# **The Effectiveness of Learning-for-use Model in** Developing Information Generation and Assess**ment Skills in Science and the Habits of mind for Second Preparatory Grade Students**

Omima Mohamed Afifi Ahmed[1]

**Abstract**

This research aimed to develop information generation and assessment skills in science and the habits of mind for second Preparatory grade Students by using" learning-for-use model". The unit " Periodicity of elements and their properties " in science textbook" 1st term "( 2014-2015) for second preparatory students was selected , then "the learning materials" learner and teacher guides were prepared according to" learning-for-use model" .To achieve the aim of the research instruments of research were built " information generation and assessment skills in science test and the habits of mind measure" . Participants were (116) students in Giza governorate . Results of research showed " large effect size and effectiveness of " learning-for-use model" in developing information generation and assessment skills in science and the habits of mind for second Preparatory grade Students.

**Keywords:** learning-for-use model - information generation and assessment skills in science - habits of mind - Preparatory school Students.

[1] Assistant professor of Curricula and Teaching Science, Faculty of Graduated Studies for Education, Cairo University

## Introduction

In today's era, humanity is facing a great scientific and technological revolution that surpassed the previous revolutions. This revolution requires individuals with a strong scientific base to cope with the rapid and consequential changes and developments resulting from this revolution, and the transition from a culture of received information to a culture of information generation and assessment using habits of mind .

Information generation and assessment skills are important in the teaching and learning of academic subjects in general and science subject in particular; because they make learning meaningful for students, helps them to be a positive participant in the learning process and able to search and explore information not passive recipients, increase motivation to learn , are fundamental bases in the performance of tasks not only in learning, but in different areas of life science it is necessary to solve problems effectively, as it helps to produce new, deep and innovative solutions for problems rather than traditional solutions. They support lifelong learning and make the sense of pleasure produced by the mind more than the completion of memorizing information produced by someone else (Jarwan, ,2016,208-228; Sharma, & Rani, ,2017,156).

The information generation and assessment skills are among the most important indicators of the standards of the graduates of the basic education stage in Egypt represented in the field of thinking: The first standard "dealing with knowledge" and in the field of lifelong learning: the first standard" learning for the development of learning skills" and

the second standard "learning to be"( Basher, et al., 2011, 136-156),So Many studies confirm the importance of developing them in science such as(Sadiq, ,2016; Jad al-Haq,2016; Danior,2014)

Costa & Kallick (2008) noted that the neglect of the use of mental habits cause a lot of deficiencies in the educational process results. Mental habits not possessing information but is figuring out how to work it and use it well. It is a pattern of smart behaviors that leads the learner to produce knowledge, not a previous pattern. They believe that the habits of mind focus on how to act when a student does not know the correct answer. In addition, the call for modern education methods to be mental habits is a major objective in all levels of education starting from primary education . Some educational projects have adopted the mind as the basis for the educational development of habits , such as: projects of scientific culture or "Science Education to All Americans " "project (2061)". Foundation of American Scientific Progress (1993), And the Elizabeth Queen Project (2004) (AbdulMotlb ,2016, 228-229).

Many studies confirm the importance of habits of mind and developing them such as(AbddulMotlb ,2016**;** Vollrath ,2016)

Science teachers should therefore design real learning tasks that engage learners and challenge them to be creators of knowledge rather than consumers. When learners are challenged, they use the habits of the mind to improve the ways in which they generate scientific knowledge, and then learning becomes meaningful and moves to their lives outside the science' classroom.(Costa&Calick,2008,16).

Edelson's model of learning- for- use is one of instructional models that can contribute to the development of information generation and assessment skills in science and the habits of the mind. Learning- for- use model is a framework for instructional design and methodological design to acquire knowledge that will be accessible and usable in situation where it is useful. The model is based on cognitive theory and constructivist approach of teaching. The model focuses on integrating cognitive content and learning processes supported by varied inquiry learning activities, that give learners the opportunity to develop their experiences in realistic situations that work towards a deeper understanding of the scientific content .It focuses on the learner building of his/her own scientific knowledge through his/her direct and indirect interaction with others, and it encourages the use of knowledge and application, giving the opportunity for learners to think , reflect and compare the previous knowledge with the new learning knowledge . the model has a three-step process which are " motivation, knowledge construction, and knowledge refinement step".(Edelson , 2001,358-359; Edelson,et al.,2002 )

Some studies have demonstrated the effectiveness of the learning- for- use model in achieving some goals of science education " such as: treatment of misconceptions, acquisition of chemical concepts, achievement of science , reflective thinking, critical thinking skills and attitude towards chemistry". These studies are (Edelson ,2001; Edelson et.al., 2002; Adili &Ba'arah ,2007; Saleh,2013; Marasigan & Espinosa ,2014).

**Sense of the research problem**

It is clear from the above the importance of developing the information generation and assessment skills in science and the habits of mind as two objectives of teaching science. But the reality of science teaching is still focused on indoctrination by the teacher and memorization by the learner, neglecting the development of thinking skills and habits of mind, This is confirmed by the latest conferences of scientific education (Hassanein, 2016; Rashid, 2017). This is also confirmed by many studies (Sadiq ,2016; Taha ,2015; Fergaly ,2013; Omar,2017; Mahmoud ,2015; Ramadan ,2014), and these studies emphasized the importance of developing information generation and assessment skills and habits of mind . The researcher was confirmed from the previous by conducting pilot study on (120 1st , 2nd and 3rd preparatory grade students in Giza governorate at the second semester of the academic year 2013/2014) through the application of the information generation and assessment skills in science test prepared by Al - Saadi (2004) and the habits of mind measure prepared by Abdul Wahab (2007) The results of pilot study were the shortage in information generation and assessment skills in science and habits of mind for preparatory grade students.

Therefore, the researcher seeks to identify the effectiveness of the learning -for use- model in the development of information generation and assessment skills in science and the habits of mind for Preparatory grade Students; since to the researcher's knowledge , there is no Arab or foreign study done this research.

**Problem of the research**

The problem of this research is the shortage in information generation and assessment skills in science and habits of mind for preparatory grade students. Accordingly, the researcher attempted to answer the following main question:

What is the effectiveness of "learning-for-use model" in developing information generation and assessment skills in science and the habits of mind for second preparatory grade students?

To answer this question, the following sub-questions were addressed:

- What is the effectiveness of "learning-for-use model" in developing information generation and assessment skills in science for second preparatory grade students?
- What is the effectiveness of "learning-for-use model" in developing the habits of mind for second preparatory grade students?

**Aims of the research :** The objectives of the present research are:

- Developing the students' information generation and assessment skills in science by using "learning-for-use model".
- Developing the students' habits of mind by using "learning-for-use model"**.**

**Definition of Terms**

After reviewing the educational literature, the procedural definitions of the research terms were defined

- ***"Learning-for-use model"*:** An educational learning model based on cognitive theory and constructivist approach of teaching that focuses on the integration of cognitive content and learning processes by focusing on inquiry learning activities. Learning goes through three main steps. The first step is "motivation", focuses on stimulating the second preparatory grade student's knowledge in science by arousing his desire and curiosity to learn. The second step is " knowledge construction " , in which the student constructs new knowledge himself by observing and communicating with others. The third step is" Knowledge Refinement " through reflection and application of this knowledge.
- ***Information generation and assessment skills in science*:** a set of mental processes and activities carried out by Second Preparatory Grade Students when confronted with some problems related to" the periodicity of the elements and their properties" unit, to produce as much information as possible, set hypotheses, predict , criticize, identify the errors and fallacies by "knowing the relevance of information to the problem, discriminate between opinion and fact, and identify the fallacy in reasoning or conclusion." These skills can be diagnosed by the score the students get at the test prepared by the researcher for this purpose.
- ***Habits of mind:*** It is defined as a set of mental skills, attitudes and values which enable second preparatory grade students to build preferences of performance and intelligent behavior from a set of options available to them when they are confronted with a problem , or when the answer or solution is not available in their cognitive structure, then applying this performance or behavior effectively

and sustainably in this approach .These habits can be diagnosed by the score the students get at the measure Prepared by the researcher for this purpose.

**Deimitations of the research**: The present research is delimited to:

- A group of (116) students" 2nd grade" from Kafr Hegazy Preparatory School at Giza governorate for the academic year 2014/ 2015.
- The unit " Periodicity of elements and their properties " in the science textbook" 1st term " for the second preparatory grade students.
- Measuring information generation skills ( fluency, hypothesizing and predicting in light of data) and assessment skills (criticizing, identifying the errors and fallacies which include" relevance of the information to the problem, discrimination between opinion and fact and identifying the fallacy in reasoning or conclusion.")which are suitable to students "research group" and can be developed through the selected unit
- Measuring habits of mind which include ten habits of Costa and Kallick (2009) classification " Persisting, managing impulsivity, listening with understanding and empathy, thinking flexibly, striving for accuracy, questioning and posing problems , applying past knowledge to new situations, thinking interdependently, creating - imagining-innovating ,taking responsible risks"; because these ten habits are suitable and can be developed for students " research group" through learning the unit " Periodicity of elements and their properties"

**Significance of the research :** This research may be important to:

- ***Science teachers:*** this research will be very beneficial to teachers by guiding them to use" learning-for-use model " in teaching science. It can direct their attention to the importance of the learning-for-use and encourage them to develop their students' information generation and assessment skills and habits of mind . This research may also help teachers to enhance and evaluate their students' information generation and assessment skills and habits of mind.
- ***Curriculum and program designers:*** this research can direct the attention of curriculum and program designers to place emphasis on the " learning-for-use model "
- ***Students:*** the direct beneficiaries of the output of this research are the students. Using the " learning-for-use model " in teaching science may help students to enhance their information generation and assessment skills and the habits of mind**.**

**Review of Literature**

The objective of this Theoretical background review is to develop a vision for using the learning - for - use model in teaching to develop information generation and assessment skills and habits of mind. The theoretical framework includes the axes of the learning- for-use model, information generation and assessment skills and the habits of the mind.

**First : Learning-for-Use (LfU) Model**

**" Edelson's Model"** Learning-for-Use (LfU) model is a design framework that was developed by Edelson to support the design of inquiry learning activities that achieve both content and process learning. ( Edelson ,2001,356) .

**Principles of Learning-for-Use (LfU) Model**

The Learning-for-Use (LfU) model is built on contemporary fundamental theories of learning , specially cognitive and situated learning perspectives. The model is based on four principles (Edelson,2001,357; Edelson, et.al., 2002; Marasigan& Espinosa,2014,53) they are:

***1. Principle 1* :** Learning takes place through the construction and modification of knowledge structures.

***2. Principle2*:** Knowledge construction is a goal-directed process that is guided by a combination of conscious and unconscious understanding goals.

***3. Principle3*:** The circumstances in which knowledge is constructed and subsequently used determine its accessibility for future use.

***4. Principle4*:** Knowledge must be constructed in a form that supports use before it can be applied.

**Steps of Learning-for-Use (LfU) Model**

The Learning-for-Use model incorporates its four principles and their implications into a description of learning. The learning-for-use model characterizes the development of useful understanding as a three-step process including (1) motivation, (2) knowledge construction, and (3) knowledge refinement. (Edelson, 2001, 358-359;Edelson, et.al., 2002)

***(1)Motivation: Experiencing the Need for New Knowledge***: The first step in learning –for- use model includes two processes (a) Experience demand. (b) Experience curiosity. The aim of the first step is recognizing the need for new knowledge. This recognition, occurs when one comes up against a limitation or gap in understanding and

one's knowledge. Reaching the limits of one's knowledge has two effects: It creates a desire (motivation) to address the limitation by acquiring new knowledge, and it creates context in memory by activating the knowledge structures for introducing new knowledge and integrating it with previous knowledge and for acknowledging the requirements of incremental knowledge construction.( Wang& Liou,2017,898; Ilhan**a**, et al.,2016). The motivation step in the LfU model addresses Principle 2: the goal-directed nature of learning. ***The researcher*** determined the role of the teacher and the learner in the motivation step as follow:

***The role of the teacher*****:** The teacher motivates learners to learn by directing them to take responsibility for learning while conducting various activities that create a demand for knowledge , excite their need to experience and curiosity and lead to their previous knowledge or misconceptions. These activities are: asking questions, doing a practical presentation, providing a brief pre- test, training students on strategy of self-questioning, allowing learners to think aloud without commenting on learners' responses" .

***Role of learners*****:** The learners respond with verbal or written response to questions , practice self-questioning, summary and think aloud during the group discussion.

***(2)Knowledge Construction: Building New Knowledge Structures***: Second step includes two processes ,which are observation and communication. This step results in the construction of new knowledge structures in memory that can be linked to existing knowledge. The learner constructs new knowledge as the result of experiences " first hand experience, communication from others, or a

combination of the two" that enable him or her to add new concepts to memory, subdivide existing concepts, or make new connections between concepts. Social constructivism theory contends that cognitive development is a social process derived from dynamic interactions and communication with more experienced people (e.g., parents, teachers, and friends) or from the use of mediator aids (e.g., books, physical models, computerized visualization, etc.). Learning can be enhanced through written and spoken discourse in settings of collaborative learning and through scaffolding.( Barak, 2017,460; Booth, 2014; Coll , et al.,2009)**.** This step in the LfU model addresses Principle 1: construction and modification of knowledge structures". ***The researcher*** determined the role of the teacher and the learner in the Knowledge Construction step as follow:

***The role of the teacher*****:** The teacher engages learners in a practical or mental inquiry investigative activity, which focuses their attention and directs them towards targeted scientific concepts. He encourges the social interaction and communication with peers within and between the groups to observe and express their interpretation of the phenomenon or scientific concepts in their own words, The teacher tries to overcome the difficulties within each group by providing appropriate scaffolding learning, The teacher directs students to connect scientific concepts with their previous concepts, i.e, to generate relationships and connections between new concepts and information stored in long-term memory.

***The role of the learners*****:** The learners engaged in activities to investigate the scientific concepts during the social interaction between the members of each group separately, and they use strategies

to summarize and explain the generated concepts. They link new concepts to their previous concepts though interaction and communication with peers in the other groups through collective discussion of the whole class with the teacher.

*(3)* ***Knowledge Refinement: Organizing and Connecting Knowledge Structures***: The third step includes application and reflection processes. This step responds to the need for accessibility and applicability in learning for use. In the refinement step, knowledge is reorganized, connected to other knowledge, and reinforced to support its future retrieval and use. To be useful, declarative knowledge must be reorganized into a procedural form that supports the application of that knowledge .Useful knowledge must also have connections to other knowledge structures that describe situations in which that knowledge applies.. Many cognitive activities can be utilized in refining knowledge such as comparing , classifying , inducing , deducing, analyzing errors , constructing supported evidence , abstracting, analyzing viewpoint . This step addresses Principles 3 and 4: the situated nature of knowledge and the need for procedural knowledge. (Alrababah, 2017,80; Karim ,et al.,2017,3 ) . ***The researcher*** determined the role of the teacher and the learner in the Knowledge Refinement step as follow:

***The role of the teacher***: The teacher provides learners with activities that create the positions of the problems which challenge them to apply new knowledge. He provides learners with opportunities to reflect upon their new knowledge and experiences retrospectively, reorganize and reindex their knowledge.

***The role of the learners*:** The learners engaged in activites to apply scientific concepts in solving the problems presented to them .They reflect on the scientific knowledge and think about them.

**Note:** the order of steps of learning –for – use model is important. To create the appropriate context for learning, motivation must precede construction, and to insure accessibility and applicability, refinement must follow construction.

**Several studies have been conducted using the "Edelson Model" learning –for- use model in teaching science**.such as: ***Edelson (2001)***, This study showed the effectiveness of a study unit based on the model in teaching earth sciences for students in middle school in Chicago. ***Edelson, et.al.( 2002)***, This study showed that there was no effectiveness of the model in the treatment of misconceptions in the earth sciences for students in middle school in Chicago. ***AbdulKarim (2003)***, This study demonstrated the effectiveness of a program based on learning requirements for use in changing perceptions of the contemporary nature of science for science pre-service teachers. ***Adili &Ba'arah (2007)***, This study demonstrated the effectiveness of the model in the acquisition of chemical concepts among ninth graders in Jordan. In his study ***Saleh(2013)***, which proved the effectiveness of the model in the development of the achievement of science and reflective thinking among intermediate students in the second grade in Saudi Arabia. In their study ***Marasigan & Espinosa (2014)***, they demonstrated the effectiveness of a modified useful-learning approach " a combination of Learning-for-Use model developed by Edelson (2001) and hypothetical -Predictive Reasoning by Lavoie

(1999)" on developing critical thinking skills and attitude towards chemistry among Preparatory School students in Philippine.

**From the previous studies,** the researcher noticed a contradiction in the results of previous studies in terms of effectiveness of the model in the development of the objectives of teaching science; so the researcher sought to identify the effectiveness of learning-for-use model in developing information generation and assessment skills in science and the habits of mind for second preparatory grade students.

**The researcher** benefited from reviewing the theoretical framework of the learning- for- use model in the preparation of teacher and student guides according to the model.

**Second : Information generation and assessment skills**

Information generation and assessment skills are important goal in science education

**Information generation skills** : They includes fluency, flexibility, hypothesizing and predicting from data**.**

***Fluency skill* :** It is the processes of generating a large number of alternatives, synonyms, ideas, problems or uses with speed and ease when responding to a particular stimulus,. Fluency is a process of optional recall of previously learned information, experiences or concepts. The most forms of fluency : verbal" words", intellectual meanings and shapes fluency (Jarwan, 2016,208-209)

**** Flexibility* :** It is the processes of generating variety of ideas or new solutions that are not of the type of ideas and routine solutions. It transforms the thinking process in response to changing circumstances and position requirements "adaptive flexibility" . It can defined as spontaneous change in the state of mind of the individual to do

something in a different way " spontaneous flexibility"( Sharma, & Rani, 2017).

***Hypothesizing and Finding Assumptions*:** Hypothesizing is a means of interpreting a phenomenon or a problem.The hypothesis is a preliminary conclusion or an unsupported statement, subject to experimentation and examination in order to arrive at a reasonable answer or a principle that explains the ambiguity of the situation or problem. The assumption is that an idea or information is well known so that it can be used to solve a problem or to prove the validity of an issue. (Jarwan, ,2016,213-215).

***Predicting :**The skill of prediction in the light of the data means the processes of reading the data or the available information and reach to the reasoning beyond it in one of the following dimensions (time - subject - sample and society) (Jarwan, ,2016,216-218).

**Information assessment skills:** they include (criticizing, identifying the errors and fallacies )

***criticizing :** It is a process of reflection that involves careful examination of a subject in order to identify its strengths and weaknesses by analyzing and evaluating the subject based on criteria that serve as a basis for criticizing or judgment. The criteria that normally form the basis of the provision may be clearly defined or understood from the language used to criticize the subject. The process of criticizing depends to a large extent on the information base for students on the subject of criticizing ( Facione ,2015,6-10 ).

***recognition the errors and fallacies :** It includes

***a. discriminating between opinion and fact :***The learner needs effective training and practice to acquire the necessary skill to be able

to identify words or expressions that are fixed facts, and those that express the views or opinions of his or her colleagues .Thus, it is necessary to clarify the general criteria that constitute a boundary between facts and opinions. ( Marasigan& Espinosa,2014,41,)

***b. Contradiction or inconsistency*:** Contradictions in any written, audible or visual material simply mean that there is a conflict or inconsistency between two things or two ideas that cannot be valid at the same time. (Jarwan, ,2016,225).

***c. Linking information to problem*:**. If the learner is unable to sort out the information related to the access requirements to solve the problem from that marginal or misleading information, he or she may lose control of the situation, become confused and distracted, and thus will not be able to resolve the problem correctly. Thus, the skill of identifying information unrelated to solving the problem is an important skill of evaluative thinking as a component of critical thinking. (Facione ,2015,6-10 )

***d. identifying the fallacy in reasoning or conclusion:*** Logical reasoning is a process that involves drawing conclusions based on the evidence, and people often rush to reach conclusions that are not justified by the evidence. The erroneous conclusions come in several forms, including :the assumption that something would not have happened if not preceded by other events , the assumption that the whole thing has the characteristics of each part of its parts, the assumption that the characteristics of the whole thing apply to each case that belongs to the whole . the assumption that the presence of a property in athing entails the existence of another property. and use

correct hypotheses in a way that leads to false conclusions (Facione ,2015,6-10 ).

**Science education and development of information generation and assessment skills:** Due to the importance of information generation and assessment skills as a goal of science education. Several studies have been interested in its development using various approaches, models, strategies and teaching methods among learners in the different educational stages such as**:** ***Taha (2015)*** is study confirmed the effect of the interaction of mental maps and the pattern of thinking and learning in the development of the skills in chemistry among secondary students. In her study ***Fergaly (2013)*** confirmed the effectiveness of active learning strategies in the development of skills among first grade secondary students in biology.In her study ***Al-Amoudi (2012)*** confirmed the effectiveness of the Witley model in the development of information generation skills in chemistry among the third grade secondary students. In his study ***Mansour (2010)*** confirmed the impact of physics based on systemic approach on the development of generating ideas and evaluation skills among secondary school students. **From the previous studies,** the researcher noticed that -Within the limits of the researcher's knowledge- there wasn't any Arab or foreign study that was interested in developing the information generation and assessment skills using the learning –for-use model, which indicates the importance of conducting the current research.

**The researcher** benefited from reviewing the theoretical framework of information generation and assessment skills in preparing the test of measuring skills and the preparation of teacher and student guides .

**Third : The habits of mind**

The development of the habits of mind is one of the goals of science education, which should be developed for the learner throughout his life to use it in dealing with various situations in daily life. And not affected by everything that is said, especially in the age of globalization. One of the features eligible for entry into this age is the need to possess mental habits to deal with contradictions in intellectual, scientific and ethical issues in society ( Mazen,2011,333)

**Classification of habits of mind:** there are different Classification **such as :** Marzano's Productive habits of mind classification(Alrababah , ,2017,80-81), Hyerle's classification (Hyerle ,2009) , Costa and Kallick classification **(Costa & Kallick ,2009)**. The researcher will detail the last classification because it is the most comprehensive classification.

**Costa and Kallick classification of the habits of mind**

Costa and Kallick classify the habits of the mind according to (16) intelligent behavior of effective thinking (Costa & Kallick, ,2008,24-37; Costa & Kallick ,2009,8-13; Nofal, 2010; Costa, 2012; Vollrath, 2016,29-42).They are:

***1. Persistence*:** It means the commitment of individuals to the task entrusted to them until they completed it and not surrender easily, the ability to analyze the problem and develop a system or structure or strategy to solve them, possessing a number of alternative strategies to solve problems and use them, collecting evidence on the success of the strategy followed and retreating from that strategy if it does not resolve the problem.

***2. Managing Impulsivity***: It means thinking and thinking before solving the problem that individuals face. Establishing a vision for a plan of action, goal or direction before starting , struggling to clarify and understand their own guidelines, developing a strategy to deal with the problem by postponing giving immediate judgment on that idea until it is fully understood, and examining alternatives and results for a number of possible directions before acting.

***3.Listening with Understanding and Empathy***: It means the vision of the various viewpoints of others transparency, and polite attention to the other person by showing understanding and empathy with his idea, or by rephrasing this idea accurately, adding another meaning to it, clarifying it, or providing an example .

***4.Thinking flexibly*** : It means having the ability to change views when receiving additional data, engaging in multiple activities at once, relying on problem-solving strategies, and exercising flexibility by estimating when a broad thinking is appropriate and when the situation requires detailed accuracy, the creation and pursuit of new approaches.

***5.Thinking about Thinking (Meta cognition )*:** It means the individual's Awareness of his actions and its ability to prepare internal questions during the search for information and meaning. As stated by Costa & Kallick (2008), "The major components of meta cognition when confronted with a problem to solve are, developing mental maps or action Performance plans, maintaining that plan in mind over time, then reflecting on and evaluating the plan.

***6. Striving for Accuracy and Precision***: It means taking sufficient time to check over work, paying attention to detail, recognizing and

correcting inaccuracies, reviewing the rules or the models to be followed to ensure that the final products match those standards fully, adding greater clarity to their final product and follow-up continuous learning to reach that work and complete the task entrusted with mastery.

***7. Questioning and Posing Problems*:** It means finding and solving problems by asking questions that fill the gaps between what the individual knows and what is not known, the attention and awareness of the mind of the surrounding contradictions and phenomena in the environment and exploring the reasons behind them . Asking questions that assess causal connections and relationships such as questions about how? When ? what's the reason ? What is the result?

***8. Applying Past Knowledge to New Situation*** : It means referring to prior knowledge and experience, extracting meaning and move it forward and then apply it to a new situation or another context to solve problems; in order to make learning connection.

***9.Thinking and Communicating with Clarity and Precision* :** It means the individuals express themselves accurately through both writing and speaking, think critically, support statements with explanations, labels , analogies, comparisons, quantitative measurements and evidence. use precise language, getting their point and information communicated with precision and understanding. They avoid over- generalization , delisting and Distorting .

***10. Gathering Data through All Senses*:** It means collecting information and most of the linguistic, cultural and physical learning from the environment occur through observation and comprehension

of objects through the sensory pathways: taste, olfactory, tactile, auditory, visual.

***11. Creating, Imagining, Innovating***: It means introducing new solutions to problems in a different way, examining alternative possibilities from several angles, taking risks, expanding perceived boundaries, driving with internal motivations not with external motives, working to meet the challenge, not for the sake of reward, openness to criticism and asking for feedback from others, perseverance in order to achieve more fluency, detail, novelty, simplicity, craftsmanship, perfection, beauty, harmony, and balance.

***12. Responding with Wonderment and Awe*:** It means students respond with enthusiasm and passion when learning and mastering subjects in the classroom, they love learning, solve and create problems, enjoy figuring out things themselves, and strive in becoming a continuous lifelong learner.

***13. Taking Responsible Risks* :** It means students place themselves in uncertain situations that may result in failure; although they view setbacks as challenging and growth producing. The act of taking educated risks incorporates the intertwining of habits through drawing on past knowledge, striving for accuracy and a strong motivation to move beyond thinking. This requires a secure environment that is free of judgment and acceptance of ideas.

***14. Finding Humor*:** It means the liberation of creative energy, and requires the search for everything that is new and which helps to entertain self-stability and happiness with different discoveries. Humor is described as a flexible tool and effective communicator for

maintaining attention, expressing ideas, communicating difficult information, and helping in the growth of social skills for students.

***15. Thinking Interdependently*:** It means increasing ability to think in harmony with others, communicate with others and sensitivity to their needs, the ability to justify ideas, test the validity of strategies for another solutions, and listen to and seek collective opinion and give up an idea to work on someone else's idea, empathy, compassion, collective leadership and altruism.

***16. Remaining Open to Continuous Learning*** : It means trust coupled with curiosity that allows continuous search for newer and better ways, a constant struggle for improvement, growth, learning, adjustment and self improvement, perceiving of problems, situations, conflicts and circumstances as valuable opportunities for learning. Knowing the lack of knowledge and not fear of it, but recognition of it .

***The researcher*** limited to the development of ten habits of mind from the habits of Costa and Kallick which suit the age of learners and can be developed through the unit selected.

**Science Education and the Development of Habits of Mind**

Due to the importance of habits of mind as a goal of science education, many studies have been interested in its development using various approaches, models, strategies and teaching methods among learners in the educational stages such as ***Omar(2017)*** is study confirmed the effectiveness of a strategy based on thinking maps of teaching science on the development of the Marzano's Productive habits of mind for the preparatory second grade pupils. **Mahmoud**

**(2015)** is study confirmed effectiveness of teaching science using the strategy of generating ideas "Scamper" on the development of habits of mind for the preparatory first grade pupils. In her study ***Ramadan (2014)*** confirmed impact of Skamper's strategy on the development of some habits of mind in science for primary four grade students.In her study ***El Baz (2014)*** confirmed impact of the use of teaching differential on the development of some of the habits of mind among primary four grade students of different achievement in science.

***From the previous studies,*** The researcher noticed that -Within the limits of the researcher's knowledge- there wasn't any Arab or foreign study that was interested in developing the habits of mind using the learning –for- use model, which indicates the importance of conducting the current research.

***The researcher*** benefited from reviewing the theoretical framework of the habits of mind in preparing the habits of mind measure, teacher and student guides.

**Research Hypotheses**

To solve the research problem and answer the research questions, the researcher tested the following hypotheses:

1. here is a statistically significant difference between the mean score of the experimental and control groups in the post-administration of the information generation and assessment skills in science test in favor of the experimental group.
2. There is a statistically significant difference between the mean score of the experimental group in the pre and post

administration of the information generation and assessment skills in science test in favor of the post administration .

3. There is a statistically significant difference between the mean score of the experimental and control groups in the post-application of the habits of mind measure in favor of the experimental group.
4. There is a statistically significant difference between the mean score of the experimental group in the pre and post administration of the habits of mind measure in favor of the post application

**Methodology**

To answer the questions of the study and check the validity of its hypotheses, the following procedures were followed:

**First**: **Reviewing literature and related studies** : to "learning-for-use model" , information generation and assessment skills in science and the habits of mind.

**Second: Selecting the scientific content**: the unit " Periodicity of elements and their properties " was selected, which is a unit from the second grade, Preparatory stage textbook ( 1st term ) for the academic year 2014/ 2015.This unit is selected because the unit's topics contain many scientific concepts that represent a scientific basis for the following years. The teaching time of the unit is relatively large and it contains many activities and practical experiments in which the students can use many mental processes to generate and assess information and practice the habits of mind.

***Analyzing the content of the unit**: Preparing the student's and teacher's guide and the research instruments necessitated content analysis of the unit.

***a. The aim of content analysis:*** Identifying and extracting the objectives and basic concepts through adhering to the operational definition of the content and the verbal connotation of each concept according to what is mentioned in the textbook.

***b. Reliability of the content analysis****:* Content analysis was conducted by the researcher twice with a three weeks interval using the same procedures and the principles of content analysis of the first one. Cooper's equation ratio of agreement (Abu Allam, 2011, 485) was applied to find out the relationship between the results reached in the two analyses. The correlation coefficient was (0.94) which is an acceptable one and indicates reliability of the analysis

***c. Validity of the content analysis****:* After finishing the content analysis of the unit, The researcher confirmed the validity of the analysis through another researcher * analysis and the ratio of agreement between the analyzes was (91%), which can be trusted and indicates validity of the analysis. Thus, the scientific concepts were put in their final form in the list with their verbal connotation (Appendix 1).

**Third: Preparation of the learning materials**: It included the student's and teacher's guides

**1- Preparation of the student's guide according to the learning-for -use model:** The researcher formulated the procedural objectives of the unit in the light of the previous analysis of the unit" Periodicity of elements and their properties " and then reformulated the unit in

the form of educational learning activities according to the steps of the "learning- for -use" model, which aimed to develop the skills of generating and evaluating information in science and the habits of reason as follows:

***Motivation activities*:** Students responded with verbal or written response to questions , practiced self-questioning, summarized and thinked aloud during the group discussion .They practiced fluency, hypothesizing and predicting skills and practiced the habits " Persisting, listening with understanding and empathy and questioning and posing problems "

***Knowledge Construction activities*:** Students investigated the scientific concepts during the social interaction between the members of each group separately, and with peers in the other groups, and tryied to link them to their previous concepts**.** They practiced science processes" observation ,classification, communication, predicting, inferring, using number, hypothesizing , controlling variables, interpreting data , experimenting and Procedural definition" which Contribute in developing generation and assessment skills. They also practiced most of the ten habits.

***knowledge refinement* activities:** Students applied scientific concepts in solving the problems presented to them. They reflected on the scientific knowledge and thought about them. They practiced " skills of criticizing, relevance of the information to the problem, discrimination between opinion and fact and identifying the fallacy in reasoning or conclusion". They practiced the habits of "applying past knowledge to new situations, thinking interdependently and creating-imagining - innovating , thinking flexibly or one of ten habits ".

After preparing the student's guide, it was submitted to a panel of jury(experts and professors in curricula and methods of Science teaching) (Appendix 2) to establish its appropriateness for achieving the desired aims of the current research, suitability of the educational activities, evaluation techniques and the language used. The researcher modified the student's guide as directed by jury till the guide appeared in its final form (Appendix 3).

**2- Preparation of the teacher's guide according to the learning-for -use model**: It was prepared for the teacher to follow while teaching the selected unit. It included:

***a. An introduction***: This included the aim of using the guide and some general guidelines for the teacher about how to implement the lessons according to the learning- for -use model.

***b. Aims of teaching the topics***: The general aims for teaching the topics were identified and presented in the teacher's guide.

**c. A time plan for teaching the topics**: A timeline was prepared according to the time plan identified by the Ministry of Education which specified five weeks: four periods a week for teaching the unit.

***d. Lesson plan:*** the lessons were organized so that each includes a title, operational objectives, the materials needed, procedure of teaching according to "the learning- for -use model" and lesson evaluation.

***Validating the teacher's guide**: the guide was submitted to a panel of jury to get their opinion concerning correctness of the objectives and appropriateness of the activities, appropriateness of the lesson plan according to "the learning- for -use model", suitability of the

worksheets to the teaching activities and suitability of the evaluation tasks.

The jury gave some comments, and the modifications related to the activities were carried out. The final form of the guide is in (Appendix 4).

**Fourth : Preparation of the instruments of the research:** To identify the effectiveness of " learning-for-use model" in developing information generation and assessment skills in science and the habits of mind for second preparatory grade students, two instruments were prepared the information generation and assessment skills test and the habits of mind measure. The following procedures were followed:

**1- Preparation of information generation and assessment skills test**

This test was prepared as follows:

**Identifying the aim of the test:**

This test aims at measuring information generation and assessment skills in the unit" periodicity of elements and their properties" for second preparatory grade students.

**Identifying information generation and assessment skills :** After reviewing literature and previous related studies**,** seven sub-skills **were identified**: Information generation skills ( fluency, hypothesizing and predicting in light of data) and assessment skills (criticizing, relevance of the information to the problem, discrimination between opinion and fact and identifying the fallacy in reasoning or conclusion.") .

**Formulating the test items:**Since each skill of information generation and assessment has a special nature, the formulation of its

items varies according to each skill as follows: ***For fluency skill*** : items were formulated in the form of open –ended questions**,** and many possible numbers of answers were requested in the shortest possible time . ***For hypothesizing*****:** items were formulated in the form of situations or problems, each of which was followed by four possible causes. and the learners were asked to judge which of these hypotheses was possible or unlikely. ***For predicting in light of data***: items were formulated in the form of situations or problems, each of which was followed by four results and the request for judgment on which of these results was expected or unexpected. ***For criticizing*** : items were formulated in the form of a number of statements that included expression of some information and the request to express opinion in terms of support or opposition for each statement. ***For relevance of the information to the problem*** : items were formulated in the form of a set of problems, each problem was followed by four information and a request was made to determine which information was related to the problem and which was not related . ***For Discrimination between opinion and fact***: items were formulated in the form of a number of statements and a request was made to determine which one is an **opinion** and which is a fact. ***For identifying the fallacy in reasoning or conclusion*** : items were formulated in the form of scientifically correct statements followed by reasoning or conclusion and a request to determine the validity or inaccuracy of this reasoning or conclusion .

**Test validity:** To check the test validity, it was submitted to a panel of jury to validate the comprehensiveness of the items, their suitability to the aims, preciseness of their formulation, their

relationship to the sub-skills and preciseness and clarity of instructions. In light of the jury' opinions, modifications were made and the test included 50 items.

**Piloting the test:** The test was administered to a piloting group that consisted of 45 second preparatory grade students at Mansheyet Al-Qanater educational directorate, Giza Governorate, who finished studying the unit" in the academic year "2013-2014" according to the traditional method . The following are the results :

***a. Test reliability:*** Test reliability was calculated by using Cronbach's Alpha formula (Ali, 2010, 579). Reliability coefficient was 0.77 which is an acceptable and suitable one and indicates reliability of the test for application and measuring the second preparatory grade students information generation and assessment skills in science.

***b. The time needed for answering the test:*** This was calculated by estimating the average of the time taken by the students. The average was "55 minutes" including reading the test instructions.

**The test correction :** For the fluency skill, half degree for each correct answer was given "the maximum correct answers are 4". For hypothesizing, prediction in light of data, and the relevance of information to the problem skills ", half degree was given for each correct answer for each alternative. For criticizing, discrimination between opinion and truth and the identifying of fallacy in reasoning or conclusion" were given a degree for each item to be answered correctly.

**The final version of information generation and assessment skills test** In light of the previous results, the test in its final form consisted of 50 items((Appendix 5). the maximum score of the test was "70 "

and the minimum score was zero . Table (2) shows the specifications of information generation and assessment skills test.

***Table 2: Specifications of information generation and assessment skills test***

| Skills of the test | No. of items | score of each item | Total score | Hundred percent |
|---|---|---|---|---|
| 1-Fluency | 5 | 2 | 10 | 10% |
| 2- hypothesizing | 5 | 2 | 10 | 10% |
| 3- Predicting in light of data | 5 | 2 | 10 | 10% |
| 4- Criticism | 10 | 1 | 10 | 20% |
| 5- Relevance of the information to the problem | 5 | 2 | 10 | 10% |
| 6-Discrimination between opinion and truth | 10 | 1 | 10 | 20% |
| 7- identifying the fallacy in reasoning or conclusion | 10 | 1 | 10 | 20% |
| Sum. | 50 | | 70 | 100% |

**2- Preparation of the habits of mind measure:**

The habits of mind measure was prepared as follows:

**The aim of measure:** It aims at assessing the habits of mind to identify the effectiveness of learning –for- use model in developing the habits of mind for second preparatory grade students.

**Identifying the dimensions of the measure:** After reviewing literature and previous studies related with the habits of mind "10 habits of mind were identified " ,which included "persisting, managing impulsivity, listening with understanding and empathy, thinking flexibly, striving for accuracy, questioning and posing problems , applying past knowledge to new situations, thinking interdependently, creating, imagining and innovating ,taking responsible risks"**.**

**Identifying the kind of the measure items and formulating them:** The items of the measure were formulated in the form of a number of statements to indicate the performance of students and their practice

of the ten habits, the researcher took into account that each statement has one idea . The measure contained negative and positive statements and revealing statements to verify the seriousness of the response. The response was selected from a three-point Likert scale (agree, unsure , don't agree). The students have to choose the response that matches their own opinions. The measure consisted of 50 items. Twenty six items are positive while 24 are negative.

**Writing the instructions of the measure :** The instructions of the measure were written in clear language that makes it easy for the students to answer. It also included an illustrative example to help the student. **Validity of the measure:** the measure was submitted to a group of jury for checking validity of the items, their preciseness, comprehensiveness and suitability for the intended dimensions of the scale, appropriateness of the language to the preparatory stage students. The jury gave their opinions and the measure was modified in the light of their opinions. **Piloting the measure:** The measure in its first form was administered to a piloting group the same pilot group of the generation and assessment skills test"; in order to find

***a. the measure's reliability*:** measure reliability was calculated by using Cronbach's Alpha formula (Ali, 2010, 579). Reliability coefficient was 0.73 which is an acceptable one. Thus, the measure is applicable.

***b. Duration of the measure***: The average time for all the students to finish responding to all the items of the measure was 45 minutes including reading instructions.

**Scoring the measure**: The positive statements are given three score for "agree", two for "unsure", one for "don't agree respond" .Scoring

is reversed for the negative items. Thus, the maximum score for the scale was 150 and minimum score was 50.

**The final version of the habits of mind measure:**

After making the required modifications, the final version of the habits of mind measure was prepared (Appendix 6). Specifications are presented in table 3.

***Table 3 : specifications of the habits of mind measure***

| No. | Habits of mind | Positive items | Negative items | Total | Total score | Percentage |
|---|---|---|---|---|---|---|
| 1 | Persisting. | 2,3,4 | 1,5 | 5 | 15 | 10% |
| 2 | Managing impulsivity. | 8,10 | 6,7,9 | 5 | 15 | 10% |
| 3 | Listening with understanding and empathy. | 11,13,16 | 12,14,15 | 6 | 18 | 12% |
| 4 | Thinking flexibly. | 17,19,21 | 18,20,22 | 6 | 18 | 12% |
| 5 | Striving for accuracy. | 23,26 | 24,25 | 4 | 12 | 8% |
| 6 | Questioning and posing problems. | 28,29,30 | 27,31,32 | 6 | 18 | 12% |
| 7 | Applying past knowledge to new situations | 33,35,37,38 | 34,36 | 6 | 18 | 12% |
| 8 | Thinking interdependently. | 39,41 | 40,42 | 4 | 12 | 8% |
| 9 | Creating, imagining, innovating. | 43,46 | 44,45 | 4 | 12 | 8% |
| 10 | Taking responsible risks. | 47,49 | 48,50 | 4 | 12 | 8% |
| | Total | 26 | 24 | 50 | 150 | 100% |

**Fifth: Selection of the population and research group**

The research population was general education preparatory stage, second graders. **Participants are** one hundred – sixteen(116) Grade 2 students at Kafr Hegazy Preparatory School, in Manshaet El Kanater Directorate , Giza governorate participated in the research. Participants are students in two different classrooms, (58) students from class ( 2/1) represented the experimental group (EG) whereas the control group (CG) consisted of (58) students from class (2/2). The

students were purposively sampled. Having been drawn from the same geographical set up, the students were of the same economic status.

**Sixth : Research Design**

The Research followed the descriptive method in identifying the theoretical frame of the research . It also used pre/ post two groups (experimental and control) design to control the variables and to compare between experimental group which studied with" learning-for-use model " and control group which study with the traditional teaching methods.

**Seventh : Field Application**

The field application has gone through the following stages:

**1. Pre-using of the learning-for-use model:** It had been through:

a- The researcher meeting with the science teacher of the experimental group to clarify the purpose of the research, its importance and philosophy, how to use the teacher's guide according to the model, and how to train the students to use it.

b- Training students to use the learning-for-use model.

**2- Pre- administration of the instruments**

The instruments of the research (information generation and assessment skills in science test and the habits of mind measure ) were administrated to the experimental and the control groups before teaching the unit on 21/9/2014 to get data related to homogeneity of the groups. Table (4) presents data on the results of the pre-application of the instruments.

***Table 4: Mean scores, standard deviations and t-values of the research instruments' pre score for the experimental and the control groups***

| Istruments | Total score | C.Group $N_1$=58 | | E. Group $N_2$=58 | | T-value |
|---|---|---|---|---|---|---|
| | | mean | SD | mean | SD | |
| skills test | 70 | 3.30 | 0.42 | 3.39 | 0.37 | 1.27 |
| Habits of mind Measure | 150 | 54.05 | 3.38 | 54.89 | 4.32 | 1.17 |

Table (4) shows that there are no a statistically significant differences at the 0.01 level between the mean score of the experimental and the control groups in the pre- administration of the research instruments (information generation and assessment skills in science test and the habits of mind measure). This indicates that the two groups were homogeneous before conducting the experiment.

**3. Teaching the experimental group:** At this stage, the research experiment began on 22/9/2014, where the experimental group studied the unit using the learning-for-use model by the class teacher, while the control group studied the unit with the another class teacher, with traditional teaching methods which depending on summarizing and using some activities and practical presentations by the teacher. The researcher took into account the equivalence of the two teachers in terms of teaching experience, as well as the equal teaching time for the experimental and control groups (20 periods), which was decided by the Ministry of Education. The study ended on 2/11/2014. The researcher was keen to follow up the two groups.. It was noted that the

students of the experimental group were interested in learning using the learning-for-use model and gradually mastering their steps.

**4. Post- administration of the instruments of the research:** After the research experiment ,the two tools: information generation and assessment skills in science test and the habits of mind measure were administrated to the experimental and the control groups on 5/11/2014 and 6/11/2014, and data were statistically treated.

**Results of the study and their interpretations**

This section presents results of the research in terms of its hypotheses

**First : Results of the administration of the information generation and assessment skills in science test.**

***Checking the validity of the first hypothesis:**

To verify the validity of the first hypothesis, means and standard deviations of the post score of the information generation and assessment skills in science test for the experimental and the control groups were calculated. In addition , t-values for non-paired groups and effect size were also calculated. Table(5) presents these results.

***Table 5: Means, standard deviations , t-values and effect size of the information generation and assessment skills in science test ' post score for CG and EG***

| skills | Total score | C. Group $N_1$=58 | | E. Group $N_2$=58 | | T-value* | Effect size D |
|---|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | | |
| Fluency | 10 | 1.55 | 1.17 | 9.89 | 0.20 | 53.24* | 9.97 |
| Hypothesizing | 10 | 4.30 | 0.83 | 8.57 | 0.72 | 29.49* | 5.52 |
| Predicting in light of data | 10 | 4.54 | 1.26 | 8.45 | 0.60 | 21.21* | 3.97 |
| Criticizing | 10 | 1.97 | 0.65 | 8.76 | 0.58 | 59.00* | 11.05 |
| Relevance to the problem | 10 | 5.02 | 0.82 | 8.80 | 0.76 | 25.83* | 4.84 |
| Opinion and fact | 10 | 2.15 | 0.71 | 8.75 | 0.73 | 48.96* | 9.17 |
| The fallacy in reasoning | 10 | 2.55 | 0.95 | 8.63 | 0.66 | 39.66* | 7.43 |
| Total test | 70 | 22.08 | 1.96 | 61.86 | 1.23 | 130.85* | 24.50 |

***T-value is significant at the 0.01 level**

It is clear from Table(5) that there is a statistically significant difference at the 0.01 level between the mean score of the experimental group and those of the control group in the post application of the information generation and assessment skills in science test in favor of the experimental group. The highest t-value was (130.85) for the test as a whole whereas the lowest was( 21.21) for " the sub skill: the predicting in light of data " which is significant at the 0.01 level. Effect size was more than 0.8 in the sub skills and the test as a whole which indicates a large effect of "learning-for-use model" in developing information generation and assessment skills in science for second preparatory grade students. Thus, ***the first***

***hypothesis is accepted.***

***Checking the validity of the second hypothesis:** To check the validity of the second hypothesis, means, standard deviations of pre-post score of the test for the experimental group were calculated. In addition, t-value for paired groups and effect size were also calculated as in table

***Table 6: Means, standard deviations , t-values and the effect size of the information generation and assessment skills in science test' pre-post score for EG***

| skills | Total score | Pre- administration N=58 | | Post- administration N=58 | | T-value* | Effect size d |
|---|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | | |
| Fluency | 10 | 0.49 | 0.32 | 9.89 | 0.20 | 189.71* | 50.25 |
| Hypothesizing | 10 | 0.41 | 0.20 | 8.57 | 0.72 | 83.04* | 22.00 |
| Predicting in light of data | 10 | 0.40 | 0.20 | 8.45 | 0.60 | 96.27* | 25.50 |
| Criticizing | 10 | 0.50 | 0.32 | 8.76 | 0.58 | 93.94* | 24.88 |
| Relevance to the problem | 10 | 0.50 | 0.00 | 8.80 | 0.76 | 83.13* | 22.02 |
| Opinion and fact | 10 | 0.60 | 0.37 | 8.75 | 0.73 | 75.00* | 19.87 |
| The fallacy in reasoning | 10 | 0.49 | 0.32 | 8.63 | 0.66 | 84.00* | 22.25 |
| Total test | 70 | 3.39 | 0.37 | 61.86 | 1.23 | 346.21* | 91.71 |

It is clear from Table (6) that there is a statistically significant difference at the 0.01 level between the mean score of the experimental group in the pre and post administration of the information generation and assessment skills in science test in favor of the post administration. The highest t-value was (346.21) for the test as a whole whereas the lowest was(75.00) " the subskill: discrimination between opinion and fact skill" which is significant at the 0.01 level. Effect size was more than 0.8 in the subskills and the

test as a whole which indicates a large effect of "learning-for-use model" in developing information generation and assessment skills in science for second preparatory grade students. Thus, ***the second hypothesis is accepted.***

***Effect size and effectiveness of " learning-for-use model" in developing information generation and assessment skills in science**

To find out the effectiveness of " learning-for-use model" in developing information generation and assessment skills in science, "Black's modified gain ratio" was calculated. Table (7) shows this.

***Table 7 :Means, t-value ,η2, the effect size and Black's modified gain ratio of the information generation and assessment skills in science test' pre-post score for EG***

| Independen-t variable | Dependent variable | Total score | Pre-Mean score | Post-mean score | T-value | η2 | Effect size d | Gain ratio |
|---|---|---|---|---|---|---|---|---|
| The model | skills | 70 | 3.39 | 61.86 | 346.2 | 0.99 | 91.71 | 1.72 |

Table (7) shows the large effect size (91.71) of the independent variable" learning-for-use model" in the development of information generation and assessment skills in science, as measured by the skills test. 99% of the total variance of skills as a whole is due to the effect of the " learning-for-use model". Black's modified gain ratio" for the skills (1.65), which is more than the minimum identified by Black (1.2) , This indicates the effectiveness of " learning-for-use model" in developing information generation and assessment skills in science for second preparatory grade students. ***The first question of research was***

***answered.***

**This result of the research is consistent with the results of the studies conducted by (**Marasigan & Espinosa ,2014; Ulusoy & Onen,2014;Saleh,2013; King & Ritchie, ,2013; King, & Ginns,2015) in the effectiveness of " learning-for-use model" and context-based learning " in developing thinking skills and achievement **.And with the results of the studies conducted by** (Sadiq ,2016; Taha ,2015; Fergaly ,2013; Al-Amoudi ,2012; Mansour,2010) in the effectiveness of constructivist models and stratieges in developing generation and assessment skills in science**. The previous result can be due to** the LFU model based on the constructive approach of teaching .It focused on integrating cognitive content and learning processes supported by varied inquiry learning activities that gave learners the opportunities to develop their experiences. It focused on the learners constructing meaning that lead to understanding of scientific knowledge through direct and indirect interaction with others, and it encouraged the use and application of knowledge, giving them the opportunities for `thinking , reflecting and comparing the previous knowledge with the new learning knowledge . Moreover , learners practiced information generation and assessment skills during the steps of the model. ***(In motivation step)***: They could practice fluency, hypothesizing and predicting skills during Experience curiosity activities .***(In Knowledge Construction step)***:They could practice science processes " observation ,classification, Communication, Predicting Inferring ,using number, hypothesizing , Controlling Variables, Interpreting Data , Experimenting, Procedural definition" which Contributed to developing generation and assessment skills .

***(In knowledge refinement step)*** : Learners could practice criticizing, relevance of the information to the problem, discrimination between opinion and factand identifying the fallacy in reasoning or conclusion.

**Second :Results of administration of the habits of mind measure**

***Checking the validity of the third hypothesis:** To verify the validity of third hypothesis, means and standard deviations, t-values and effect size of the habits of mind measure' post score for experimental and the control groups were calculated. Table (8) presents these results.

***Table 8: Means, standard deviations , t-values and effect size of the habits of mind measure' post score for CG and EG***

| habits of mind | score | C. Group $N_1$=58 | | E. Group $N_2$=58 | | T-value* | Effect size D |
|---|---|---|---|---|---|---|---|
| | | M | SD | M | SD | | |
| Persisting. | 15 | 7.64 | 1.02 | 14.33 | 1.98 | 22.89* | 4.29 |
| Managing impulsivity. | 15 | 8.02 | .91 | 14.16 | 1.95 | 21.69* | 4.06 |
| Listening with understanding | 18 | 9.26 | 1.73 | 15.52 | 2.20 | 17.00* | 3.18 |
| Thinking flexibly. | 18 | 9.21 | .98 | 14.60 | 0.49 | 37.24* | 6.98 |
| Striving for accuracy. | 12 | 7.25 | 1.73 | 11.38 | 0.49 | 17.43* | 3.26 |
| Questioning and posing problems. | 18 | 6.83 | 1.59 | 11.02 | 0.63 | 18.62* | 3.49 |
| Applying past knowledge | 18 | 9.41 | 1.21 | 14.53 | 1.36 | 21.33* | 3.99 |
| Thinking interdependently. | 12 | 8.33 | 4.16 | 11.39 | 0.49 | 5.58* | 1.04 |
| Creating, imagining, innovating. | 12 | 9.14 | 3.65 | 15.87 | 1.59 | 12.86* | 2.41 |
| Taking responsible risks. | 12 | 7.03 | 2.11 | 10.79 | 0.76 | 12.74* | 2.39 |
| Total | 150 | 82.12 | 13.88 | 133.59 | 7.04 | 25.18* | 4.72 |

***T-value is significant at the 0.01 level**

It is clear from Table (8) that there is a statistically significant difference at the 0.01 level between the mean scores of the experimental group and those of the control group in the post application of the habits of mind measure in favor of the experimental group. The highest t-value was (37.24) for " the habit:

thinking flexibly " whereas the lowest was(5.58) for " the habit: thinking interdependently " which is significant at the 0.01 level. Effect size was more than 0.8 in the measure as a whole and in its habits which indicates a large effect of "learning-for-use model" in developing habits of mind for second preparatory grade students. Thus, ***the third hypothesis is accepted.***

***Checking the validity of the fourth hypothesis:** To check the validity of the fourth hypothesis, means, standard deviations t-values and the effect size of the habits of mind measure' pre- post score for the experimental group were calculated. Table (9) presents these results.

***Table 9: Means, standard deviations , t-values and the effect size of the habits of mind measure' pre-post score for EG***

| Habits of mind | Total score | Pre- application N=58 | | Post- application N=58 | | T-value* | Effect size D |
|---|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | | |
| Persisting. | 15 | 5.36 | 0.48 | 14.33 | 1.98 | 33.50* | 8.87 |
| Managing impulsivity. | 15 | 4.95 | 0.80 | 14.16 | 1.95 | 33.18* | 8.79 |
| Listening with understanding | 18 | 6.36 | 0.48 | 15.52 | 2.20 | 30.91* | 8.19 |
| Thinking flexibly. | 18 | 6.95 | 0.80 | 14.60 | 0.49 | 61.80* | 16.37 |
| Striving for accuracy. | 12 | 4.65 | 0.48 | 11.38 | 0.49 | 74.74* | 19.80 |
| Questioning and posing problems. | 18 | 4.34 | 0.48 | 11.02 | 0.63 | 63.86* | 16.91 |
| Applying past knowledge | 18 | 5.95 | 0.80 | 14.53 | 1.36 | 41.24* | 10.92 |
| Thinking interdependently. | 12 | 4.95 | 0.80 | 11.39 | 0.49 | 52.05* | 13.79 |
| Creating, imagining, innovating. | 12 | 6.65 | 0.48 | 15.87 | 1.59 | 42.11* | 11.15 |
| Taking responsible risks. | 12 | 4.73 | 0.96 | 10.79 | 0.76 | 37.38* | 9.90 |
| Total | 150 | 54.89 | 4.32 | 133.59 | 7.04 | 72.54* | 19.21 |

***T-value is significant at the 0.01 level**

It is clear from Table (9) that there is a statistically significant difference at the 0.01 level between the mean score of the experimental group on the pre and post applications of the habits of

mind measure in favor of the post application. The highest t-value was (74.74) for " the habit :striving for accuracy ". whereas the lowest was(30.91) for " the habit: listening with understanding and empathy " which is significant at the 0.01 level. Effect size was more than 0.8 in the measure as a whole and in its habits which indicates a large effect of "learning-for-use model" in developing habits of mind for second preparatory grade students. Thus, ***the fourth hypothesis is accepted.***

***Effect size and and effectiveness of " learning-for-use model" in developing habits of mind**

To find out the effectiveness of " learning-for-use model" in developing the habits of mind ,Black's modified gain ratio was calculated. Table (10) shows the result.

***Table 10 :Means, t-value ,η2, the effect size and the Black's modified gain ratio of the habits of mind measure' pre-post score for EG***

| Independent variable | Dependen-t variable | Total score | Pre-Mean score | Post-mean score | T-value | η2 | Effect size d | Gain ratio |
|---|---|---|---|---|---|---|---|---|
| The model | Habits | 150 | 54.89 | 133.5 | 72.5 | 0.99 | 19.21 | 1.35 |

Table (10) shows the great effect size of the independent variable" learning-for-use model" in the development of habits of mind, as measured by the habits of mind measure is (19.21) and 99% of the total variance of habits as a whole is due to the effect of the " learning-for-use model". Black's modified gain ratio for the skills (1.35), which is more than the minimum identified by Black (1.2) which indicate the effectiveness of " learning-for-use model" in developing the habits of mind for students at the second grade of the preparatory stage. **The second question of the research was answered. Result**

**of the research is consistent with the results of studies**(Omar,2017; Mahmoud ,2015; Ramadan ,2014; El Baz ,2014; AbdulRawaf,2013) **in** the effectiveness of **constructivist models and stratieges in developing** the habits of mind. **The previous result due to:** The LFU model focused on integrating cognitive content and learning processes supported by varied inquiry learning activities that gave learners the opportunities to develop their experiences and encouraged them to think and use many habits of mind during thinking in three steps of the model. ***In motivation step***, "Experience demand and curiosity"the learners could practice " Persisting, listening with understanding and empathy and questioning and posing problems". ***In Knowledge Construction step " observation and communication"***, while working cooperatively ,they could practice most of the ten habits" Persisting, managing impulsivity, listening with understanding and empathy, thinking flexibly, striving for accuracy, questioning and posing problems, applying past knowledge to new situations, thinking interdependently, creating- imagining- innovating and taking responsible risks . ***In knowledge refinement " application and reflection"***, learners could practice' applying past knowledge to new situations, thinking interdependently and creating- imagining- innovating , thinking flexibly " or they might practice any of ten habits.

**Recommendations of the research**

In the light of the results of the current research, the researcher recommends the importance of preparing science students teachers and training in-service science teachers on the use of educational models

based on learning for use, directing the attention of curriculum and program designers to place emphasis on the " learning-for-use model", as well as the using of strategies and models of teaching that develop skills of information generation and assessment skills, and habits of mind.

**Suggestions for further research**: In light of the results of the research results, the researcher suggestes the following researchs:

1. The effectiveness of the learning –for- use model in developing understanding in biology , reasoning thinking and achievement motivation for the secondary stage students.
2. The effectiveness of the learning –for- use model in developing physics' concepts, the habits of mind for secondary stage students.
3. The effectiveness of the learning –for- use model in developing visual thinking in science and self-efficacy for preparatory stage students.
4. The effectiveness of the learning –for- use model in correcting alternative conceptions in Chemistry and self-esteem for the secondary stage students.
5. The effectiveness of the learning –for- use model in developing inquiry thinking and understanding the nature of science for preparatory stage students.

**References:**


- AbdulKarim, S.(2003)Effectiveness of a program based on the learning requirements of pre-service teachers to change their perceptions of the contemporary nature of science. **7th Scientific Conference "Towards Better Scientific Education"** , July, 487-544.
- AbddulMotlb , O.(2016). Effect of Habits of Mind Program on

the Development of Positive Thinking and the Level of Learning Basic Soccer Skills among Students of the Faculty of Physical Education**. Science, Movement and Health,** 16 (2) June: 228-235

- Abdul Rawaf , M. (2013). Effectiveness of thinking maps on the development of the skills of visual thinking and the habits of the mind and academic achievement in chemistry among students in the first grade of secondary education. **Arab Studies in**
- **Education and Psychology**, 37( 4), 161-223 .

Abdul Wahab, Fatima Mohammed (2007). Effectiveness of using maps of thinking in the achievement of chemistry and the development of some thinking skills and habits of mind among students in the 11th grade in the Sultanate of Oman. **Arab Studies in Education and Psychology**, Vol.1, No.2, 11-77.

- Abu Allam, R. (2011). **Research Methods in Psychological and Educational Sciences**, Cairo, Publishing House for Universities.
- Al-Adaily, A. & Baara,H. (2007). Effectiveness of the learning model for use in the acquisition of students of the basic elementary stage in Jordan: the desired chemical concepts. **Educational Magazine** - Kuwait, 22( 85), 205 - 250
- Al-Amoudi ,H.(2012). Effectiveness of the Witley model in the development of achievement and information generation skills in chemistry and achievement motivation among the third grade secondary students. **Egyptian Journal of Science Education**, 15 (1), 262-219.
- Al-Wardani, O. (2017). The impact of a strategy based on thinking maps of teaching science on achievement and the development of the produced habits of mind for Marzano for the pupils of the

preparatory stage. **Egyptian Journal of Science Education**, 20(2). February, 163-198.

- Alrababah , F.(2017).The Effectiveness of Marzno's Dimensions of Learning Modle in The Tenth Grade Students Acquisition of Scientific Concepts in Science and the Development of Critical Thinking Skills and Their Attitude Towards Science . **British**
- **Journal of Education,** 5(1) January, 76-84.

Al -Saadi , al-Ghoul al-Sa'di (2004). The effectiveness of teaching science using the systemic approach in developing the information generation and assessment skills in science and the meta -cognitive thinking of the preparatory students. PhD. thesis, Girls College, Ain Shams University.

- Barak ,M.(2017).Cloud Pedagogy: Utilizing Web-Based Technologies for the Promotion of Social Constructivist Learning in Science Teacher Preparation Courses. **J Sci Educ Technology**, 26:459–469.
- Basher, H., Qassem, M. & El Baz ,A. (2011). **Standard levels of pre-university graduates**. Cairo: Dar Alfikr Al arabi.
- Booth, T. (2014). Applying Constructivist Active Learning Theory in the Creation of Information Security Hands on Labs **.**Master's Thesis, Lulea University of Technology.
- Coll, R. , Taylor, N., & Lay, M. (2009). Scientists' habits of mind as evidenced by the interaction between their science training and religious beliefs. **International Journal of Science Education**, 31(6), 725-755.
- Costa ,A.(2012).Developing an Even More Thoughtful Learning Community With Habits of Mind. University of Hawaii, Manoa.

- Costa, A., & Kallick, B. (2008). **Learning and leading with habits of mind: 16 essential characteristics for success**. Alexandria, VA: ASCD.
- Costa, A., & Kallick, B. (2009). **Habits of mind across the curriculum: Practical and creative strategies for teachers.** Alexandria, VA: ASCD**.**
- Danior, Y. (2014). The effect of the use of the CASE model in the teaching of physics on the development of achievement, scientific thinking and the generative thinking for the first grade secondary students. **Arab Studies in Education and Psychology**,No. 55, 41-88.
- Edelson, D. (2001). Learning -for- Use : A framework for theDesign of Technology- Supported Inquiry Activities. ***Journal of Research in Science Teaching***, 38(3), 355- 385.
- Edelson, D., Salierno, Ch.,Matese, G., Pitts, & Sherin, B. (2002). Learning- for- Use in Earth Science: Kids as Climate Modelers. Paper presented at the annual meeting of the National Association for Research on Science Teaching, New Orleans, LA, April.
- El Baz ,M. (2014). The impact of the use of teaching differential in the development of achievement and some of the habits of mind among primary school students of different achievement in science. **Egyptian Journal of Science Education**, 17, No. 6 (1) November, 1-46
- Facione ,p.(2015 ). **Critical Thinking: What It Is and Why It Counts? Measured Reasons LLC**, Hermosa Beach, CA**.www. insightassesment.com**

- Fergaly, W . (2013). Effectiveness of active learning strategies in the development of information generation and assessment skills among first grade secondary students in biology. Master Thesis, Faculty of Education, Mansoura University
- Hassanein, B.(2016). Integration of science, technology, engineering and mathematics in science curricula in basic education. **The Eighteenth Scientific Conference: Science Approaches Between Egyptian and International,** 24-25 July, 99- 140
- Hyerle,D. (2009) . **Visual Tools for Transforming Knowledge** . Second Edition,USA: Corwin Press .
- Ilhan**a** , N., Yildirim**b**, A. & Yilmaz , S.(2016).The Effect of Context-based Chemical Equilibrium on Grade 11 Students' Learning, Motivation and Constructivist Learning Environment. **International Journal of Environmental & Science Education** , 11( 9), 3117-3137.
- Jad al-Haq, N.(2016). Teaching science using Introspection learning to develop generative thinking and achievement motivation for middle school students. **Egyptian Journal of Science Education**, 19(4), 1-40.
- Jarwan, F. (2016): **Teaching Thinking Concepts and Applications**. 9th edition. Amman, Jordan, Daralfikr**.**
- Karim , S ., Prima, E. Utari1, S., Saepuzaman, D& Nugaha, M.(2017). Recostructing the Physics Teaching Didactic based on Marzano's Learning Dimension on Training the Scientific Literacies. IOP Conf. Series: **Journal of Physics: Conf. Series**

**812(http://iopscience.iop.org/1742-6596/812/1/012102)**

- King, D. & Ginns, I. (2015). Implementing a context-based environmental science unit in the middle years: Teaching and learning at the creek. **Teaching Science**, 61(3), 26-36.
- King, D. & Ritchie, S. (2013). Academic success in context-based chemistry : Demonstrating fluid transitions between concepts and context. **International Journal of Science Education**, 35(7), 1159-1182.
- Mahmoud ,A.(2015). Effectiveness of teaching science using the strategy of generating ideas "Skamper" in the development of thinking skills and mental habits of mind for the preparatory first grade pupils. **Egyptian Journal of Science Education**, 18( 4) July, 1-50.
- Mansour ,M. (2010). Development of the physics curriculum in the secondary stage in the light of the systemic approach and its impact on the development of achievement and skills of solving physical problems and generating ideas and evaluation. PhD thesis, Faculty of Education, Mansoura University.
- Marasigan, A.& Espinosa, A.(2014). Modified Useful-Learning Approach: Effects on Students' Critical Thinking Skills and Attitude towards Chemistry. *International* **Journal of Learning, Teaching and Educational Research**, 1 ( 1) January, 35-72.
- Mazen ,H.(2011). The habits of the mind and strategies to activate them in the teaching and learning of science and scientific education. **Educational Journal, Faculty of Education, Sohag**, No.29 January, 331-354.

- Nofal, M.(2010). **Practical applications in the development of thinking using the habits of mind.** Amman, Jordan: Dar Al Masirah for Publishing and Distribution.
- Ramadan, H.(2014). Impact of Skamper's strategy on the development of achievement, problem solving skills, and some habits of mind in science for primary school students. **Arab Studies in Education and Psychology**, NO. 51, pp. 77-118.
- Rashid, A. (2017). The Role of Science Teaching in 21st Century Skills Development. **Nineteenth Scientific Conference : Scientific Education and Sustainable Development**, 23-24 July.
- Sadiq, M.(2016). The interaction between spatial thinking and the strategy of " Generate, Sort, Connect, Elaborate " (GSCE) on achievement of science and the development of the Generative thinking skills for Pupils of the tenth grade. **Egyptian Journal of Science Education**, 19( 3) May, 75 – 128.
- Saleh, M. (2013). The Effectiveness of the Edilson Model of Learning for Use in the Development of Some Skills of Reflective Thinking and Achievement in Science among Second Grade Students in the Kingdom of Saudi Arabia. **Egyptian Journal of Science Education** , 16( 1), 85 - 118.
- Sharma, A**.**& Rani**,** V.(2017)**.** Construction and Standardization of Creativity Test**. International Journal of Engineering Technology Management and Applied Sciences,** 5( 6),156-162**.**
- Taha ,A (2015).The effect of the interaction of mental maps and the pattern of thinking and learning in the development of information generation and assessment skills in chemistry among

secondary students. **Journal of Arabic Studies in Education and Psychology** . Issue 58, 225 – 267.

- Ulusoy, F.& Onen, A.( 2014).A Research on the Generative Learning Model Supported by Context-Based Learning. **Eurasia J. Math. Sci. & Tech. Ed.**, 10(6), 537-546.
- Vollrath, D. (2016). Developing Costa and Kallick's Habits of Mind Thinking for Students with a Learning Disability and Special Education Teachers. **Graduate Theses & Dissertations**. Paper 5
- Wang, C.& Liou, P.(2017) Students' motivational beliefs in science learning, school motivational contexts, and science achievement in Taiwan. **International Journal of Science Education** ,39(7), 898-917.