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The Effectiveness of a Suggested Program Based on the Molecular Approach in Teaching Chemistry in Developing Achievement and Generative Thinking of First Year Secondary Students

A Thesis

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Summary of the study

Introduction

The present age is characterized by the increasing growth of scientific knowledge. This is because the world is exposed to change in civilization characterized by innovations and updating based on science and technology. Our world today is totally competitive, and there is no place for a weak person or a weak society. There is only a place for a strong person and a strong society which can face challenge and risks. Science education is the life boat that faces international challenges through developing the skills and abilities of members of the society in order to be able to get into competition. Building any civilized society is based on the minds and hands of its citizens

The education is responsible for building the strong society it gains its members knowledge and skills which are important for facing the challenges and risks. the syllabus come as a tool of education to affect this responsibility. Among these syllabus which contribute in this regard the chemistry syllabus as it is a broad field and is closely connected to society and its problems. Chemistry plays a great role in industrial and economical development of society. Man was able to, through chemistry to change raw materials to new materials that provide him with daily needs and improve his life conditions. He was able to compose hundreds of chemical substances that can be used in medicine, agriculture, industry and other fields that are basic in improving quality of human's life and society. Organic chemistry is important in all sides of life as it is the basic source

of creating an infinite number of organic materials. From there materials, some important industrial products are made which we need in different fields of life like: plastic, dyes, insecticides, some kinds of paints and other products are which irreplaceable in our daily life. Moreover, supporting substances for life from which bodies of living creatures are composed such as proteins, fats, carbohydrates, enzymes and vitamins are all organic composites which are indispensable in life. Also there are some large molecules which participate in biological operations inside the human body such as DNA.

As a result of what was previously mentioned, it is vital to teach chemistry appropriately to develop scientific knowledge of students, scientific skills, attitudes and interests. Also important is developing interaction between science, technology and society, developing the scientific method of thinking and achieving scientific enlightenment.

However, teaching chemistry is still focusing on knowledge and information. Teaching science in general and chemistry in particular still emphasizes providing the students with scientific knowledge which is difficult and unrelated to students' lives and real problems. This knowledge became an end in itself.

The syllabus now doesn't help in developing students' thinking although development of thinking is one of the basic aims in teaching science. There is still insufficiency in developing thinking skills in teaching chemistry.

Thinking in general is important in life as we need thinking in searching for sources of information required for

situations in order to use them in solving problems in the best way.

The thinking process is related to types of active behavior and leads to important products like ideas, knowledge, reasons, critical analysis and making connections thinking develops the student's ability to study ideas, analyze and assess them in order to reach a scientific decision towards problems or towards the situations related to his / her personal life and to the society in which he / she lives. Generative thinking is considered one of the thinking types related to recall, production or restatement of knowledge structures existent in long term memory and causing connections, results, transformations or components union. Therefore, it is a must that we develop thinking in general and generative thinking in particular due to challenges and complications which require that students play an active role in the educational process

Hence developing generative thinking skills is an aim which we try to achieve through teaching science by giving the learner more responsibility in the teaching and learning process, getting away from artificiality and caring more about depth in learning. This type of thinking can be enhanced through discussion, questions asking, information and data criticism , giving freedom to the student which increases his/her ability of investigation.

Hence, The researcher thought of trying to develop thinking skills. Through surveying previous studies, the researcher found that the molecular approach in teaching chemistry helps in developing this kind of thinking. And that it helps in achieving the following:

1. Improving the students' acquisition of chemical interactions by simplifying the way they happen
2. Developing the ability to imagine by forming mental images for chemical compositions and interactions
3. Fusing both molecular and superficial level for chemical interactions.
4. Correction of chemical concepts.
5. Providing great chances for the student and challenging their minds to think in a scientific way.
6. Integrating concepts, data analysis and complicated issues discovery.

Also, the molecular approach helps in:

- Illustrating accurately difficult chemical concepts in a student –centered manner.
- Facilitating flexibility and depth in multi pronged topics like: electronic deviation, theoretical molecular urbitalat, and the changes of free energy in non –standard conditions.
- Relating the chemical concepts the student learns with the surrounding world on the molecular level. It also helps the pupils to recognize atoms and molecules which constitutes the microscopic world around them like clarifying ionic composition for sodium ions with chlorine on the molecular level. Moreover, it illustrates molecular patterns and the various methods through which chemistry is dealt with.
- Clarifying the basics elements in chemistry which helps students understand the process involved.

Statement of the problem:

- The problem of the study is that there are problems facing the teaching and learning of chemistry in general and organic chemistry in particular.
- There is also weakness in developing some generative thinking skills.
- Because of importance of the Molecular Approach in teaching chemistry which was clear in previous research, so the researcher is trying to use this approach in developing some generative thinking skills.

The present study tried to answer the following main question:

What is the effect of using a molecular approach – based program in teaching organic chemistry on developing achievement and generative thinking of first year secondary students?

This main question branches into the following questions:

1- What are the generative thinking skills which are suitable to first year secondary students?
2- What are the bases of building a molecular approach –based program in chemistry?
3- What is the effect of a molecular approach – based program in organic chemistry on developing Achievement?
4- What is the effect of a molecular Approach – based program in organic chemistry on developing generative thinking?

Aims of the study:

The present study aimed at:

1- Finding out the effectiveness of a Molecular Approach-based program on developing first year secondary students, achievement of organic chemistry.
2- Finding out the effectiveness of a Molecular Approach-based program on developing generative thinking skills of first year secondary students.

Significance of the study:

Significance of the study was represented in the following

1- Building a suggested program in chemistry in the light of the Molecular Approach that can be used in planning ministry of Education Curricula.
2- Developing generative thinking skills and achievement of first year secondary students.
3- Presenting on operational model for using the Molecular Approach in teaching chemistry that the teacher can benefit from.

Limitations of the study:

The present study was limited to:

1- A sample of first year secondary students in a school in fayoum.
2- A suggested program (prepared by the researcher)
3- The experimental part of the study will be applied in the second term 2011.

Tools of the study:

The tools of the study were the following:

a- Educational tools:

- Teachers' guide prepared by the researcher
- Students' book prepared by the researcher

b- Measurement tools:

- Achievement test prepared by the researcher
- Generative thinking test prepared by the researcher

Method of the study

The present study used the descriptive research and the experimental research:

1- The descriptive research:

That was used in surveying previous studies and the theoretical fromeword related to the topic of the research.

2- The quasi- experimental research:

In which one quasi- experimental group is used a group of first year secondary students.

The hypotheses of study:

The study tried to verify the following hypotheses:

1- There is a statistically significant difference between means of scores of the experimental group students in pre-post applications of the achievement test favoring the post application.
2- There is a statistically significant difference between means of scores of the experimental group students in the pre-post applications of the generative thinking skills test favouring the post application.

Procedures:

The study was conducted according to the following steps:

1- Preparing a generative thinking skills list required by first year secondary students through reviewing previous studies.
2- Writing the list in its preliminary form and showing it to a group of jury members.
3- Writing the list in its final form.
4- Determining the bases of building on organic chemistry program for first year secondary students in the light of the molecular Approach through the following:
   a- Reviewing literature related to the Molecular Approach.
   b- Reviewing previous research and studies.
5- Building the suggested framework for the program in the light of the Molecular Approach in its preliminary form and showing it to a group of jury members.
6- Writing the framework in its final form.
7- Preparing the educational tools including:
   a- Preparing the teacher's guide in the suggested program with regard to objectives, content and activities.
   b- Preparing the student book in the suggested unit with regard to objectives, content and activities.
8- Preparing measurement tools including:
   c- preparing an achievement test and showing it to a group of jury members to decide its suitability For application
9- Calculate the validity and reliability for the tow tests.
10- A administering the pretests on the sample of study and getting the results.
11- Teaching the Molecular Approach-based program for the experimental group.

12- Administering the post tests on the sample,
13- Getting the results, treating them statistically, interpreting them and disusing them.
14- Presenting recommendations and suggestions according to study results.

Terms of the study:

1- the molecular Approach:

it is operationally defined as a suggested program for teaching organic chemistry for first year secondary students to avoid teaching chemistry on superficial level only but caring about the Molecular level (invisible) also to develop the students' achievement and thinking to achieve chemical concepts ' acquisition appropriately

2- generative thinking:

It is operationally defined as the students' ability to use previous ideas to generate new ideas which makes the process of finding out information characterized by novelty, flexibility, fluency and sensitivity to problems. It is measured by the mark the student gets in the generative thinking skills test.

Results of the study:

The study achieved the following results:

1- There is a statistically significant difference between means of scores of students in the experimental group in the pre-post applications in the achievement test at (0.01) level of significance favouring the post applications. This indicates the progress the sample of study achieved in the post application in comparison to their marks in the pre-

application. This proves the effectiveness of the suggested Molecular Approach-based program in teaching chemistry to develop academic achievement.

2- There is a statistically significant difference between means of scores of students in the experimental group in the pre-post applications of generative thinking skills test at (0.01) level of significance favouring the post application. This indicates the progress the sample of study achieved in the post application in comparison to their marks in the pre-application. This proves the effectiveness of the suggested Molecular Approach-based program in teaching chemistry to develop generative thinking.

Recommendation of the study:

Through the result of the study, the researcher recommends the following:

1-The necessity of developing thinking skills in general and generative thinking skills in particular of secondary stage student and encouraging them to use fluency and flexibility of ideas.

2-Emphasizing scientific investigation skills of secondary stage students in chemistry syllabi.

3-Developing chemical concepts at the Molecular level of secondary stage students.

4-The necessity of teacher's use of activities and different educational aids which stimulate students' thinking instead of receiving the information passively

5-Providing curricula planners and developers with study results which proved the effectiveness of the Molecular Approach in

order to develop and plan chemistry curriculum in terms of this approach.

Suggestions of the study:

In the light of the results of the study, the researcher suggests the following:

1- Developing chemistry curriculum in the secondary stage in the light of the Molecular Approach to enhance conceptual understanding.

2- The effectiveness of a suggested Molecular Approach-based program in teaching chemistry on developing problem solving skills and attitude towards chemistry.

3- The effectiveness of a training program for teachers of chemistry to develop the skills of using the Molecular Approach in teaching.

4- The Effectiveness of a suggested program based on the Molecular Approach in teaching chemistry in developing science concepts and scientific thinking of secondary school students.

ملخص الدراسة باللغة الإنـجليزية