity, as quick as possible
- ✓ Do not use any electrical device such as lap tops, or data show equipments; a tiny spark may cause an explosion, which is something not sought especially during an earthquake.
- ✓ Keep emergency supplies inside the classroom during both scholar's semesters
- ✓ Move to save locations in the classroom, such as under the table or the desk, or close to the cornerstone.

Some responses are considered not relevant or have no importance with regard to the situation (E.g. sleep).

What students did with this particular activity revealed an awareness of what is to be done when faced with unavoidable and critical situations. Generally, our learners displayed a positive attitude toward the interactive exchange of different real life issues and relevant ideas concerning safety list for surviving an earthquake for they reported that they usually prefer learning how-to-deal- with method because it allows them to find out what other people think about any topic they wish to learn, therefore discover more skills and ideas quickly.

Also, regarding the contextual clues, our learners take advantages of the classroom being a training field where they can be mentally triggered to create a visual performance while interacting with the environmental objects given the available tools to react to the possible problem.

Our participants showed confidence and comfortably talked about possible tips which can reduce different costs and damages of the aforesaid natural event (earthquake) which demonstrates learners' cognition and a tendency to explore useful information, expressing the give and take communication which is thought to be effective for making sense of the problem and attaining a solution.

This interaction can be said to be very important during classroom discussion (and in other places such as work places, home, etc..) which has particularly provided learners with an opportunity 'to bring to life' their instinctive curiosity as how to respond to such accidents unbounded by the classroom rigid authority; learning environment is made relaxed as much as possible by tolerating diversity of opinions and expressing appreciation.

Also, we aimed through this activity to aid our participants to build up cooperative approach to learning through interactive communication between group members and groups, and with regard to their memory faculty, we claim that they actually benefited from existing contextual clues in the classroom which were possibly made available by the participants' contribution (their learning is displayed through their behavior) to the classroom conversation, both are indispensable for long-lasting storage of information.

Furthermore, thought provoking context, which is stimulated by the survival scenario, was loaded with various previously experienced earthquakes, such as those expressed by the learners (for example, the one which was recently experienced in Constantine in 2011).

We tried through our research to activate learners' different mental faculties, so, we used in our instruction words such as remember, pay attention to, think over...which are believed to 'tempt' thinking, and most importantly to settle their learning on thought provoking topics, one justification for this claim is that thought provoking learning is a crucial requirement of the 21st century education for learners are not regarded as empty 'vessels' to be filled with information, but active participants, seeking to make sense (Williams and Burden, 1997) of different information and to extend their perception of the surroundings and to enhance thinking skills needed to adapt with the speedily changing world.

Changes which distinguish our contemporary era are likely to overwhelm intellectually and socially unprepared learners; changes which range from the technological inventions which have been plainly observed during the last few years to the need to arrive at a cooperative consensus to dealing with real life

problems where all opinions are to be considered, regardless of different thinking styles and attitudes, for what actually matters, we insist, for learners is to deal as effectively as possible with a given problem, within a cooperative team, a claim which is aligned with our research hypothesis; enhancing problem solving skills via cooperative learning . Our role is to help learners foster the aforementioned skills via instruction and training.

As it was investigated in chapter five (cooperative learning), thinking is triggered in the presence of others.

5.4.4. Thought-Provoking and Real-World Situations

-The objective

The central aim of the following activities is to involve learners into thinking about the real life situations as an opportunity to update their background information with relevance to problem solving as a thinking aspect, and most importantly learners are helped to enhance problem solving through cooperative exchange of responses (answers, past experiences, etc...)

It is perhaps undeniable, the fundamental need to draw attention to the importance of the relevance of the topics to real world situations during learning, and problem solving, alongside the current earth studies our learners are mainly occupied with. Studies which include the climate shift, landslips, and volcanic eruption, have also been brought into play by being among various worldwide concerns needed to handle ; this was particularly made obvious by being conversed during teachers' assembly as to coordinate between different teaching practices to teach the aforesaid topics within the planned educational program of the faculty.

The idea of relating topics of discussion to real world situations is constantly emphasized in order to encourage research and thinking, is also considered of a paramount importance for it is a provocative and motivation maintaining affair. (To hit two birds with one stone).

Hence, with the subsequent thought-provoking activity, we tried to raise learners' curiosity; their thinking is called for when they were asked questions that are linked to their own interest and which are considered evident and fact-dependent problems. Issues which help them extend knowledge of the relevant area to their study through investigation and discussion and which necessitates, in the first place, individual reflection (reflective thinking) on the problem as an attempt to define what exactly the problem is, and the possible operation(s) which can probably be taken to resolve or even reduce the negative effects of the problem. This reflection is likely to be elaborated during group communication. (In our learners' case, reflecting on natural phenomenon which seems largely evident and global)

The best part in the following activity, is that learners' thought is being triggered, yet given no clear reply to their wonders (there is no royal road to knowledge) as to show them the advantage and the joy of obtaining knowledge for themselves; this can be justified by the assumption that a lack of information is irritating and the existence of a hole in ones information, when detected, produce a kind of cognitive tension which can be surmounted merely through investigation.

-Assigning Roles to the Participants

Groups were composed heterogeneously. Members of the groups were selected from the list according to their ability to initiate conversations,

questioning (asking why, what and how sorts of questions...) and conflict resolver(s).

Also, in each group we tried to include at least a member who is expected to engage the rest of the group members to trigger their thinking and guard the course of the discussion. The decision is made indirectly not to allow the less able learners to misinterpret roles assignment for unequal treatment from the teacher's part to prevail in the classroom sphere.

Moreover, in order to facilitate research and encourage learners to share knowledge and save significant information, we allowed the use of laptops and Smartphone in the classroom, when it is called for. This is due to our consideration of the value of the numerical devices for enhancing learning and drawing inferences particularly that we noticed that most learners are good at manipulating tech-devices and regard them as a daily routine essential for navigating geological areas (e.g. GPS), and drawing maps.

The learners initiate their thinking by asking WH questions which help them attain a clearer explanation of the topic and enable them to focus on what they are required to seek out from the text.

Activity 4

Temperature increases after rain, Explain!

The cause

The operation; the verb “to increase” shows an external (environmental) factor that influences the temperature to change upward. The learners have to go outside in a rainy day, or enquire their background knowledge and find out the difference of the temperature degrees during before and after rain.

Temperature average is lowered due to the rain fall. The learners are aware of the fact that the rain causes a relative increase in the heat, but are not confident about the precise scientific explanation they hold for this natural phenomenon.

Answers were exposed on the white board in front of the entire class, to allow an exchange of opinions and suggestions which are formerly suggested are also made available for sharing and elaboration.

Several ideas were suggested in response to the question, the followings are some instances.

So, according to the learners, the temperature is observed to increase after the rain fall because of:

Either, the water is originally in its gaseous form, when it transforms into liquid form, a process which releases the heat.

Or, the soil is warmer especially during the summer time due to the sun heat, the latter is said to be absorbed by the soil, and when the rain drops hit the soil; the heat under the soil is liberated in the air as a result of the evaporated water.

Judgment of the correctness of the opinions was not permitted during classroom discussion in order to encourage creative 'flood' of ideas and interaction which were activated as a result of a tense-free atmosphere.

Instructing learners the significance of cooperative learning and the advantage that can be shared through classroom interaction; gains such as extending the value of learning, problem solving, collaborative skills and motivation increase due to the positive interdependence. The latter is made clear particularly through learners attempt to clarify their points of view to each other which corroborate for the learners the appeal to hold the responsibility for ones' learning and for the others' as well, as a way to enhance learning and growth.

In addition, holding responsibility helps learner seek more socially and intellectually approved learning tools which may support their learning and 'save their faces' (for failure is face-threatening), not to overlook that holding such responsibility makes learners more focused on goal achievement, not being distracted by the unnecessary distractions.

Activity 2:

"A problem well-stated is a problem half-solved"

- Charles Franklin Kettering (1876-1958)

The learners are instructed to do the followings:

1) Bear in mind the following problem solving strategies while reading a scientific text which contains information about the climate change and its consequences on the humans' raising awareness of their responsibility to act.

Problem solving strategies are:

- Problem understanding
- Problem Identification
- Generation of possible solutions and strategies

2) Consider if the above saying fits with an issue, which is opted for as a current worldwide concern which is climate shift. In brief, our learners are challenged to make sense of the given problem and attempt to review the aforesaid statement in relation with problem understanding, problem statement and problem solution.

Accordingly, throughout the activity, three goals which are set to meet them, they are as follows: 1) the learners learn to relate the concept to the real life events, 2) and to cling to achieve a comprehensive understanding of the present situation and the desired situation, 3)to discover possible solutions. For this, learners were instructed to keep focused on the goals throughout their readings, namely understanding the problem and generating possible solutions.

To increase understanding, and boost up enthusiasm, learners were asked to prepare for this activity, through watching several documentaries such as the one entitled HOME, which is distributed to YouTube, the video -sharing website. Videos which are particularly delivered as messages aimed at increasing human's awareness of the catastrophic evolution of the Earth's shift, due to an exaggeration in the use of the natural resources.

To ensure virtual attachment to the suggested issue which is climate shift and its consequence on human awareness of the importance of taking action, we tried to make available a variety of up-to-date references and hands-on experiences, such as giving hints about some environmental protective associations situated in many areas in Algeria, to mention few, Protecting the Environment and Nature Association in Constantine, and Almarij Association for Protecting the Ecosystem which is located in Elkhroub district and which are concerned mainly with raising awareness of the responsibility of man to the detrimental influences to the environmental changes and the possible procedures which can be adopted to reduce pollutions.

According to learners' propositions, which are discussed in the classroom, in order to minimize the influence of climate shift on human living, we as rational beings- humans, compared with other species are able to use their reason to distinguish good from bad; in our case the negative changes caused by the

climate shift, which is brought by human harmful behaviors, and the procedures which can be employed to rescue the earth- we can adopt less use of the electric energy and switch to clean energy including the solar energy which is viewed abundant particularly in the southern half of the earth . also, in order to reduce the effect of climate change, learners investigated the ecological phenomenon, known as desertification and the practices to minimize the period of desertification in southern Algeria; one method as mentioned by the learners is to make use of a fabricated botanical cover, both of which may bring about significant repair to the ecosystem, and the national economy.

Remarkably, the learners showed a great concern for what is going on in the world which they live in, especially, topics such as this one which they find relevant, important and thought-provoking.

As it can be noticed, this activity was designed particularly to relate to real world issues, which is meant to develop a deeper sense of responsibility and motivation and to maintain a selective attention on the learning task.

Furthermore, this activity pushes learners to surf the internet, a research tool which is preferred by most learners nowadays, for it satisfies their curiosity, and meets almost all learning preferences such as learning through reading or watching videos, or both by allowing them to switch from reading to watching and so on. As a consequence, the learners are encouraged to act on relevant information on account of a deeper thinking effort devoted to obtain and extend better understanding of the problem. Put it differently, the information which appear in numerous and diverse forms such as eBooks, e-articles, videos, and quizzes and which are perhaps not available in the library shelves, for learners seeking to make sense of the surrounding environment via learn new information, and employ them to his or her environment and acquire skills such

as critical thinking skills which help to distinguish what is pertinent and useful from irrelevant data to deal with the given problem; these are made available in abundance in the realm of the internet. Our roles, is to encourage moderate surf of the internet, for an over reliance is tiring and time consuming not to overlook the advantages which can be gained from an active reading of the printed books which are offered.

Additionally, It is due to the investigative journey toward comprehending the factors that cause climate shift, learner make use of a variety of data which are present in different forms, and which may help or hinder comprehension, for example, as long as different learning styles are concerned, visual learners benefit from data which are presented in different visual ways, and thereby make retention and understanding as easy and memorable as possible, while learners with a linguistic learning style prefer reading and rehearsal. This was plain when some learners preferred talking than reflection, the latter can be observed through behaviors when some learners ask for time to withdraw and think for themselves for the problem.

This activity reveals learners' ability to understand and infer deductively valid inferences from the given instance which specifies conditional reasoning. The learners will deduce the followings:

- If the problem is well stated, then the problem will be half solved.
- If the problem is not well stated, then, the problem will not be half solved.

Notes:

Problem solving skills were incorporated into problem solving activities. That is, we tried to explain them and their significance during classroom discussion followed by examples. Beside we tried to trigger learners' thinking to formulate examples of a number of categories of inductive reasoning, including hypothesis formulation and observation, as well as deductive reasoning conditional statements(if...then).

In order to identify the problem, learners have to make sense of it, and as to understand the problem, they have first to recognize its existence. The latter can probably be achieved through an attempt to figure out the discrepancy between the current situation and the desired situation, and to underline the obstacles and causes which make up the present situation.

Furthermore, we instructed our learners to consider flexibility while dealing with the problem, that is the above steps are not sequential, and they can start with any step they wish or they find easy as far as they do not lose sight of the main aim.

If the previous aims are met, then our learners are said to enhance their learning.

Recognition → understanding → identification.

Or, if the learners begin with an understanding of the problem, they would most probably search for relevant information which supports clearer identification of the problem, and therefore they make sure that the problem really exist and requires a solution(s).

So, the learners were given a set of inquiring questions meant to probe their understanding of the problem and which are kept nearby throughout the activity process.

- What is the problem?
- What are the available research tools which can be used to get the information?
- What are the causes of the problem?
- What are the possible solutions?

Basically, knowing that a problem does really exist is an important step in problem solving activity because it will influence the subsequent steps. So we expected our learners to use both problem solving skills; inductive and deductive reasoning to recognize the existence of the problem, its existence, definition and possible solutions as a topic to handle. Hence, inductive reasoning demands the investigation of different data which are related to it and gather sufficient evidences which support the deductive conclusion which is climate shift is taking place and therefore it is bringing about changes to human lives (and other livings).

Also, an important reason which encouraged us to design this activity and include it in our educational program is to encourage our learners to develop 'why not' attitude toward learning via problem solving skills, especially when cooperative problem solving is emphasized during the process. A search for the problem existence, defining the problem with their own words and trying to generate solutions as well as unlocking possibilities of differences among opinions during the investigation, are a combination of powerful learning skills which are most likely fostered during the activity process owing to the active involvement in the activity, in brief learning via doing.

It is worthwhile to point out to the essential principles which are emphasized during the above teaching program to enhance problem solving skills and motivation through cooperative learning and how it relates to learners basic studies related to earth sciences (Geology).

First, our learners were informed that they are taking a training program. After deciding to administer the pre-test at the beginning of the school year, we attempted to determine the intellectual requirements and needs of the activities which are to include in the training program, essentially vis-à-vis to our underlined objectives stated in the hypothesis, and with an emphasis on the learners' ability to handle them, as well as learners' field of interest which is geology. Accordingly, we made sure, that the activities should be designed to be relevant, also neither too difficult, nor effortless, in order to encourage initiative and increase self-confidence.

Second, ensure an active participation of every learner. With the assignment of roles, and with the emphasis on constant exchange of information, responsibility for doing one's share of the group talk, questioning, investigating, and, possibly, providing feedback is said to be improving.

Third, the objective of every activity is stated clearly. This has multiple advantages to learners, to state some, knowing which 'road' to take, maintaining focused attention on the activity, and holding responsibility for the completion of the activity. This principle is of paramount significance for it strongly supported active involvement during the training sessions.

Fourth, sustaining motivation and learning as goals. The integration of games in the classroom, taking breaks, and freedom to express thoughts, and vocalize feeling or concerns are very much allowed during the training program.

5.5. Results and Discussion

In this research we are interested in evaluating the effectiveness of the training program on learners' thinking and learning. During every session, the learners are assigned a set of activities which ranged from group building activities, to problem solving activities and asked to try to be active participants especially when the activity requires group effort to achieve a common goal, then at the end of the training workshop, the learners are asked to reflect on the advantages they think they obtained from the activity and write them down in a notebook using any language they desire, French, English or Arabic or they believe they master better, as well as be open to state possible shortcomings or obstacles if they are found.

5.5.1. Cognitive, Motivational and Communicative Issues to the Training Program

The training program is designed as an attempt to support the value of active engagement to meaningful learning, and to get learners into the process of obtaining and acting upon knowledge. Training program aids learners to develop required skills including communication skills, thinking skills and self-directed as well as cooperative learning. Hence, by training learners to foster their problem solving skills and make sense of the hidden purposes of the suggested activities by means of hands-on learning, questioning and investigation , and to foster their sense of belongingness to a group to learn and to help others to learn as well, being our main objectives which steer our research, we intend to offer perhaps a broad range of opportunities for learners to interact with the learning environment, group mates, teachers and the activity which is the teaching approach emphasized by the constructivists to raise motivation and to improve performance simultaneously.

For time consideration, we tried as much as we can to let the learners feel unrestricted with the time element especially when the activity requires reasoning. We want our learners to focus mainly on improving their thinking of the topic, to exert ideas and to find out a meaningful way to exercise problem solving skills, a process that can possibly take longer time unburdened by the time limitation, and which allows learners to pick and apply the most appealing learning strategies to their cognitive learning styles, thereby the development of intellectual independence is given such significance as much as learning to process knowledge through cooperative learning.

However, the results obtained are attributed to the dynamic interaction of the three variables, problem solving, motivation and cooperative learning due to the following reasons:

- a)** The variables can in no way be separated no matter how cleverly capable we are. Motivation and cognition are affected by the existence of each other, for we noticed that motivated learners are better at recognizing problem solving activity as a learning trip worth the effort they make, an attitude which leads to more development of the intellectual abilities.

- b)** All learners possess certain cognitive ability; all they needed is to trigger their cognition in a way which makes them aware of them, and dig for a collection of a variety of chances to enhance them. (e.g. via cooperative learning) Training program one underlined objective is to allow learners to communicate freely their thoughts, and share different experience with the class not be concerned by any sort of judgment or the test scores.

- c) Aspects such as memory, group decision making and creativity (brainstorming) are activated in the presence of others. This can be explained by the social nature of human beings, so we believe that learners are by no means should be beheld as vessels to be filled with pieces of information, yet whole beings, a complicated yet dynamic systems who possess a set motivational, cognitive and social factors which act together to help them make sense of knowledge and improve their learning performance.

5.5.2. Choice and Justification of the T.test (the paired t.test)

The t.test is well-known as a statistical measure used to compare the mean scores of two groups; the experimental group and the control group (Brown and S.Rodgers, 2002).

Also, t.test is deemed a scientific method used to check any statistical difference between the scores of both groups to tell if the treatment which implies a directed manipulation of a specific independent variable during an experiment has significant effect on learners' performance. Paired t.test, also called within-subjects design is a type of t.test, yet a slight difference between the two tests should be pointed out is that the former is used to measure the mean score of two groups, whereas the latter is used to compare the mean score of a single group which has been followed up, necessitating that the learners' performance is tested before and after the training program (i.e.treatment) to see how well or to what extent we can say that the group of subjects could perform differently in two different test conditions, mainly regarding the two obtained measures of the subjects, in order to shed the light

on the success level of the intervention (training program) say, the comparison between the pre.test and post.test scores(Brown and S.Rodgers, 2002).

Accordingly, the sample which is randomly taken from the population will serve up our study in both conditions that is before and after the training program; the same group will be followed up during the study as one way to minimize the control of irrelevant variables or errors which may unnecessarily influence our results, given that each participant is subject to the treatment.

Moreover, as far as our training program is concerned ,we dare to say that we contrast with the idea of learners being subjects of an experiment, and treated this way during the training program, so we have been trying to make sure that all the participants were actively involved in the process, that is learners played indispensable roles for running the training program, being not passive subjects waiting for knowledge to come under their feet, yet active agents flying up to chase for knowledge from a variety of sources, a notion which is strongly emphasized by group investigation as a cooperative learning approach to enhance both thinking, group research skills and motivation .

So, paired t.test will be allowing us to examine the relative usefulness of the training program for improving learning performance; problem solving, motivation and collaborative skills.

Given that our sample, which consists of 20 participants, is drawn from a population of 60, paired t.test can also be used with both very large and very small samples (Brown and Rodgers, 2002).

5.5.3. Null Hypothesis and the Alternative Hypothesis

H0: training program has no significance for learners learning and problem solving skills

H1: training program enhances learning and problem solving skills

Compiling Scores (table1)

SUBJECTS	SCORES BEFORE TREATMENT	SCORES AFTER TREATMNET	DEFFERENCE d	d 2
1	11	15	04	16
2	04	09	05	25
3	15	16	01	01
4	02	06	04	16
5	02	03	01	01
6	01	05	04	16
7	07	11	04	16
8	08	05	-3	09
9	03	06	03	09
10	10	11	01	01
11	02	05	03	09
12	07	09	02	04
13	02	10	08	64
14	13	15	02	04
15	02	02	0	0
16	12	14	02	04
17	11	12	01	01
18	03	11	08	64
19	17	17	0	0
20	11	13	02	04

Table (1) shows raw scores of pre.test and post.test(two measure of the same subjects).

Mean for scores before T.P	Means for scores after T.P	The sum of difference in two conditions	The sum of difference multiplied by the difference d
M1=8.25	M2=9.75	$\Sigma d=52$	$\Sigma d^2=264$

Table (2) shows two measures of the same subjects, pre.test and post.test which are followed during the training program.

Organizing Data in Terms of Frequency Distribution (table3)

Scores Before Treatment	Number of Frequencies
01	1
02	5
03	2
04	1
07	2
08	1
10	1
11	3
12	1
13	1
15	1
17	1

N= 20 (the total number of observations)

Table (3) shows the frequency distribution of scores obtained before the training program

Scores after the treatment	Number of Frequencies N
02	1
03	1
05	3
06	2
09	2
10	1
11	3
12	1
13	1
14	1
15	2
16	1
17	1

N=20

Table (4) displays frequency distribution of scores obtained after the training program

So, as it is shown in the tables above, we notice a significant difference in the scores; that the group's scores before the treatment fall in the range of 1-17, whereas the group's scores after the treatment are ranged from 2 to 17 and tend to increase above the average. Also we notice that below the average scores and low scores which are obtained before the training program exceeded those of after it, for there are nine learners who scored very low before the training program which implied a serious educational need for an intervention compared with seven learners who scored low after the training program which entails that (regardless of how better performance we aimed is) learning has taken place.

The frequency distribution of the scores which are average and above the average, we got after the treatment are better than the scores obtained before the treatment; about 10 students who scored above the average and only 01 student scored average after the intervention, whereas 07 students scored above the average and the rest of scores fall in the range of 1-10 before the intervention.

So, it looks like that the group's performance is relatively improved compared with previous level that is the results the group recorded in the pre.test, for learners achieved higher scores after the training program as we have hypothesized (the prediction). Accordingly, in viewing of both the means obtained before the treatment ($M=8.25$) and after the treatment ($M=9.75$), we can conclude that the training program which emphasized cooperative learning and problem solving was effective for enhancing learners 'learning.

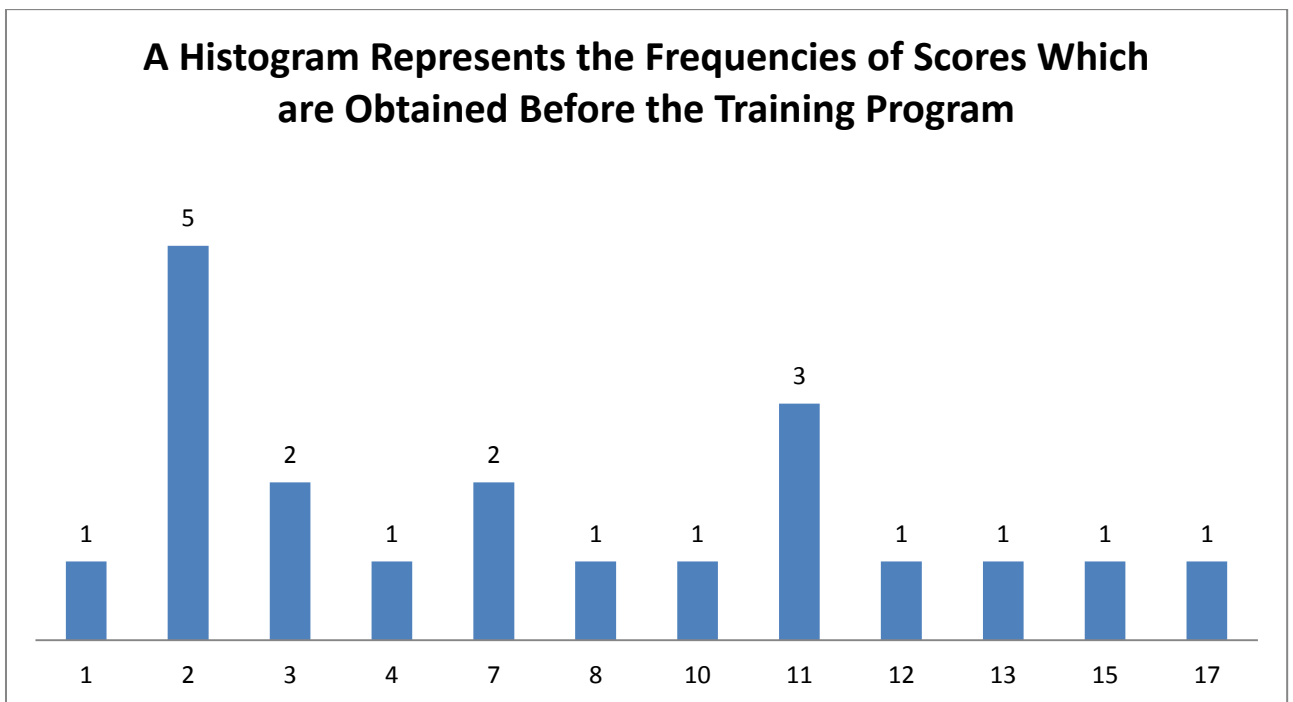


Figure (4) the vertical axis shows the data obtained before the training program. Above each bar in the histogram we see the number of frequencies of each score

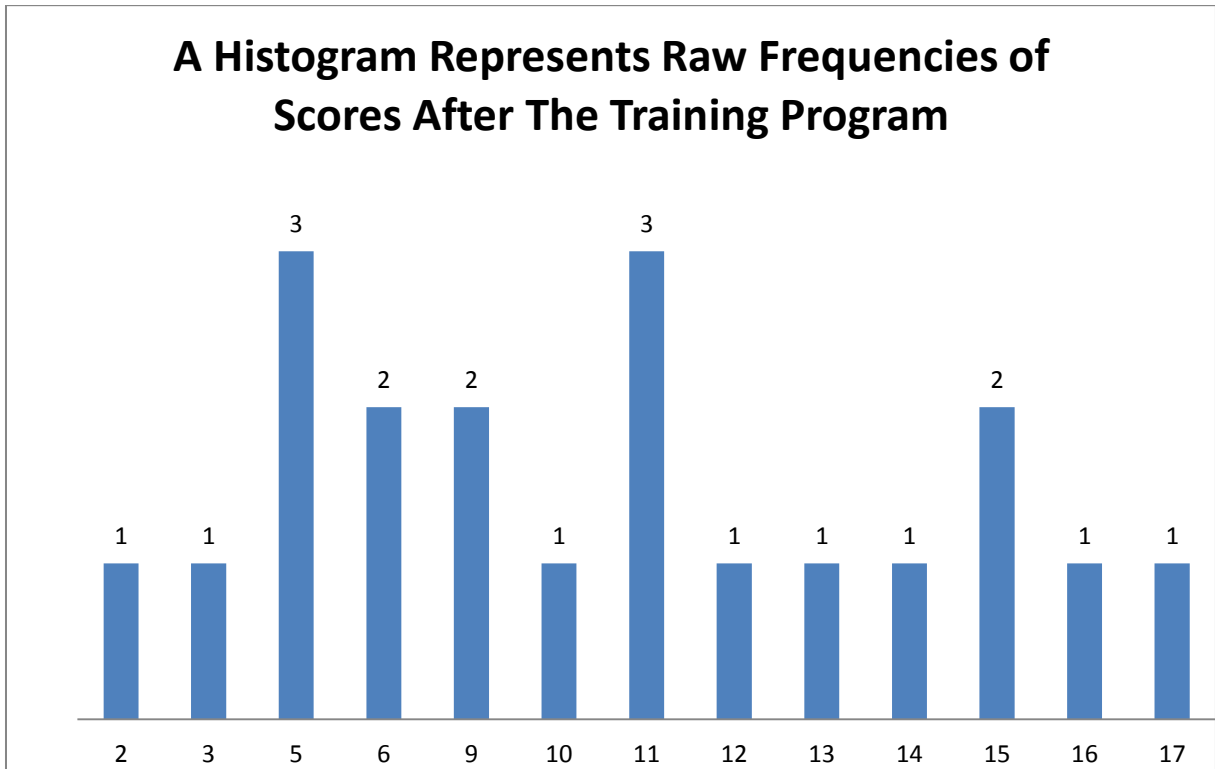


Figure (5) the vertical axis presents the obtained scores after the training program, and the frequency distribution is shown on top of every bar

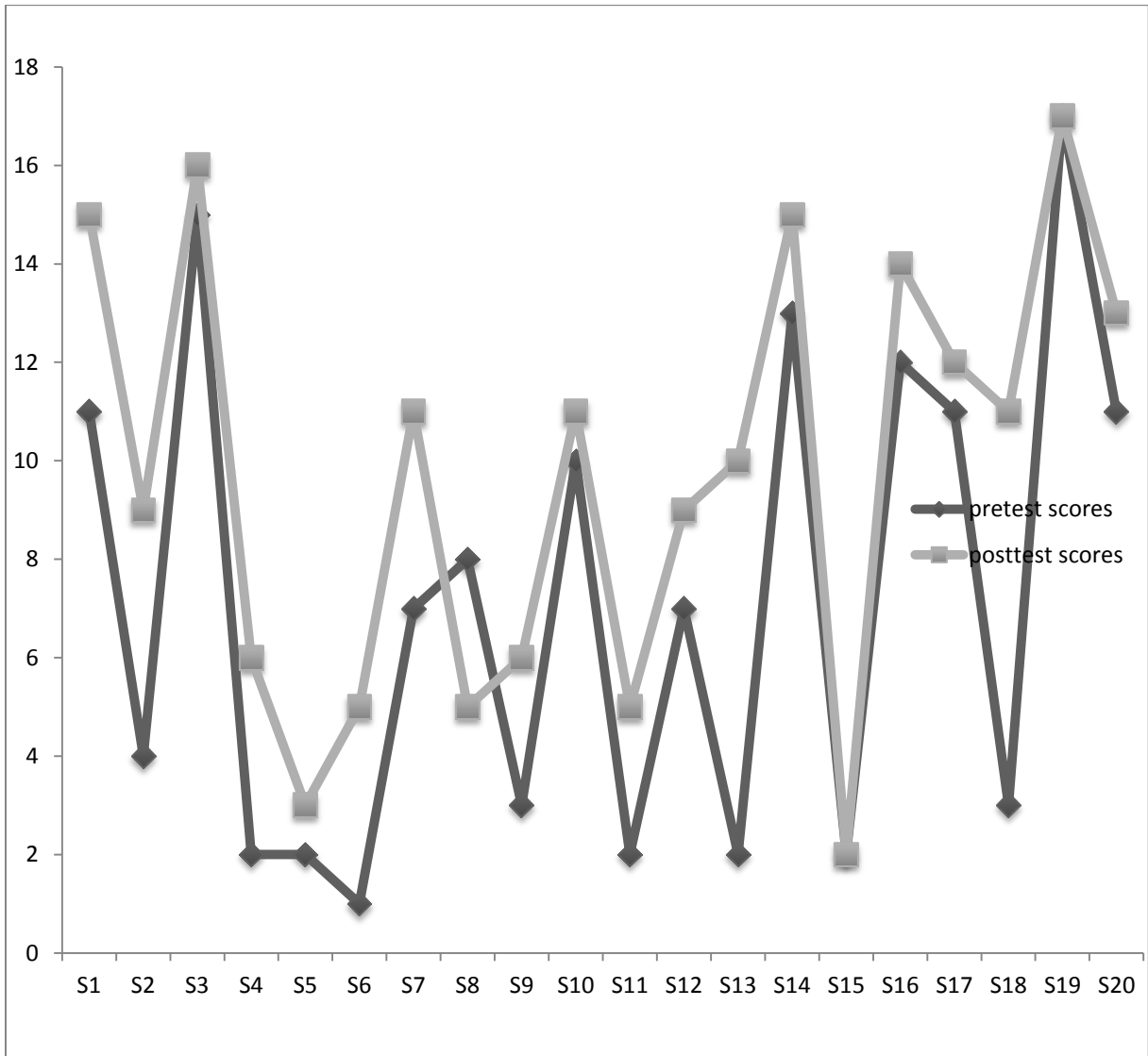


Figure (6) a polygon of the pre-tests and post-test scores, shows the difference between the scores obtained during the two situations

5.5.4. Calculation, Results and Interpretation

Paired t.test was conducted to compare learners' performance before and after the training program. In other words, we want to check whether there is a significant difference in the scores of the two conditions to tell whether the treatment was effective for improving learners' learning. (Problem-solving, cooperativeness, and motivation)

❖ Paired t.test Calculation

With regard to table.1, we notice two measures on the same sample. The repeated measure test will allow us to compare the mean scores of single group,(the sample of our interest) which is supposed to perform in both conditions; the before as well as after the treatment and confirm if there is any difference among the mean scores between the pre.test and post.test with the purpose of verifying the effectiveness of the training program; that our prediction is deductively valid and inductively remains probable and open to extra future educational challenges.

So, the paired t.test was conducted to compare the performance of learners on problem solving activities and cooperative activities with and without training program conditions.

First, we calculate the degree of freedom:

$Df = N - 1$ (the equation) , $df = 20 - 1$

$df = 19$ the test has 19 degrees of freedom

Coming back to the values obtained from table.1, we substitute $\Sigma d^2 = 264$,

$\Sigma d = 52$, and $df = 19$ into the equation $t = \frac{\Sigma d}{\sqrt{\frac{n(\Sigma d^2) - (\Sigma d)^2}{n-1}}}$, and calculate the paired

t.test. So, the result obtained is 4.47, being the level of significance.

So, $t_{obtained} = 4.47$

Given that the null hypothesis is assumed to equal zero value (H_0) which implies that there is no significant effect of the training program (the treatment), this can be conceived true only if there is zero difference between the mean scores of the two conditions. However, from table.1 we notice relatively increased scores, that is the difference $\neq 0$, therefore, we can say that the null hypothesis which suggests that the training program does not improve learners' performance is rejected in favor of the alternative hypothesis (H_1).

To determine the critical value ($t_{critical}$), we need to consult the distribution table. Hence, remembering that there are nineteen degrees of freedom ($df = 19$), alpha level is 0.05 ($\alpha = 0.05$), and the one-tailed hypothesis (for we have hypothesized a positive effect of the training program on learners' level of performance), we notice that the critical value for t , is 2.09 ($t_{critical} = 2.09$).

Given that the $t_{obtained}$ we calculated for the difference between the scores mean of pre.test and the scores mean of post.test is 4.47, which is obviously more extreme than the critical value for t which is 2.09 as found in the distribution table : $4.47 > 2.09$. The result indicates that the difference

between the scores mean of pr.test and the scores mean obtained on the post.test did not probably occur by chance.

Table (5) displays the difference between the *t* obtained and the critical value for *t*

Degree of freedom	The sum OF THE DIFFERENCES (1) BETWEEN THE SCORES OBTAINED BEFORE AND AFTER THE TRAINING PROGRAM	The sum OF THE DIFFERENCES (2) BETWEEN THE SCORES OBTAINED BEFORE AND AFTER THE TRAINING PROGRAM	The <i>t</i> obtained from the scores mean of pre test and post test	The critical value for <i>t</i>
df	Σd	Σd ²	t.test	t.critical
19	52	264	4.47	2.09

The *t*.obtained we calculated for the difference between the scores mean of pre.test and the scores mean of post.test is 4.47, which is obviously more extreme than the critical value for *t* which is 2.09 as found in the distribution table namely $4.47 \geq 2.09$. The results indicate that the difference between the scores mean of pre.test and the scores mean obtained in the post.test did not probably occur by chance.

The required value of *t* at 0.05 level of significance for 19 *df* is 2.09; since the obtained value of *t* is higher than the *t* critical value (the obtained value of *t* is much higher than the required value), we can say then that the training program has a positive influence on the performance of learners. Overall, the results obtained are in the direction of our hypothesis.

Putting it All Together

We began this research with describing the nature of the sample of our interest, who are Intellectually advanced postgraduates at the university of Mentouri, attending geological studies in the Science of Earth faculty .The participants recognize the importance of learning through cooperation, yet need to practice English language as the main language of communication in the classroom; also, we noticed that the participants are quite aware of the need to improve effective communication with their classmates and strongly agree on hands-on learning experiences.

We started our investigation with a pre.training which involves learning new vocabulary and enhancing speaking skills through practice. Learners prepare a set of new words in English they wish; explore their meaning(s) and use them in sentences of their own they possibly know; so learners enjoy learning new vocabulary of their choice and preserve them in their long-term memory through acting upon them freely. Also, learners in speaking about vocabulary they explored while being in the library or through watching TV programs, we could provide them with immediate feedbacks on the correct use of English words to combine meaningful sentences.

Subsequently, we identified what we believed to enhance overall learning; the key element of our research hypothesis which is cooperative learning. We showed enthusiasm through dedicating a whole two workshops for explaining the motivations behind choosing cooperation as the principal ground on which we build effective problem-solving skills, motivation and collaborative skills, and allowing learners to experience vividly through team building activities including helium roll activity, and data cards activity.

General Conclusion and Recommendations

In the present study, our main concern is to improve in learners the ability to apply problem-solving skills and cooperative learning skills, in order to deal with problems effectively, and therefore boosting their learning outcomes. Active involvement into activities, which are designed for triggering deeper thinking on an issue, trying to figure it out, investigate and explain it, and finally find out a solution, promotes thinking skills, and increases understanding and learning of the given issue . Cooperative learning is the basic milestone for effective learning, because it encourages active involvement into learning tasks, and allows the integration of problem-solving skills into cooperative learning during group interaction. Indeed, cooperative learning activates learners' cognitive processes, and encourages genuine interaction between learners, teachers, and the material being taught within a supportive learning environment.

On the basis of what has been said so far, we become convinced by the leading view of Slavin (1985), which is continuously repeated and emphasized throughout our research, namely enhancing academic achievement through cooperative learning. As a highly promising and effective cooperative learning method, group investigation brings learners together to explore and use problem-solving skills while investigating a research topic. In so doing, learners get involved into in-depth research of thought-provoking issues, and develop a healthy relationship with their group mates throughout the group investigation; in short, learners learn to cooperate, and cooperate to learn. So, we continue to cling to the

interdependence of both problem-solving and cooperative learning being the cornerstone of effective learning and higher academic achievement.

Accordingly, we propose a training program, which is entitled as cooperative problem-solving program, which constitutes a set of thought-provoking, as well as cooperative learning activities, which are intended to raise learners' awareness of the importance of active involvement into learning and hand-on problem-solving skills and cooperative learning, which would eventually enhance their learning performance, and make it much more beneficial and motivating.

The educational training program gets learners actively involved into activities, which are particularly designed to enhance in learners the ability to employ problem-solving skills including observation, experimentation, brainstorming and decision-making, and which are meaningful, relevant to real-life situations, and call for cooperative learning.

The results which are obtained after the training program show a difference in the scores of the learners on the post-test, compared with the pre-test scores confirming our research hypothesis which states that learners' learning performance may improve, because of getting them involved into cooperative problem-solving tasks. The training program allowed the learners to participate in a set of tasks which triggered both their cognitive activity and cooperative learning.

During training program, our learners tried for themselves a variety of research methods, such as observing natural phenomena, collecting data, and communicating their finding; also, they were viewed to pay more attention to each other's opinions and ask for clarifications, as well as cooperative learning skills, such as willingness to explain things to each

other, and tolerance for unusual and new ideas, as well as a range of learning strategies, risk-taking and initiatives in particular (e.g. learners were viewed to go to different places in a rainy day to check whether the rise of temperature took place just after, while or before the rain fell). Also, we were captivated by how remarkably our learners can perform, when they are asked to solve problems, which are both relevant to the real-world situations, and interesting in terms of their significance for contributing to the geological studies, and particularly when they are investigated in English language (many learners reported that they wished to improve their ability to use English language, along with learning geology, and that such training program allowed them to try to learn geology in English language instead of French or Arabic languages).

Again, we can say that the results which are obtained in the post-test show a significant improvement in learners' performance, compared with the pre-test scores, which entails a positive effect caused by the three months duration training program on learners' achievement, along with emphasizing an active involvement into cooperative and problem-solving activities throughout the conduction of the training program.

Hands-on problem-solving and learning activities enable higher quality thinking skills to flourish and produce meaningful learning. Skills such as deductive and inductive reasoning skills, goal setting, planning and evaluation of the end results (solution) within cooperative learning environment are not only needful for boosting successful academic achievement, yet indispensable tools for meeting the 21st century requirements, which are increasingly demanding the accumulation of cooperative efforts to meet a common goal.

In the light of our finding, we would like to present some recommendations for future application and practices ,to aid our learners be equipped with significant set of learning and thinking skills, to improve their academic performance, and help them be effective problem-solvers throughout their learning. These recommendations can be summarized as follows:

- 1.** Fostering problem-solving skills, calls for a deeper comprehension that effective learning and boosted academic performance are intertwined with that of thinking skills. Indeed, we need not introduce problem-solving skills, as such, as isolated from the topic being taught. This is so, because our learners learn most effectively, and are able to retain the information for relatively longer period of time, when they are instructed to exert deeper mental work, that is being conscious of the thoughts which cross their mind, and attempt to act upon them, while cooperating with group mates toward a common goal.

Our learners become occupied with gathering as much information as possible, believing that by acting this way, they would be able to pass an exam without much mental effort, counting on the amount of information they can keep, regardless of how well they have understood it. Yet they may feel disappointed, and become astonished of finding out how fast they become unable to recall the information they were struggling, probably day and night, to maintain in their memory. So, the deeper thinking is exerted, the deeper the learning is achieved; the more knowledge is associated to real-world situations, the more problem-solving skills are used, and therefore the better memorization of knowledge and skills.

2. Practice makes perfect. It can probably be argued that applying problem-solving skills, while learning an academic content, is an extremely demanding mental work, for it requires learners to pay focused attention on several coming pieces of information, and creating mental representation of them while interacting with the surrounding environment. So, thinking and learning enterprise is not an easy-made work, which waits for luck to hit, or inviting conditions to be available, yet our learners need to understand that: 1) knowledge will not , by any means, knock at their doors, that is they should be curious to know more , learn to observe things around, experiment and evaluate their comprehension; in short, they need to go, and get it for themselves; 2) along with developing their ability to employ problem-solving skills, they should learn, to apply them to real-life situations.

3. Prior to teaching an academic content, our learners need to be introduced to problem-solving skills, and explore possible ways to use them, so as to provide learners with background knowledge and skills, which will enable them to associate what was learnt, with what is being experienced; problem solving via analogy is a straightforward instance, which shows the importance of background knowledge for dealing with the current problems.

4. For such practice, our learners should be instructed to get actively involved into different learning experiences, which are designed to enhance problem-solving skills, via cooperative learning. So, establishing a learning environment, which emphasizes both learning, thinking and practice ,and encourages cooperation to meet a goal, foster the 21st century skills, which enable learners to succeed not only in the classroom, but to survive in the workplaces, and

make sense of real life events. Hence, integrating such an aspect of learning, through active involvement into problem-solving activities, calls for learners' responsibility for exploring topics from different perspectives, asking many questions, then search for reasonable answers. In so doing, our learners internalize the topic(s) being investigated, and to store it in their memory for a long period of time.

Also, active involvement into problem solving should not be restricted to classroom participation; this requires our learners to seek several opportunities for their progress, for instance they can be advised to attend to both annual and monthly scientific conferences, so the latter should be made universal so that learners get equal opportunities to interact with skillful experts and benefit from their deep experiences in different educational domains. In so doing knowledge delivered in the classroom will no more be a source of satisfaction, yet learners' hunger for knowledge proceeds to increase so as to develop an approach toward independent learning, which is much more effective than any other type of learning, for it influence learners' progress in remarkable way. Self-regulation, or independent learning, does not exclude the need for cooperative learning, yet being able to behold the value of knowledge for oneself stems from intrinsic motivation, which is also an important attribute for effective learning.

5. Ask learners thought-provoking questions. Actually it is difficult and almost impossible to disentangle questions which stimulate learners' deeper thinking as to dig deep into a certain topic, from questions, which probe learners' comprehension of the topic. The former might be used to stimulate specific aspects of thinking; for instance learners might be asked to search for the

reasons behind a problem, in this case, they learn to distinguish between the causes and the effects of a particular situation; likewise, if we are to make our learners improve their creative problem solving, we choose to ask them question such as, how can you possibly apply the solution in a novel situation?. So, our learners learn to visualize a new case and apply knowledge and skills they have obtained due to a previously experienced situation to the new one; whereas, probing comprehension is tightly linked with learners' achieved comprehension of a particular topic, yet it is worth remembering that such questions can do much more than checking comprehension, for they unlock deliberate and conscious mental work on the subject matter.

6. Reading and writing. Last but not least, our learners are made aware of the importance of reading-writing relationship as a life-long mental activity. Reading novels, do-it-yourself books, people's behaviors, messages, dictionaries, are instances of things we read, that is reading is an activity, which is said to stretch one's ability to make sense of the world. Nevertheless, one's memory is somehow of a limited capacity, which stores only information, which are acted upon with some actions, as well as the undeniable fact that human memory becomes fragile, and unable to store beyond its capacity, the older it gets, which leads to missing significant information, and prevents learners from enriching their responses to the surrounding environment. That is writing is believed to be the complementary activity, which makes learning possible, and long lasting, for it provides a precious opportunity for learners to note down necessary information, as they read, and makes them available to review and use in the future.

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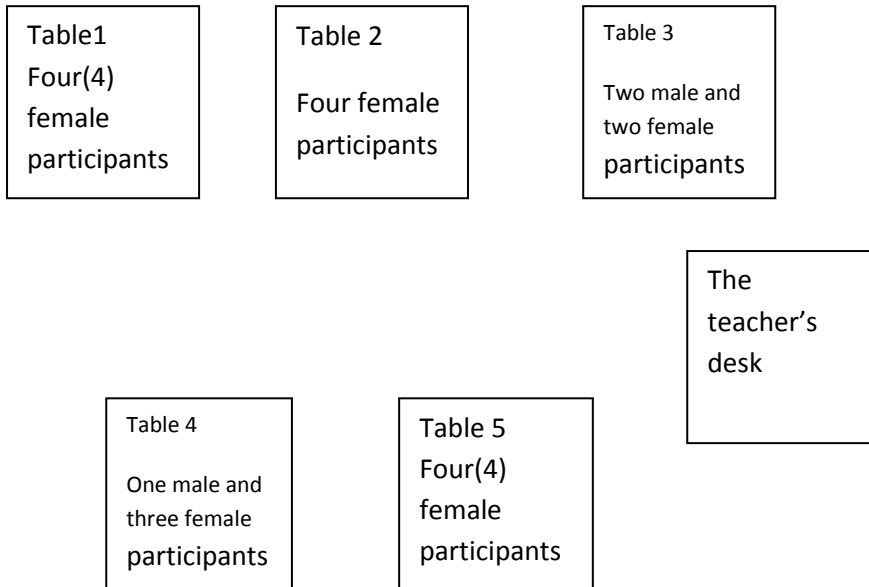
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Appendices

Appendix #01

Pre Training Program Training and the organization of the classroom



- ✓ The topic :Group free discussion
- ✓ The aims

- 1- To encourage learners to talk, as freely as possible with each other about anything
- 2- To encourage learners to initiate speaking in English language and find out definitions of terms in English
- 3- To increase their self-confidence through encouraging risk-taking and allowing mistakes
- 4- Building a bridge between learners through highlighting a mutual exchange of personal experiences

- ✓ The topic of discussion : optional
- ✓ Learning tools: reading and sharing ideas

Appendix # 02

Team-Build Activities

The Helium roll



(website source)

Appendix # 03

Survival Scenario (survive an earthquake)

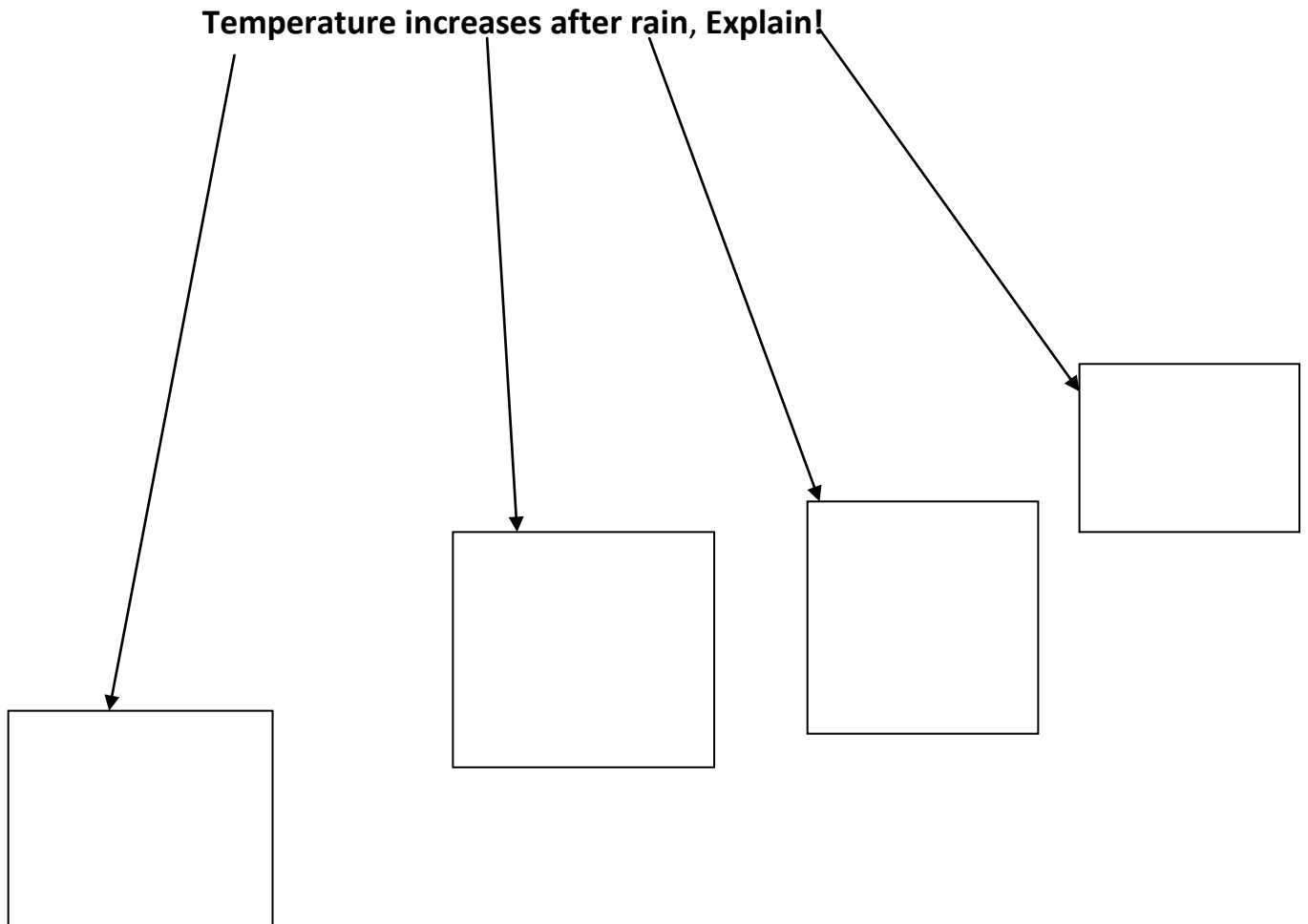


Appendix ≠ 04

Thought–Provoking and Real World Situations

Questions and requirements:

1. Divide the sentence into its components
2. Try to understand each component and find out how it relates to the components which are included in the sentence
2. Ask wh (why, which, when) questions as much as you can
3. Suggest explanations and check your answers through hands-on experience.



Appendix ≠ 05

A number of increases in small earthquakes or tremors around a volcano are often a warning sign of an impending volcanic eruption which are caused by the movement of magma into a chamber under the volcano under high pressure which can cause fracturing of the country rock leading to seismic activity.

The commencement of emission of gas and steam from a volcano, as well as increase in emission volume or pressure and potentially a change in gas composition may all mark an increase in activity. Changes in groundwater chemistry and temperature may also occur.

When the magma gets close to the surface, the gases dissolved in it start to come out, forming gases which help the magma rise further and erupt. If there is a lot of gas in the magma, it may explode as the gases expand. There may also be triggers like a landslide that uncaps the magma reservoir, or an interaction with groundwater that causes an explosion.

Activity(1)

- Give an appropriate title to the text.....
- Earthquakes is.....
- Eruption =.....
- Seismology is the field concerned with.....
- Most of the diamonds that have been discovered were delivered to earth's surface by deep-source volcanic eruption. Explain.

.....

Activity(2) Fill in the following table:

English	French
Covalent bonds	
	Indice de refraction
	Pierre précieuse
	xénolite

Activity (3)translate the following paragraph into English language:

Le changement climatique est causé
 Par les facteurs qui incluent des pro-
 Cessus océaniques,par exemple, la
 Circulation onéanique,radiation
 Solaire reçue par la terre, la tecton-
 ique des plaques.

.....

Appendix ≠ 06

Text

“1.8000 miles (2900km) thick. Inside the mantle is the earth core .Magma or the melted rocks and gas are trapped in the core. A volcanic eruption occurs when magma from deep inside the earth pushes up through the mantle and the crust. Magma that reaches the earth’s surface is called lava. Steam and gases, such as carbon dioxide, are also released into the atmosphere during a volcanic eruption.

“What causes a volcano to erupt? Volcanologists say that eruptions are caused when giant moving slabs of the earth’s crust and upper mantle collide or grind against one another. These slabs are called tectonic plates. As two tectonic plates collide, pressure squeezes magma up between the plates, causing a volcanic eruption. Volcanoes can also erupt when tectonic plates drift apart” .(Volcanic Eruption by Nancy Robinson Masters,2012:05)

Activity 1

- Give an appropriate title to the text
- Seismology is the field concerned..... Complete the sentence with correct answers
- Most of the diamonds that have been discovered nowadays are delivered to earth’s surface by deep-source volcanic eruption. Explain!

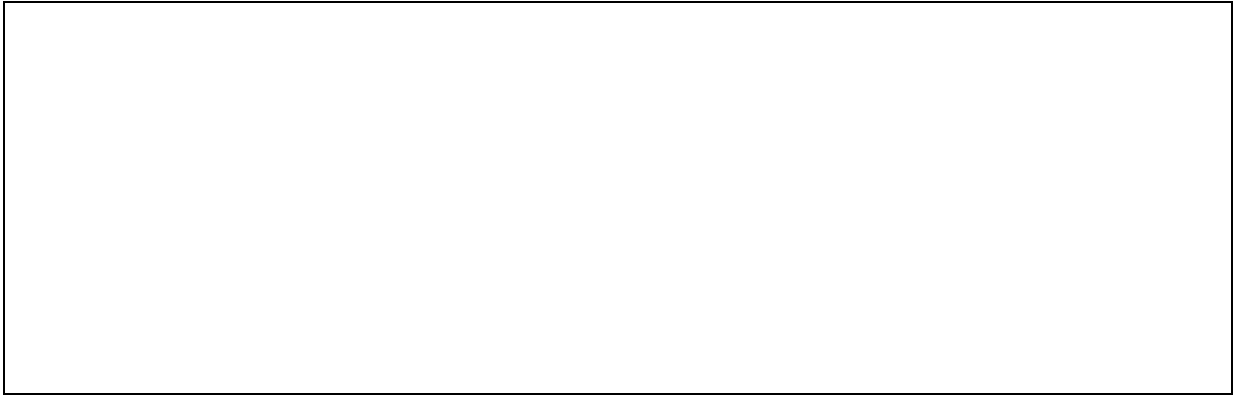
Activity 2 Fill in the table:

English	French
	Liaison covalente
Index of refraction	
	Pierre précieuse
xenoliths	

Activity 3

You are trapped in the forest, and suddenly you have heard an explosive volcanic eruption nearby!

- define what might have trapped you
- state possible safety tips for surviving a volcanic eruption
- Choose only one tip then state why you opt for it.



ملخص

يهدف هذا البحث إلى إظهار أهمية المشاركة الفعالة في التعلم لتعزيز التحصيل الدراسي، من خلال تعريف طلاب الدراسات العليا من قسم الجيولوجيا في جامعة منتوري في قسنطينة إلى برنامج حل المشاكل والتعلم التعاوني، والذي يتضمن مجموعة من الأنشطة، مثل بناء الفريق، والأنشطة المثيرة للتفكير. نحن نعتزم الحصول على تشجيع المتعلمين الفعالة المشاركة في المهام المثيرة للتفكير، والتي تتطلب تطبيق مهارات حل المشكلات، والتعاون، ثم على الضوء نسلط أثر برنامج التدريب على الأداء الأكاديمي المتعلمين. الهدف العام الذي يوجه البحث هو أن المتعلمين يتعلمون بشكل أفضل من خلال التدريب العملي على الأنشطة التي صممت خصيصا لتعزيز مهارات حل المشاكل والتعلم التعاوني. يوفر التعلم التعاوني وحل المشكلات المتعلمين فرصا حقيقية لاستكشاف وممارسة مهارات حل المشكلات، مهارات التفكير استنتاجي، ومهارات التفكير الاستقرائي داخل بيئة التعلم التعاوني. المتعلمين تعزيز مهارات التعلم التعاوني مثل الاعتماد المتبادل الإيجابي والتفاعل وجهها لوجه، والاتصالات، وفريق العمل في التعامل مع القضايا التي تتطلب التفكير العميق، ومهارات حل المشكلة. وبالتالي دعم فرضية هذا البحث. لذلك، يتم توجيه التعلم التعاوني نحو الحصول على المتعلمين تشارك في استكشاف، توظيف، وبالتالي تحسين مهارات حل المشاكل التعاون بينهما. وبالتالي، المشاركة الفعالة في التعلم يمكن في الواقع تعتبر بمثابة حجر الزاوية للتعليم فعال ومفيد.

كلمات المفتاح: مهارات حل المشاكل، الاداء، التعلم التعاوني

Résumé (French)

Cette recherche, qui comprend cinq chapitres, vise à montrer l'importance de la participation active à l'apprentissage pour stimuler les résultats scolaires, en exposant les étudiants de troisième cycle du Département de géologie de l'Université Mentouri à Constantine à un programme de résolution de problèmes et d'apprentissage coopératif, Qui comprend une combinaison d'activités telles que le renforcement de l'équipe et les activités stimulantes. Nous voulons inciter les apprenants à participer activement à des tâches stimulantes, qui nécessitent l'application de compétences en résolution de problèmes et de coopération, puis voir l'effet du programme de formation sur La performance scolaire des apprenants. L'objectif général qui guide toute la recherche est que les apprenants apprennent mieux grâce à des activités pratiques spécialement conçues pour améliorer les compétences en résolution de problèmes et l'apprentissage coopératif. La résolution de problèmes coopératifs offre aux apprenants de véritables possibilités d'explorer et de pratiquer des compétences en résolution de problèmes, à savoir des compétences de raisonnement déductif et des compétences de raisonnement inductif, dans un environnement d'apprentissage coopératif. Les apprenants favorisent les compétences d'apprentissage coopératives, telles que les interactions interconnectées positives, l'interaction en face-à-face, la communication et l'équipe travaillant tout en traitant des problèmes nécessitant une réflexion approfondie et des compétences en résolution de problèmes. Notre conception de recherche étudie l'effet d'un programme de formation sur le rendement scolaire des apprenants. Ainsi, l'apprentissage coopératif vise à inciter les apprenants à améliorer leurs compétences en résolution de problèmes et leurs compétences coopératives, de sorte que la participation active à l'apprentissage est considérée comme la pierre angulaire d'un apprentissage efficace et significatif.

Mots clé : déduction, induction, motivation, coopération