

Developing Chemistry Curriculum in Light of the Standards of life Applications and the Effectiveness of Teaching a Unit of the Developing Curriculum based on Format Model (4MAT) for Developing Mental Motivation and Chemical Awareness of Secondary Stage Students

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Abstract

The study aimed to Develop Chemistry curriculum in light of the standards of life applications and the effectiveness of teaching a unit of the developing curriculum based on format model (4MAT) for the Development of Mental Motivation and chemistry awareness for secondary stage students. To achieve this, the researcher prepared a list of standards and indicators of life applications for the content of the chemistry curriculum in the secondary stage ,A list of life applications in light of the list of standards, then the developed framework for the chemistry curriculum were prepared in light of the standards of life applications for secondary school students (the three grades), including curriculum maps, and a unit was prepared. "Industrial Chemistry" from the developed framework for the content of the chemistry

curriculum formulated in the light of McCarthy's 4MAT model form for second year secondary school students. The researcher prepared the experimental study tools, the mental motivation scale prepared by Giancarlo & Factions, 1998, and the chemical awareness scale with its three axes and the study group was selected. They were (27) female students from second year secondary school for girls in Bani Mazar. (73%). The results showed the ineffectiveness of teaching the industrial chemistry unit using the (4MAT) model on mental motivation among the students , and the effect of teaching the unit on the chemical awareness of the students was found.

key words :-

Developing the chemistry curriculum - standards for life applications - the developed framework - the format model (4MAT) - mental motivation - chemical awareness.

Introduction

The contemporary world has witnessed amazing and rapid scientific developments in various aspects of daily life. This scientific development has led to the need of curriculum developers to take special interest in chemistry curriculum and provide it with everything new and modern to benefit the learner and increase his scientific knowledge and benefit him in his daily life.

Chemistry is the science concerned with studying the components of the environment and its composition and the interaction of these components with each other by the action of energy, with the aim of identifying the rules governing these reactions. It is possible to prepare new forms of materials that did not exist previously in nature, and are dealt with daily with manufactured polymers , medicines Dyes and pesticides as existing materials.

Therefore, chemistry is a basic science around which the rest of sciences and life itself are centered (Muhammad Hilmi Najdi, Noha Muhammad Najdi, 2009, 1).

The national standards of scientific education and Arab and international standards are among the most prominent projects that lead to achieving the goals that society seeks to reach, and therefore the standards are among the most important foundations on which chemistry curriculum can be developed. (Muhammad Saber Salim, 1998, 1-19) It is in this era that a wide gap has emerged between the curricula of natural sciences and global levels and the gap is getting wider over time, so we need to develop curricula in the public education stages in order to face the challenges that hinder our progress and threaten our entity and provide a competitive advantage with the rest of the students in different countries of the world.

Qatar's chemistry content standards (Education Authority, 2004), the standard levels document for science content for pre-university education (National Authority for Quality Assurance and Accreditation, 2009), and global standards emphasize the importance of life applications of chemistry, as these documents contain many criteria and indicators that are Interested in life applications of this science.

Many countries took an interest in applied chemistry through holding conferences, including Qatar, which hosted the 2012 Pure and Applied Chemistry conference, and the Fifth International Conference on Advanced

Chemistry and Applied Chemistry organized by the National Research Center from October 21 to 23, 2014, was held in Egypt. Applied in Jeddah from 18-19 November 2015.

It is clear from the above that the importance of linking chemistry with its life applications, and the necessity of including it in the curriculum of chemistry at the secondary stage, is due to the entry of chemistry in all aspects of life, and therefore, the need to highlight the relationship between chemical facts and concepts and their applications in practical life as an essential part in introducing concepts in the curricula of chemistry at the secondary stage.

The study Problem:

The researcher noticed, through his work as a chemistry teacher, difficulties for secondary school students in understanding chemistry, and This may be due to its lack of correlation with their lives and the absence of the functional role of chemistry in life, and ultimately leads to automatic preservation of information without understanding it in order to succeed in the final exams at the end of the year. When the researcher conducted a diagnostic test on (17) secondary school students consisting of (15) questions in order to know the extent of their knowledge of life applications, the results indicated that (76%) of the students did not have knowledge of the applications. They referred to the importance of some topics and their study, such as green chemistry, and applications of nanotechnology.

In addition, a survey was prepared for teachers on life applications in chemistry textbooks and their importance for students, which was applied to nine chemistry teachers. Results showed that chemistry teachers agreed that there are difficulties for secondary school students in understanding Chemistry, as chemistry curriculum is not related mostly to the student's life, and there are topics that represent a burden on students such as atomic theories, theories of covalent bond interpretation, chemical equilibrium, and the detection of anions and cations in inorganic compounds, and this is consistent with what some studies have indicated as a study by (Munir Musa Sadiq, 2004, 409), (Ahlam of Al-Baz Hussein, 2006, 196), (Osama Jibril Ahmed, 2008), (Mahmoud Syed Abunaji, 2008, 168), (Fatima Al-Amouriyah, 2011, 112), (Ali Hassan Abdel Nasser, 107, 2014) that there are difficulties for secondary school students in understanding chemistry, because it is not related to their lives and the absence of its functional role in life, which ultimately leads to the automatic preservation of information without understanding it in order to succeed in the final exam , Which affects their ability to achieve.

A list of standards for the life applications of the content of the chemistry curriculum was prepared, which was based on the standard levels for the content of science in Egypt and some Arab and international standards. An analysis tool was prepared in the light of the list of standards, and to ensure the stability of the analysis

process. The results of the analysis showed that (74%) of those standards and indicators related to life application of the chemistry curriculum content are not covered in chemistry textbooks.

This is consistent with what some international and Arab studies and projects have indicated on the importance of the main structure for designing a chemistry curriculum at the secondary stage on applied chemistry, and the perception of concepts that demonstrate the benefits of chemistry and its connection to the student's life, such as organic, biological, environmental and industrial chemistry and this is considered an entry point for preparing curriculum related with the real life of students, emphasizing the functional importance and highlighting the applied role of chemistry (Akram Hassan Muhammad, 2012, 5).

The reality of science teaching in our schools, especially chemistry, indicates that the focus is still on methods of explanation and indoctrination on the part of the teacher and memorization on the part of the learner, which reflects the low level of achievement of students, and this is consistent with what was reached by (Alia Ali Al-Sayed, 2014, 110) And by (Ban Mahmoud Muhammad, 2011) who found that 70% of teachers rely on the usual methods that lead to poor results for students, and that 30% use modern methods and strategies, while no teacher mentioned that he uses methods that take into account the different learning styles of learners.

Mental motivation is considered an important aspect of human development to increase students' ability to create and solve problems in non-traditional ways and to improve the level of performance during their studies. Its development through various strategies such as the study of (Ayed Khudair Daye, 2019), (Siham Ramadan Awwad, 2018), (Zainab Aziz Ahmed, Ban Muhammad Ahmad, 2015) and (Thani Hussain Al-Shammari, 2014).

The researcher also concluded through the results of the opinion poll applied to students that one of the reasons for the students' decreased knowledge of life applications may be the low level of awareness of the importance of chemistry in their practical lives and daily practices. The urgent need for individuals is a degree of awareness of the importance of chemistry and its role in their lives. They play an active role in their environment and society, so it is necessary to work on developing chemical awareness in its various dimensions among secondary school students through which they can effectively employ chemistry and its applications in their daily lives. Some studies have indicated the need to develop awareness among students, such as the study of (Suzanne Hussein Siraj, 2018) And (Basma Muhammad Ahmad, 2012) and (Maryam Ahmad al-Shabibi, 2006).

In the light of the above, it becomes clear that there is a scientific and educational necessity that calls for rebuilding the content of chemistry curriculum at the secondary stage on the basis of their connection with the life of the learner,

his environment and the society in which he lives, to confirm the functional and practical role of chemistry in the lives of students as an attempt to avoid the difficulty of these curricula and reduce the phenomenon of students' reluctance to Study chemistry in light of the standard levels of chemistry curriculum content. It is also evident that there is a need to use teaching models such as the 4 MAT model in teaching chemistry for the secondary stage, as this model can help increase students 'motivation towards acquiring scientific concepts related to life applications by linking them to the learner's cognitive structure, and experimenting with these concepts and applying them in new situations, which makes the concept keep an impact on the mind of the learner, just as education in schools does not fit all learning styles and is specific to a specific class, while McCarthy's format model depends on a learning cycle based on four learning methods that expands students' ability to comprehend.

In view of the importance of life applications of the content of the chemistry curriculum in the life of the learner, the importance of standards that are one of the most important foundations according which the chemistry curriculum is developed, and the importance of having a strategy that contributes to their learning according to different patterns, the study problem was identified in the limitations of current chemistry curricula in dealing with life applications and showing the functional role for chemistry in the life of students.

To handle this problem, the study attempts to reach:

- The list of the standards and indicators of life applications of the content of the chemistry curriculum for students of the three grades at the secondary stage.
- The list of the life applications of the content of the chemistry curriculum for secondary school students in light of indicators of life application standards, which can be presented through the developed curriculum.
- The framework for the content of the chemistry curriculum for students of the three grades at the secondary stage in light of the standards of life applications of the chemistry curriculum.
- The form of a unit of study from the curriculum developed in light of the McCarthy (4MAT) model.
- The effectiveness of the developed academic unit in developing the mental motivation for secondary school students.
- The effectiveness of the developed academic unit in developing chemistry awareness for secondary school students.

Objectives of the study:-

The study aimed to achieve the following:

- Developing the chemistry curriculum in the light of standards of the life applications of chemistry for the three grades of secondary school students.
- Preparing a unit of study from the developed curriculum based on McCarthy's 4MAT model.

- Recognizing the effectiveness of the developed unit based on the 4MAT model in developing mental motivation of secondary school students.
- Recognizing the effectiveness of the developed unit based on the 4MAT model in developing the chemistry awareness of secondary school students.

Hypotheses of the study

The study sought to verify the following hypotheses:

- There is no statistically significant difference between the mean scores of the study group that studied the proposed unit in light of the life applications of chemistry using the (4MAT) model in the application (pre-post) measure of mental motivation.
- There is a statistically significant difference at the level of significance (≤ 0.05) between the mean scores of the study group that studied the proposed unit in light of the life applications of chemistry using the model (4MAT) model in the application (pre-post) to measure chemistry awareness in favor of post-application.

Study materials and tools: -

A) Study materials for preparing the developed curriculum in chemistry and teaching one of its units:

- A list of standards and indicators of life applications for the content of the chemistry curriculum in the secondary stage to analyze the content of chemistry books in the three grades of the secondary stage.
- A list of the life applications of the chemistry curriculum content of the three grades of Study materials for

preparing the developed curriculum in chemistry and teaching one of its units: -

- The proposed depiction of the developed curriculum in light of the list of standards and indicators of life applications for the content of the chemistry curriculum of the three grades of the secondary stage.
- The study unit is one of the units of the curriculum developed and formulated in light of McCarthy's 4MAT model.
- A teacher's guide for the proposed unit of study in light of McCarthy's 4MAT model.

B) Experimental study tools:

- Mental Motivation Scale, prepared by (Giancarlo & Factions,1998), translated by (Tawfiq Ahmed Merei, Muhammad Bakr Nofal).
- Chemistry Awareness Scale (prepared by the researcher).

The approach of the study: -

The researcher followed the following:

First: the descriptive approach in Preparing the proposed depiction for the developed framework for a curriculum in chemistry in the light of standards and indicators of life applications for the curriculum in chemistry at the secondary stage.

Second: the semi-experimental approach: The researcher used the semi-experimental approach to measure the effectiveness of teaching the unit "Industrial Chemistry",

one of the units of the proposed developed curriculum in life applications for the content of the chemistry curriculum in developing mental motivation and Chemistry awareness of its three dimensions among secondary school students.

Study Group:

The study tools were applied to (27) female students from the second year of secondary school at the girls' secondary school in Bani Mazar.

Study procedures:

First: Procedures for preparing study materials and tools:

- Preparing a list of standards and indicators of life applications for the content of the chemistry curriculum for the three grades at the secondary stage.
- Preparing a tool for analyzing the content of chemistry curriculum at the secondary level in light of the list of standards and indicators of life applications of the content of the chemistry curriculum, and presenting it to a group of arbitrators.
- Analysis of the content of chemistry curricula for grades (first - second - third) secondary in light of the list of standards and indicators of life applications.
- Preparing a list of life applications for the content of the chemistry curriculum in light of the list of standards for life applications.
- Preparing a tool for analyzing the content of chemistry curriculum at the secondary level in light of the list of

life applications of the content of the chemistry curriculum, and presenting it to a group of arbitrators.

- Analysis of the content of chemistry curricula of grades (first - second - third) secondary in light of the list of life applications for the content of the chemistry curriculum.
- Preparing the proposed (framework) to develop the chemistry curriculum in light of the standards of life applications for secondary school students in the three grades, by defining (learning outcomes, content, educational activities and methods, teaching strategies, and evaluation methods) of the curriculum in the form of curriculum maps, and displaying it on a set of the arbitrators to ensure its suitability for secondary school students.
- Preparing a detailed unit of the proposed developed curriculum based on the McCarthy (4MAT) model for the unit and the teacher's guide for the unit and presenting it to a group of arbitrators to express their views, learn about their proposals, and make the necessary adjustments.
- Preparing the measurement tools, which are the chemistry awareness scale and the mental motivation scale, and presenting them to a group of arbitrators to express their opinion, make the necessary adjustments, and reach the final image.

Second: Procedures for implementing the study experience:

- Choosing a study group from secondary school students.

- Applying the pre measuring tools (Mental motivation scale and Chemistry awareness scale) to students of the study group.
- Teaching the proposed unit to the study group.
- Applying the post measuring tools (Mental motivation scale and Chemistry awareness scale) to students on the study group.
- Statistical data processing, analysing, discussing and interpretation of results.
- Providing recommendations and proposals in light of the results of the study.

Results:

The study found the following:

- The results of analyzing the content of chemistry textbooks for the three grades at the secondary level showed that (71%) of the indicators related to life applications of the content of the chemistry curriculum were not covered in the chemistry textbooks for the secondary stage, and that the number of applications included with the content of these books is (47) of (176) applications My life increased by (27%).
- The lack of effectiveness for teaching the industrial chemistry unit using the 4MAT forms of McCarthy on the mental motivation of the study group students.
- There is an impact of teaching the Industrial Chemistry Unit using McCarthy's 4MAT model on the chemical awareness of its three Dimensions among the students of the study group.

The recommendations of the research: -

- Developing chemistry curriculum for the three grades of secondary school in light of the standards and indicators of life applications for the content of the chemistry curriculum
- The attention to environmental chemistry in building chemistry curriculum for the three grades of secondary school due to its importance in increasing students' environmental awareness.
- Developing teaching strategies used with students in teaching chemistry, which are based on brain-based learning, such as McCarthy's 4MAT form.
- Holding seminars and training for the educational process and teachers on how to use modern models in teaching, such as the McCarthy 4MAT form, to help them achieve chemistry awareness of its various axes.
- The necessity of directing teachers to develop students' scientific awareness, especially chemistry awareness, to develop the cognitive achievement of chemistry and their ability to act in life situations and their attitudes towards the study of chemistry.

References

- Ahlam El-Baz, Hassan El-Sherbiny (2006): The effectiveness of the hands and minds model in developing the attitude towards manual work, decision-making, and chemistry achievement among first-grade secondary students, The Egyptian Journal of Scientific Education, Volume IX, Issue 1, March, pp. 193-240.

- Akram Hassan Mohamed (2012): Chemistry document for the secondary stage, Curriculum and Instructional Development Center, Cairo.
- Ali Hassan Muhammad Abdel Nasser (2014): Evaluating Chemistry Curricula for the Secondary Stage in Light of National Standards for Chemistry Education, Master Thesis, College of Education, Minia University.
- Alya Ali Issa Ali Al-Sayed (2014): The Effectiveness of a Training Model Based on the McCarthy Model for the Development of Teaching Practices for Science Teachers and Their Impact on Their Students' Performance for TIMSS Tests, Arab Studies in Education and Psychology, 45th Issue, Part Four, January 2014.
- Ban Mahmoud Muhammad Husayn al-Jabawi (2011): The Impact of the McCarthy Model on Academic Achievement of Fourth-Grade Students in Physics, Babylon University Journal, Human Sciences, Volume 19, Issue 4, pp. 759-780.
- Mahmoud Sayyid Mahmoud Abu Naji (2008): The use of a proposed program in the teaching of an intensive chemistry course for first-grade secondary students and its impact on achievement and development of self-learning skills and the attitude towards it, The Scientific Journal of the College of Education in Assiut - Volume Twenty-Four, Issue One, Part Two, January, p. Pp. 168-216.
- Muhammad Helmy Najdi, Neha Muhammad Helmy Najdi (2009): Chemistry and life, foundations of modern chemistry sciences and the role of chemistry in

contemporary life, first edition, without publishing house.

- Muhammad Saber Salim (1998): Spotlight on the Development of Science Curricula for Public Education in the Arab Countries, *Journal of Scientific Education*, Volume One, Number Two, pp. 1-19.
- Munir Musa Sadiq (2004): The Effect of Using OEP's Open-End Problem Solving Approach on Achievement, Inferential Thinking and Critical Thinking in Chemistry for First-Grade Secondary Students, *The Eighth Scientific Conference - The Absent Dimensions in Science Curricula in the Arab World*, The Egyptian Society for Scientific Education, Volume (2), July, pp. 407-449.
- Osama Gabriel Ahmed (2008): A proposed curriculum in chemistry for the general secondary stage in Egypt in light of suggested standard levels, a PhD thesis, Faculty of Education, Ain Shams University.
- Siham Ramadan Awad Abdullah (2018): The effect of a program based on the McCarthy model (4mat) on the development of mental motivation among female students of Qassim University, *Journal of Educational Sciences*, Cairo University, Volume (26), Issue (3), July, pp. 218-251 .
- Thani Hussain Al-Shammari (2014) The Effectiveness of Mind Maps in First-Class Students' Acquisition and Retention of Average Physical Concepts and Their Development of Mental Motivation, *Arab Studies in Education and Psychology*, No. 49, Part 1, May, pp. 69-87.

- The National Authority for Education Quality Assurance and Accreditation (2009): Standard Curriculum Levels, March 2009.
- Zainab Aziz Ahmed, Ban Mahmoud Muhammad (2015): The Impact of the 4MAT and Case Models on Mental Motivation among Fourth-Grade Physics Students, Journal of the College of Basic Education for Educational and Human Sciences, University of Babylon, Issue (22), August 2015, p. 87 -111.
