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The extent of female biology teachers awareness of scientific enlightenment

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Abstract - The aim of the current research is to study the extent of female biology teachers awareness of scientific enlightenment by answering the following question, For the purpose of answering this question, the author prepared a scale for scientific enlightenment that includes seven areas, which are (Biological knowledge, the mutual relationship between biology, society and the environment, translation of terms, science processes, scientific directions, scientific inclinations and scientific assessment), The scale consists of 50 items that distributed equally over the seven areas of scientific enlightenment. The items for the first four areas were objective which means the answer was either true or false (takes 0-1), as for the last three areas the answer alternatives were three-fold (agree, hesitant, disagree) or (3-2-1). The research sample consisted of female biology teachers of Baghdad/ Al-Rusafa Third Education Directorate, amounting to 105 biology schools, who were chosen randomly from the middle, secondary, and preparatory schools about 150 schools. The results of the research concluded that biology teachers possess scientific awareness, depending on these results, the author developed recommendations and proposals to complement this research.

Keywords: Scientific culture, learner environment, scientific knowledge, scientific awareness, scientific enlightenment scale

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RESEARCH PROBLEM

Using the author experience of teaching and discussing the concept of scientific enlightenment with her fellow teachers, the author felt that there was a deficiency in the teachers' possession of scientific enlightenment, as the author prepared an open questionnaire about scientific enlightenment dimensions and the information they possess about scientific enlightenment for a some teachers who has an experience of biology to explain Their opinions which were 80 % lacks scientific enlightenment, even though it is considered as a reflection of scientific culture and scientific education, as a biology teachers they must possess environmental awareness in order to create a good generation that capable of Keeping up with developments in science and facing the emerging problems. One of the most common important justifications for this lack among teachers is that practicing the fields of scientific enlightenment requires a long time and they do not have it. Based on this deficiency and lack of scientific enlightenment for male and female biology teachers, the problem of the current study was determined from the following question: **Do female biology teachers have a scientific enlightenment?**

RESEARCH IMPORTANCE

The importance of the current study can be summarized in the four following points:

1. The importance of biology teachers having scientific enlightenment and scientific culture.
2. It is necessary to reveal the shortcomings in the concept of scientific enlightenment among biology teachers in order to arrive at the best scientific solutions and treatments.
3. In this study, the scientific enlightenment scale is considered a valuable scientific addition to the Iraqi library, benefiting both researchers and those involved in building and developing of biology curricula for all educational levels.
4. At the stage of preparing teachers for science, paying attention to the scientific enlightenment in the curricula and educational programs helps raise a generation capable of keeping pace with scientific and technological development and reducing the gap between us and developed countries.

AIM OF THE STUDY

The current research aims to identify the extent of biology teachers' awareness of scientific enlightenment using the question: **Do female**

biology teachers possess scientific enlightenment?

STUDY LIMITS

The current research is focused on biology female teachers for middle, secondary, and preparatory schools in Baghdad/Rusafa Third Education Directorate for the academic year **2023-2024**.

DEFINING THE TERMS

Scientific enlightenment: It is defined as the minimum level of scientific experience (knowledge, skills, attitudes, and methods of thinking) that an ordinary citizen in any society should acquire in order to enhance his level of scientific awareness and his ability to keep up with the scientific advancements which reflects positively on his behavior toward himself, his environment, and his society (Sabry and Saladin, 2005: 23).

Theoretical definition: The author adopted the definition of (Sabry and Saladin, 2005) as a theoretical definition for her current research.

Procedural definition: Understanding and knowledge of scientific concepts and processes for making personal decisions to this knowledge which related to contemporary scientific issues, that can be practiced by biology females teachers by answering the items of the scientific enlightenment scale prepared for the current study.

METHODOLOGY

First: The concept of scientific enlightenment and its dimensions

Scientific enlightenment is the basis for rebuilding the goals of scientific education, which must be concerned with forming a scientifically enlightened citizen who is able to deal responsibly with issues of society and the environment that advances the individual through science and technology, in addition to a base of basic scientific knowledge that helps the individual in continuous education (Zaytoun, 2000, 30-31). The term of scientific enlightenment went by different names but the most important of which was the term scientific culture and some of them used the concept of “scientific awareness” then it developed into the current concept of “scientific literacy”. This was confirmed by the study of the Arab Education Bureau for the Gulf States in 1991, which confirmed that the concept of scientific awareness is based on three aspects: cognitive aspect, emotional aspect and applied aspect. The cognitive aspect is the amount of scientific information available in the person, the emotional aspect is represented by the formation of inclinations and directions, as for the applied aspect is represented by the formation of scientific and applied skills. These three aspects are closest to the components of scientific enlightenment. The relationship between scientific awareness and scientific enlightenment is like the relationship of the part to the whole, therefor the concept of enlightenment is more general and comprehensive than the concept of awareness. The term scientific culture is used by some as synonymous with the term of scientific enlightenment, but there is a difference between them becuse the first concept is more broad and comprehensive than the second concept, which means that scientific culture requires an advanced level of scientific expertise, while scientific enlightenment requires only the minimum of that expertise. Therefore, it can be said that the difference between the two terms is a difference in degree and level (Sabri and Saladin, 2005: 31-32).

(Showalter, 1974) identified five dimensions of scientific enlightenment:

1- Understanding the processes of science and exploiting them to solve problems.

2- Understanding the basic concepts of science

3- Interact with the universe in a manner characterized by scientific values.

4- Understanding the mutual relationship between society, environment, science and technology

5- Mastery of skills related to technology and science (Showalter, 1974: 450).

Characteristics of a scientifically enlightened person:

As mentioned in (AlKhatayba, 2005), the characteristics of a scientifically enlightened person are:

1- He has a strong scientific background in understanding scientific facts, concepts and theories also the ability to classify the components of this scientific background.

2- He has a clear understanding of the nature of science.

3- His positive attitude towards science and technology.

4- - Realizes the value of science and technology and knows how they impact society.

5- He has the ability to use scientific processes to solve problems and make appropriate daily decisions.

6- He has the ability to make the right decisions regarding scientific subjects related to society.

7- He has the ability to harness and employ scientific processes that provide the

opportunity for the individual to be effective in his work and in his time of rest.

8- Realizes and understands that society controls science and technology.

9- He values science and technology because of the incentive for creativity it provides.

10-Understands how society affects science and technology (Khatiba, 2005, 93).

LITERATURE REVIEW:

Previous Iraqi studies that dealt with the concept of scientific enlightenment will be presented below:

Taha, 2021	Author and year
(Knowledge of scientific enlightenment among middle school chemistry teachers and the extent of its inclusion in the chemistry textbook also its relationship to the conceptual scientific culture of its students)	Aim of the study
Iraq	Country
Middle school chemistry teachers, middle school students	**Scientific level of the sample**
20 teachers and 5 students	**Sample number**
A measure of scientific enlightenment for chemistry teachers, and a test of conceptual scientific culture	**Tools**
Arithmetic means, percentages, Pearson correlation coefficient, and t-test for one independent sample	**Statistical methods**
Scientific enlightenment among chemistry teachers is not acceptable at the educational level The weakness of students' possession of a conceptual scientific culture. A strong direct correlation between the knowledge of scientific enlightenment among chemistry teachers and the students' conceptual scientific culture.	**Results**

eajil altamimi 2020	Author and year
The effectiveness of an educational program based on the SCAMPER strategy on achievement and scientific enlightenment among second-year intermediate female students in science	Aim of the study
Iraq / Dhi Qar	Country
Middle school female students	**Scientific level of the sample**
60female students	**Sample number**
achievement test in science, scientific enlightenment test	**Tools**
The statistical analysis package (SPSS) was used to get the results	**Statistical methods**
There is a statistically significant effect of the educational program based on the SCAMPER strategy on science achievement and scientific enlightenment among female students in the experimental group.	**Results**
almadi , 2011	Author and year
Revealing the level of scientific enlightenment for biology teachers in The middle school stage and the extent of its inclusion in biology textbooks and its relationship to the Scientific thinking and the environmental awareness of their students	Aim of the study
Iraq	Country
middle school	**Scientific level of the sample**
56 teachers	**Sample number**
Scientific enlightenment scale, scientific thinking scale, environmental awareness scale	**Tools**
Pearson correlation coefficient, Spearman-Brown equation, Kendall equation, Z-test	**Statistical methods**
Pearson correlation coefficient, Spearman-Brown equation, Kendall equation, Z-test	**Results**
alnueaymi, 2011	Author and year
The scientific enlightenment of middle school biology teachers and its relationship to the environmental awareness of their students 1- Do biology teachers have scientific enlightenment? 2- Do students in the second intermediate stage have environmental awareness?	Aim of the study
Iraq	Country
Biology teachers, middle school students	**Scientific level of the sample**
teachers and (400) students (130)	**Sample number**
Scientific enlightenment scale, environmental awareness scale	**Tools**
The correlation coefficient, the Spearman-Brown equation, the t-test, the Hoyt coefficient equation, and the Cronbach alpha coefficient equation.	**Statistical methods**
1- Biology teachers in middle schools possess scientific enlightenment. 2- Students in the second intermediate stage have environmental awareness.	**Results**

Similarities and differences between previous studies:

Aim of the study: The studies differed in the nature of the goals they pursue. Noting that the study (Taha 2021) aimed to study the scientific enlightenment among chemistry teachers, and the study (Ajel and Al-Tamimi 2020) aimed to study scientific enlightenment among second-year intermediate female students in science, while the study (Al-Madhi 2011) aimed to study scientific enlightenment For biology teachers in the middle school, a study (Al-Naimi 2011) aimed to study the scientific enlightenment of biology teachers in middle schools. The aim of the current study is to study the scientific enlightenment of biology teachers in all middle, secondary, and preparatory schools.

Study population: Previous studies differed in the nature of the communities they addressed among preparatory and middle school students, as well as chemistry and biology teachers in the Baghdad education directorates and the governorates, but in the current study the research population was biology teachers in the Baghdad/Rusafa Third Education Directorate.

Study sample: The number of samples varied in previous studies, it was 20 teachers and 5 students in the study of (Taha, 2021), while in the study (Al-Mady, 2011) it was 56 teachers but in the study (Ajel and Al-Tamimi, 2020) it was 56 teachers, while in the current research it reached 150 biology females teachers.

Study methodology: The current study agreed with most studies that dealt with scientific enlightenment on the descriptive approach as a research methodology.

Study tools: Most previous studies prepared a measure of scientific enlightenment. The current study will also prepare a measure of scientific enlightenment according to the theoretical background of scientific enlightenment.

Research methodology and procedures:

1- Research methodology: The author used the descriptive method because it is the most appropriate and suits the research objectives in clarifying, describing, and analyzing studies through data analysis. The descriptive method is defined as "every investigation that focuses on an educational or psychological phenomenon with the aim of diagnosing it, revealing its aspects, and determining the relationships between its elements (Al-Zubaie, 1981: 53) and the following procedures were followed:

2- The research community: The research community means the total group with elements which the author seeks to generalize the results related to the problem (Odeh and Fathi, 1992: 159). The current research community is represented by the biology female teachers in Baghdad/Rusafa Third Education Directorate, that reached 210 biology female teachers for the academic year 2023-2024, according to the statistics of the Planning Directorate of the General Directorate of Education of Baghdad Governorate / Rusafa III, distributed among (150) schools, including (46) middle schools, (57) secondary schools, and (47) preparatory schools.

3- Research sample: The research sample is defined as part of the research community and represents it in a manner that is consistent with the chosen method (Murabti and Nahwi, 2009: 104). The sample was selected randomly. The number of female biology teachers reached (105), distributed among (35) Middle school, (37) secondary schools, (33) preparatory schools i.e. 50% of the original community.

4-reSearch tool: The scientific enlightenment scale was prepared according to the following steps:

First: Defining the concept and areas of scientific enlightenment:

The author adopted the definition of the minimum amount of scientific experience that any citizen in any society should acquire in order to increase his level of scientific awareness and understanding ability to keep pace with the scientific movement and its developments that is reflected positively on his behavior towards himself, his environment, and his society (Sabri and Salah al-Din, 2005: 23) as a theoretical definition in preparing the scientific enlightenment scale. After reviewing previous studies such as the study of (Al-Naimi, 2011), the study of (Al-Madi, 2011), and the study of (Al-Muhtasib, 2006), depending on the theoretical definition, the author relied on seven areas of scientific enlightenment, which are **(biological knowledge, The mutual relationship between biology, society and the environment, translation of terms, science processes, scientific trends, scientific inclinations, scientific assessment).**

Second: Preparing the items for the scientific enlightenment scale: After the concept and fields of scientific enlightenment were defined, the author prepared 50 items for the scale, as the answer alternatives were four alternatives for the four areas (biological knowledge, the mutual relationship between biology, society and the environment, translation of terms, and science processes). One is correct it's receive 1 score as for the rest of the answers it's considered incorrect and takes 0 score. The three areas (scientific trends, scientific inclinations, and scientific assessment), the answer alternatives were threefold (Agree, hesitant, Disagree) and take scores (3-2-1). The scale items on the fields are distributed as follows:

BIOLOGICAL KNOWLEDGE

It consists of 6 paragraphs taking the sequence (1-6)

The mutual relationship between biology, society and the environment: It consists of 9 paragraphs taking the sequence (7-15)

Translation of terms: It consists of 5 paragraphs taking the sequence (16-20)

Scientific processes: It consists of 7 paragraphs taking the sequence (21-27)

Scientific trends: It consists of 12 paragraphs taking the sequence (28-39)

Scientific tendencies: It consists of 4 paragraphs taking the sequence (40-43)

Scientific assessment: It consists of 7 paragraphs taking the sequence (44-50).

Third: Validity of the scientific Enlightenment scale items:

The validity of the items is a basic condition for effective measurement tools in measuring the phenomenon being measured, as the validity of the test is intended to measure what it was designed for, that is, the extent of the validity of the test to measure a specific goal or aspect in multiple forms (AbuJadou, 2013: 299). Regarding the validity of the items, the scale was presented initially form to 16 specialists in teaching methods, measurement and evaluation to determine the suitability of the items in measuring the areas of the Scientific Enlightenment Scale, as well as their opinion on the answer alternatives. The author took all the modifications in the linguistic wording and adopted the percentage of

agreement between the experts 80% except for some minor wording modifications.

Fourth: Preparing answer instructions:

The answer instructions are the guide for the examinee or respondent. In preparing the scale, the author was keen on the following: it should be clear, easy to understand, and appropriate to the level of the research sample. The author took the purpose of the scale in order to obtain Accurate and authentic data. The author asked not to mention the respondent's name to maintain the confidentiality of the information and to reduce social desirability. The author indicated that the purpose of the information collected from the test is for the purpose of scientific research, and only the author will see it. The author presented a model of the response as an example for the respondent to follow when answering the test.

Fifth: Correcting the Scientific Enlightenment Scale:

With regard to correcting the scale, the answer alternatives for the four areas (biological knowledge, the mutual relationship between biology, society and the environment, translation of terms, science processes) were one correct answer that received 1 score, the rest of the answers were incorrect that received 0 score. The total score for the four areas ranged between 0 - 27. As for the other three areas (scientific attitudes, scientific inclinations, and scientific assessment), the answer alternatives were threefold (Agree, hesitant, Disagree), taking scores of 3 – 2 - 1. The total score for the three areas ranges from 1 - 69.

Sixth: The first exploratory experiment (experimenting with clarity of instructions and the time needed to answer) for the Scientific Enlightenment Scale:

The author applied the scale to a sample consisting of 30 schools from the research community who were chosen randomly. After application, it became clear that the information and paragraphs of the scale were obvious and that the amount of time needed to answer was 45 minutes.

Seventh: the second exploratory experiment (the experiment of statistical analysis of the items) for the Scientific Enlightenment Scale:

The purpose of the analyzing the items was to retain the good items that reveal accuracy in measuring what they were designed for (Ebel, 1972: 392). Therefore, the discriminatory power of the items and the correlation of the item's score with the total score of the field to which it belongs were verified. The scale was applied to a sample of 105 female teachers that distributed among 150 middle, secondary, and preparatory schools. After correcting the teachers answers they were Results ranked in descending order, the highest and lowest 27% of the scores were chosen, i.e. there were 28 for the upper group and 28 for the lower group. Then the upper and lower groups were statistically analyzed for the scale according to the following steps: -

1- Difficulty factor for the objective paragraphs: by this procedure, it is possible to identify the percentage of individuals who can come up with correct answers and the percentage of individuals who give wrong answers (Majid and Yassin, 2012: 30-31). An equation was used to find the difficulty factor it was found to be ranged from 0.20 - 0.54, it was considered good if it is within the required criterion for the difficulty factor 0.20 - 0.80 as shown in Table (1).

2- The discriminatory power of the items: in order to calculate the discriminatory power of each item of the scale, the special equation was applied to extract the discrimination coefficient for each of the items of the first four areas in the scale (biological knowledge, the mutual relationship between biology, society and the environment, translation of terms, science processes) which numbered 27 paragraph that its value ranged between 0.20 - 0.57. The item is good if its discriminatory power is (0.20) or higher (Ebel, 1979: 104) as shown in Table (1). As for the purpose of finding the discriminatory power of the fields (scientific trends, scientific inclinations, and scientific assessment) in the scale, a T-test was applied for two independent samples so the discriminatory power was calculated for each of the scales of 23 items. The discriminatory power of the items ranged between 2.304 - 6.436, which is significant at a significance level of 0.05 and a degree of freedom 54, as shown in table (2).

3- The effectiveness of the wrong alternatives for objective paragraphs: the meaning of the effectiveness of the wrong alternative is ability to attract the attention of low-level individuals to choose it as an alternative to the correct answer, any alternative that is not chosen by any member of the upper or lower groups is considered ineffective and must be deleted from the test (Al-Zamili, 2009: 379). when extracting the coefficient of effectiveness of the false alternatives with its own equation, it was found that all the coefficients are with a negative sign which means the members of the lower group are more than those of the upper group, meaning that all the false alternatives are effective, as they ranged between -0.03 - -0.24.

Table (1)

Ease, difficulty, and excellence of the items of the Scientific Enlightenment Scale (objective items)

Excellence	Difficulty	Ease	The number of correct answers in the lower group (28)	Number of correct answers in the upper group (28)	No.
0.36	0.39	0.61	12	22	1
0.5	0.36	0.64	11	25	2
0.46	0.41	0.59	10	23	3
0.61	0.37	0.63	9	26	4
0.39	0.52	0.48	8	19	5
0.32	0.20	0.80	18	27	6
0.21	0.29	0.71	17	23	7
0.39	0.48	0.52	9	20	8
0.5	0.36	0.64	11	25	9
0.43	0.29	0.71	14	26	10
0.43	0.36	0.64	12	24	11
0.21	0.21	0.79	19	25	12
0.20	0.54	0.46	8	19	13
0.29	0.29	0.71	16	24	14
0.32	0.20	0.80	18	27	15
0.43	0.43	0.57	10	22	16
0.25	0.27	0.73	17	24	17
0.54	0.41	0.59	9	24	18
0.57	0.32	0.68	11	27	19
0.46	0.41	0.59	10	23	20
0.21	0.32	0.68	16	22	21
0.54	0.37	0.63	10	25	22
0.25	0.23	0.77	18	25	23
0.36	0.25	0.75	16	26	24
0.43	0.25	0.75	15	27	25
0.21	0.43	0.57	13	19	26
0.43	0.28	0.72	14	26	27

Table (2)

The discriminatory power of the items of the Scientific Enlightenment Scale (2)

Level of significance	Calculated T-value	Lower		Upper		Paragraph
		Standard deviation	Arithmetic mean	Standard deviation	Arithmetic mean	
Function	4.334	1.191	3.99	0.558	2.68	1
Function	3.845	1.072	3.88	0.723	2.49	2
Function	4.240	1.180	3.66	0.952	2.44	3
Function	5.467	1.370	3.28	0.822	2.34	4
Function	5.166	1.528	3.19	1.091	2.37	5
Function	2.304	1.251	3.68	1.352	2.19	6
Function	2.538	1.649	2.71	1.704	2.15	7
Function	2.815	1.422	3.91	1.110	2.31	8
Function	2.345	1.091	4.06	1.029	2.49	9
Function	6.436	1.178	3.49	0.847	2.62	10
Function	4.714	1.299	3.79	0.784	2.66	11
Function	5.466	1.002	3.74	0.657	2.53	12
Function	3.503	1.021	3.82	0.829	2.38	13
Function	5.060	1.302	3.35	0.940	2.34	14
Function	2.837	1.365	3.32	1.355	2.99	15
Function	2.902	1.363	3.31	1.170	2.94	16
Function	5.054	1.409	3.01	1.081	2.10	17
Function	6.965	1.138	2.75	0.946	2	18
Function	4.402	1.374	3.15	1.148	2.10	19
Function	2.970	1.202	3.54	1.105	2.13	20
Function	2.636	1.560	2.50	1.787	2.97	21
Function	3.138	1.598	3.21	1.134	2.96	22
Function	2.735	1.057	4.04	1.019	2.35	23

4- Technique of relating the item score to the total score of the field (internal consistency): This method was used by finding correlations between the total scores of the field and using the Pearson correlation coefficient. The results indicated that all the calculated correlation coefficient values are greater than the critical value of the correlation coefficient, which is 0.124 with a 103 degree of freedom as shown in Table (3).

Table (3)

The correlation coefficient of the item score with the field score of the scientific enlightenment scale

Seventh field Scientific appreciation		Sixth field Scientific inclinations		Fifth field Scientific trends	
Correlation coefficient	No.	Correlation coefficient	No.	Correlation coefficient	No.
0.107	21	0.357	12	0.441	1
0.184	22	0.368	13	0.651	2
0.062	23	0.442	14	0.451	3
0.173	24	0.497	15	0.299	4
0.302	25	0.389	16	0.239	5
0.456	26	0.598	17	0.244	6
0.326	27	0.598	18	0.068	7
0.559	28	0.346	19	0.020	8

Eighth: Indicators of the validity of the scientific enlightenment scale and its reliability coefficient:

1- Apparent validity: The expression apparent validity is used to indicate the extent to which it appears that the test includes items that are related to the variable being measured, and that the content of the test is agrees with the purpose (Anastasi & Urbina, 1997: 147).

This indicator of validity in the Scientific Enlightenment Scale was achieved when the scale was presented in its initial form with its fields to experts and arbitrators in teaching methods, measurement and evaluation which were16 experts that agreed on the validity of the scale in measuring what it was developed for.

2- Reliability: The scale's reliability coefficient was extracted as follows:

***Cronbach's–alpha equation:** The idea of this method depends on calculating the correlations between the items that included in the test and dividing it into a some parts that equal to its items number, meaning that each item constitutes a subtest (Odeh, 1998: 354). To estimate the internal consistency of the scale, the research samples (105 students) answers were used. The reliability coefficient is 0.86, which is a good reliability coefficient that indicates the paragraphs are consistent with each other.

The scale in its final form: After verifying the statistical properties of the items of the Scientific Enlightenment Scale and the psychometric properties of the scale, the scale in its final form consists of 50 items and ready for application.

Present and discus the results: For the purpose of ensuring the achievement of the research objectives and answering its questions, the following results were presented:

Identify the extent of female biology teachers awareness of scientific enlightenment through the following question: Do female biology teachers possess scientific enlightenment?

To achieve this purpose, the author relied on a T-test for one sample; the following results were reached as shown in Table (4):

Table (4)

The arithmetic mean, standard deviation, and T-value calculated for the scientific enlightenment scale for female biology teachers

Statistical significance 0.05	Tabular T-value	Calculated T-value	Degree Freedom	Average Hypothetical	Standard deviation	Average Arithmetic	No.	Variable
function	1.980	150	104	59.5	1.082	43.6	105	Scientific enlightenment

From Table 4, we find that the calculated T-value (150) is greater than the tabulated T-value of 1.980 at a significance level of 0.05 and a degree of freedom of 104. When comparing the arithmetic mean of the female teachers grades, which is 43.6 (that has a standard deviation 1.082) with the hypothetical mean of 59.5, it turns out that there is a difference between the two means, and the calculated T-value. In favor of the hypothesized average, this is an indication of a decline in scientific enlightenment among a sample of female biology teachers. This result was consistent with the low levels of general scientific enlightenment reached by the local studies referred to previously: Al-Naimi's study (2011), Al-Mady's study (2011), and Taha's study (2021).

Conclusions: After verifying the results, the author concluded the low level of general scientific enlightenment among female biology teachers in middle, secondary, and preparatory schools in Baghdad/ Al-Rusafa Third Education Directorate. This result is due to the following reasons:

1- Pre-service teacher preparation programs were not keeping up with global reform projects of biology science curricula and teaching it because it's no longer qualifying them educationally or professionally to teach or learn general sciences.

2- Vocational training and in-service development programs do not contain educational materials related to the fields of scientific enlightenment.

3- Teachers fail to keep up with the most important topics related to scientific enlightenment raised by scientific innovations and its technical applications .

Recommendations: After reviewing the research results, the author recommends the following:

1- Those responsible for preparing curricula should pay attention to sources of scientific enlightenment.

2- Those responsible for preparing print and audio educational media in the pursuit of scientific enlightenment.

Suggestions: The author proposes to study bio-scientific enlightenment with a various dimensions for the teachers of other academic subjects and its relationship to psychological and educational variables such as the attitude towards science and technological inclinations.

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REFERENCES

1. Abu Jado, Saleh Muhammad Ali (2013): Educational Psychology, 7th edition, Dar Al-Masirah for Publishing and Distribution, Amman.
2. Al-Zamili, Abdul Jassim, Abdullah Muhammad Al-Sarmi, and Ali Mahdi Kazem (2009): Concepts and Applications in Educational Measurement and Evaluation, Al-Falah Library, Kuwait.
3. Zaitoun, Kamal Abdel Hamid, (2000): Teaching science from a constructivist perspective, Scientific Office for Computer, Publishing and Distribution, Alexandria.
4. Khatiba, Abdullah Muhammad (2005): Teaching Science for All, 1st edition, Dar Al-Masirah, Amman.
5. Sabry, Maher Ismail and Salah El-Din, Muhammad Tawfiq (005 2): Technological enlightenment and modernization of education, 2nd edition, Modern University Office, Egypt.

6. Taha, Hassan Taqi (2021): Knowledge of scientific enlightenment among middle school chemistry teachers and the extent of its inclusion in the chemistry textbook and its relationship to the conceptual scientific culture of their students, Al-Fath Magazine, Issue Eighty-Six.
7. Ajel, Nour Naeem and Al-Tamimi, Wissam Najm (2020): The effectiveness of an educational program based on the SCAMPER strategy in academic achievement and enlightenment among female second-year intermediate students in science, published research, Nasq Magazine, No. 26.
8. Odeh, Ahmed Suleiman and Fathi Hassan Malkawi (1992): Fundamentals of scientific research in education and human sciences, elements of research, its methods, and statistical analysis of its data, 2nd edition, Al-Manar Library, Jordan.
9. Al-Madi, Abbas Abdul Mahdi Abdul Karim (2011): Scientific enlightenment for biology teachers in the middle school and the extent of its inclusion in biology textbooks and its relationship to scientific thinking and environmental awareness of their students, unpublished doctoral thesis, College of Education for Science, Ibn al-Haytham, University of Baghdad, Baghdad.
10. Al-Muhtasib, Sumaya (2006): The level of scientific enlightenment among secondary school students in the Amman Governorate and its relationship to their attitudes towards science and technology, published research in Dirasat Journal, Volume 33, Issue 2.
11. Murabity Adel, Nahawi Aisha (2009): Al-Ainah, published research, Al-Wahat Journal for Research and Studies, No. 4, pp. 94-108.
12. Majeed, Abdul Hussein Razouki and Yassin Hamid Ayal (2012): Measurement and Evaluation for University Students, 1st edition, Al Yamamah Library, Baghdad.
13. Al-Naimi, Hadeel (2011): Scientific enlightenment for biology teachers in middle schools and its relationship to the environmental awareness of their students, doctoral thesis, University of Baghdad, College of Education for Pure Sciences / Ibn Al-Haytham.
14. Ebel, Robert, (1972): Essential of Educational Measurement, (12), 2nd, prentice Hall, New Jersey.
15. Showalter , V.M (1974) : What is unified science education? Part 6program objectives and scientific literacy , prism 11 , 2(30).

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