Research Article

Awareness of Chemical Innovations Among Teachers of Chemistry

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Abstract: *The current research aims to identify:*

1. Awareness of chemical innovations among chemistry teachers.
2. Statistically significant differences in awareness of chemical innovations, according to the gender variable (males, females) and years of service (less than 15 years, more than 15 years).

In order to achieve the objectives of the research, the researcher adopted the descriptive research method, and the research community was identified and his sample was selected: Chemistry teachers in middle, middle and high schools affiliated to the General Directorate for Education in Al-Qadisiyah for the academic year (2020-2021) AD, and the research sample consisted of (400) teachers and a school of chemistry and by the fact (187) teachers, and (213) female teachers. A measure of awareness of chemical innovations was built and consisted of (54) items. The scale was applied to the research sample, and the results showed poor awareness of chemical innovations among chemistry teachers. The awareness of the chemical innovations was not affected by the variable of sex and years of service. In light of these results, the researcher developed a set of recommendations and proposals.

Keywords: Awareness of Chemical Innovations, Chemistry Teachers.

1. Research Problem

The rapid progress that we are witnessing today in the scientific and technological field in various aspects of life has generated important issues and problems that have aroused people's interest. Therefore, several modern issues have appeared in science and opinions differed between right and wrong, and between acceptance and rejection of the concept of scientific innovations, including chemical ones, and they became important topics addressed by all individuals who are not specialists in chemistry because of its great and great impact on people's lives. The concept of scientific innovations in general, and chemical innovations in particular, emerged in large steps and increased their importance through their association with the lives of individuals and society, and when conducting interviews to explore the views of a sample of chemistry teachers in Qadisiyah governorate in intermediate, middle and high schools on the subject of chemical innovations, the researcher found that the teachers do not know The term chemical innovations in its scientific sense, but when we talk to them about what is meant by this term and what it contains of new discoveries, studies and research that fall under the fields of chemistry science. They have a complete picture of it. And here the problem of the current research became clear to the researcher:

What is the awareness of chemical innovations of chemistry teachers?

2. Research Importance:

Awareness of chemical innovations contributes to advancement and progress in societies, as it is important that the role of a chemistry teacher is not limited to teaching chemistry, but rather he must teach chemistry and its modern applications and their impact through their awareness of chemistry innovations and the embodiment of these innovations to students in their lives through their applications in health, food, drink, clothes and colors. And other necessary applications included in the science of chemistry that the teacher should be aware of (Ngozi & Norman, 2006,11). There are various uses for modern scientific innovations in chemistry, including nanotechnology and renewable energy, electronic waste, household waste, green chemistry, and the behavior of elements and their compounds, which it is necessary for the teacher to be aware of because such technologies and scientific innovations have advantages that are not without disadvantages to use it (Al-Bayati,

6,2018). The importance of chemical innovations is highlighted through a number of studies that dealt with chemical innovations, including the study of Al-Bayati (2018) and the study of Farag and Adli (2009), which emphasized the necessity of concepts of chemical innovations and their inclusion in the curricula, and the study of Nawar (2015), which emphasized the development of concepts of chemical innovations among students of high school Because of the importance of awareness of modern chemistry concepts, including innovations, many international and Arab projects and conferences have emerged that recommended teaching all that emerges from new and modern scientific concepts in the science of chemistry, including:

- **Targeted Science Project - No Waste - WantNot**
  Target Science: Waste Not, WantNot, 2007 Which aimed at preparing a program on the concepts of electronic waste and methods of recycling it, by developing awareness of it by presenting some activities that explain the reasons for its formation, and disposing of it in multiple ways, including: recycling it, preparing small landfills for them, and the specifications of these landfills (Nawar, 91,2015)
- **The Fourteenth Arab Chemical Conference (2008)**, which was held in the city of Tripoli in the Libyan Jamahiriya for the period from 3/13 to 3/4, hosted by the Libyan Chemical Society. This conference emphasized the activities related to the chemical field, including: Spreading chemical and scientific awareness among teachers through Issuing relevant pamphlets and magazines, and working on linking chemists at home and abroad (Arab Chemist Journal, 6,2009).

From the above, the importance can be highlighted in its theoretical and practical side.

1- It is considered one of the first researches in Iraq (according to the researcher's knowledge) concerned with identifying awareness of chemical innovations among chemistry teachers.

2- It sheds light on the concept of chemical innovations and their journals (nuclear chemistry, green chemistry, medicinal chemistry, nanotechnology technology, electronic waste) as these innovations represent modern concepts.

3. Research Aims:

The current research aims to identify:

1. Awareness of chemical innovations among chemistry teachers.
2. Identify the statistically significant differences in awareness of chemical innovations among chemistry teachers according to the sex variables (males, females) and years of service (less than 15 years, more than 15 years).

4.Research Limits:

The current research is determined by male and female chemistry teachers in the governmental intermediate, middle and middle schools of the Qadisiyah Education Directorate, within the academic year (2020-2021).

5. Defining Terms:

awareness of chemical innovations: the researcher did not find a definition of awareness of chemical innovations, so the researcher defined them theoretically and procedurally:

The researcher theoretically defines it as: "the knowledge, perception, tendencies, attitudes, and behaviors that chemistry teachers possess in a set of new and developed issues and topics through research and discoveries related to the science of chemistry and its branches that have a direct impact on the applications of the daily life of the individual, his environment and his society."

Procedural definition of awareness of chemical innovations: "The degree that chemistry teachers obtain through the application of the measure of awareness of chemical innovations prepared by the researcher for this purpose."

6. Theoretical Background

6.1. Awareness of chemical innovations: the meaning of awareness in the dictionary of al-Wajeez came in three formulas: memorization and appreciation, understanding and safety of perception, that is, the feeling of a living being about what is in himself and what surrounds others (The Arabic Language Academy, 675, 1998). And some educators believe that consciousness is: "Perceiving the facts related to a phenomenon or problem and what is in it about relationships that reveal the nature of the phenomenon or problem, and then enable us to understand well and

contemplate the most appropriate methods for participation and solution" (Mansour et al., 1986, 120).

Also, awareness from the point of view of psychologists is: "a clear mental awareness of the requirements for the successful work performed by the individual." While LOCK finds consciousness: it is the perception of what is going on inside the human mind, which is a reflection of the observations of the individual or his mind's observation of the interfering processes. Consciousness: the individual's perception of certain things in the situation or phenomenon (Shehata and Najjar, 339,2003). Consciousness is "not only the gathering of information, but rather the individual's perception and feeling of his behavior towards certain topics by acceptance or rejection and the development of this feeling that appears in the form of learning results that are easy to notice. And measuring them directly or appearing in the form of behavior or indirectly through certain signs or signs "(Simmons, 2003,6).

6.2. Chemical Innovations in Education:

The emergence of chemical innovations in the field of education is not the intended end in itself, but the most important thing is how to employ them to achieve the desired goals by following up and employing everything new in the field. Professionally in the field of education if he is aware of the innovations, but he must possess the following: A level of logical ability necessary to follow up on recent scientific developments. The ability to read and understand the emerging topics and issues. And the ability to understand how the basic developments necessary for an individual's life work. And the feeling that the innovations are a mental effort that helps students to understand science subjects (Alimimat, 133,2009).

Therefore, the educational curriculum should include scientific and technical innovations that are applications of science and take a place in education and the upbringing of generations through their knowledge of the innovations because they are the ones that will be responsible in the future for raising other generations (Al-Azzawi, 2009, 283-284).

6.3. Fields of Chemical Innovations:

Farraj and Adly (2009) identified a list of chemical innovations that included seven fields: The innovations related to the field of physical chemistry. Innovations related to the field of biochemistry. Innovations related to the field of photoelectric chemistry and electromagnetism. Innovations related to the field of chemistry of polymers and macromolecules. Innovations related to the field of pharmaceutical chemistry and drugs. Innovations related to the field of nuclear chemistry. Developments related to the field of environmental chemistry (Farag and Adli, 82,2009).

Nawar (2015) identified a list of chemical innovations that she covered in her study, including the following fields: electronic waste, household waste, green chemistry, nanotechnology, chemical weapons, and nuclear weapons (Nawar, 3-4-2015).

While Al-Bayati (2018) identified a list of chemical innovations that he addressed in his study, including the following fields: renewable energy, green chemistry, nanochemistry, and household waste. Electronic Waste, Nuclear Waste (Al-Bayati, 61,2018).

Through the researcher's briefing on the international projects, research and previous studies that are concerned with chemical innovations, and the poll conducted by the researcher to identify the chemical innovations that teachers should be aware of, the areas of chemical innovations that the researcher adheres to in his current research have been identified, namely: nuclear chemistry. Green chemistry, medicinal chemistry, nanotechnology, electronic waste.

The researcher has included these fields in the components of consciousness (the cognitive component - the emotional component - the behavioral component) that were mentioned previously. The following is the definition of each field:

The first field: Nuclear Chemistry: It is one of the branches of chemistry that studies the radioactivity, nuclear reactions and processes, and the nuclear properties (Meridi, 3,2017).

The second field: green chemistry: is the science that uses chemical techniques and methods that reduce or prevent the use of raw materials or by-products resulting from a chemical reaction, solvents or catalysts in manufacturing that are dangerous to humans or harmful to the environment (Shaker, 34,2009).

The third field: medicinal chemistry: is that branch of biochemistry that studies the composition of substances as well as their transformations and energy transformations also in the human body, whether in its natural or pathological state, such as measuring the percentage of creatine in the blood resulting from the destruction of proteins as evidence of the efficiency of the natural kidneys to identify deficiencies in their functions (Bartzatt, 2003,37).

The fourth field: Nanotechnology: It is the technologies made with the smallest unit of dimension measurement that a human has been able to measure up to now (nanometers), that is, dealing with objects, equipment and machines that are very accurate with dimensions. The level of the nanoscale is of utmost importance by enhancing the quality of life of countries and societies, as it is expected that nanotechnology will be the main driving force capable of change in society. As the rapid and continuous development in the field of nanotechnology accelerates the need for general knowledge and specialized skills in this field. (2009,3).

The Fifth field: electronic waste: is the remnants of various electronic devices such as electronic computers, cell phones, microwaves and other devices that are dismantled and sold their waste or transported from one place to another place for burial or burning, or searching for electronic parts and precious metals inside them and what results from all these operations. Exposure to great environmental risks because they contain harmful elements such as lead, mercury and others (Mazen, 2006, 300-301).

7. Research Methodology and Procedures

The researcher adopted the descriptive approach (correlational studies) in this research to suit the problem of his current research and its goal, as it is one of the appropriate scientific research methods to study the correlational relationships between variables, as his interest is focused on describing the phenomenon and defining the relationships between its elements, or between it and another phenomenon.

***7.1. The Research Community* :** The current research community is determined by all chemistry teachers in governmental intermediate, preparatory and secondary schools in the Qadisiyah governorate, whose number is (540) by (252) teachers and (288) schools distributed within the departments of the General Directorate of Qadisiyah Education for the academic year (2020-2021).

7.2. The research sample: In order for the sample to be representative of its original community, the researcher took a sample from the chemistry teachers belonging to the departments of the General Directorate of Education in Al-Qadisiyah in a simple random way, and the size of (400) teachers and schools from the research community were (187) teachers, (213) and a school.

7.3. Search Tool:

7.3.1.Chemical Invention Awareness Scale:

The researcher resorted to building a measure of awareness of chemical innovations based on the researcher's own definition, which states: "The knowledge, perception, tendencies, attitudes, and behaviors that chemistry teachers possess in a set of new and developed issues and topics through research and discoveries related to chemistry and its branches that have a direct impact on the applications of the daily life of the individual, his environment and his society." The researcher identified three components: the cognitive component, the emotional component, and the behavioral component. Relatively little agreement with it, very little agreement with it) and the weights of alternatives for the positive paragraphs are (5, 4, 3, 2, 1).

7.3.2. Psychometric properties of the scale.

7.3.2.1. Validity of the Scale:

Two indicators of validity were extracted for the current scale, which are apparent validity and construct validity. The following is an explanation of how to verify each indicator:

A. The validity of the paragraphs to measure awareness of chemical innovations (apparent validity).

The researcher presented the scale in its preliminary form to (20) experts from specialists with experience in the field of educational psychology and methods of teaching chemistry. The researcher took 80% or higher of the opinions of the referees as a percentage of approval of the paragraphs and in light of the opinions of the arbitrators, (6) paragraphs were deleted from the scale Because the majority of arbitrators do not agree with it, so that the applicable standard for the sample of statistical analysis consists of (54) items

B. Statistical analysis of the articles of awareness of chemical innovations (validity of construction):

Two methods were used:

1- The discriminatory power of paragraphs (in the style of the two peripheral groups)

Through this method, we can choose the paragraphs that give the largest amount of information about the differences in the answers of the individuals and delete the unmarked paragraphs, and this in turn will contribute to increasing the stability of the test (Musa, 2006, 582). And a school and he corrected the answer forms, and to extract the discriminatory strength of the scale paragraphs, the scores of the sample members were arranged from the highest total degree to the lowest total score, and the two extremist groups were determined by the total score and by (27%) from each group. The researcher used the t-test for two independent samples to calculate the significance. The differences between the mean of the two groups in the scores of each of the scale paragraphs. The results of the discriminatory power calculation showed that all the paragraphs are distinguished because they are statistically significant, because its calculated T value is greater than the tabular T value of (1.96) with a degree of freedom (214) and at a level of significance (0.05). Table (1) illustrates this.

Table 1. The distinctive strength of the measures of awareness of chemical innovations

The calculated value	The lower group		The upper group		number
	standard deviation	Arithmetic average	standard deviation	Arithmetic average	Paragraph
7.446	**0.948**	**2.95**	**1.041**	**3.66**	**1**
7.185	**0.971**	**2.19**	**1.071**	**3.19**	**2**
4.949	**0.858**	**2.30**	**1.030**	**2.94**	**3**
3.937	**0.990**	**1.97**	**1.146**	**2.54**	**4**
5.413	**0.883**	**2.37**	**1.046**	**3.09**	**5**
11.126	**1.202**	**2.61**	**0.899**	**4.22**	**6**
8.432	**1.178**	**2.70**	**0.974**	**3.94**	**7**
6.029	**0.989**	**2.46**	**0.950**	**3.25**	**8**
6.166	**1.039**	**2.38**	**0.937**	**3.28**	**9**
8.309	**0.930**	**2.22**	**1.032**	**3.33**	**10**
7.189	**1.137**	**2.43**	**1.036**	**3.50**	**11**
9.322	**1.096**	**2.56**	**0.941**	**3.86**	**12**
8.117	**1.059**	**2.59**	**0.967**	**3.71**	**13**
9.114	**1.036**	**2.36**	**0.947**	**3.59**	**14**
7.508	**1.075**	**2.32**	**1.187**	**3.48**	**15**
8.577	**1.144**	**2.71**	**0.940**	**3.93**	**16**
9.449	**0.957**	**2.28**	**0.859**	**3.51**	**17**
4.122	**1.008**	**2.47**	**1.133**	**3.07**	**18**
4.352	**1.032**	**2.59**	**0.999**	**3.19**	**19**
9.047	**1.045**	**2.46**	**0.969**	**3.70**	**20**
8.144	**0.920**	**2.35**	**0.934**	**3.37**	**21**
5.276	**0.956**	**2.39**	**1.125**	**3.14**	**22**
4.577	**0.975**	**2.24**	**1.184**	**2.91**	**23**
5.837	**0.927**	**2.28**	**1.157**	**3.12**	**24**
4.151	**0.928**	**2.18**	**1.035**	**2.74**	**25**
2.770	**0.969**	**2.35**	**1.262**	**2.77**	**26**
7.227	**0.982**	**2.37**	**0.899**	**3.29**	**27**
5.370	**1.075**	**2.24**	**1.264**	**3.09**	**28**
5.768	**0.988**	**2.56**	**0.945**	**3.32**	**29**

4.087	**0.925**	**2.27**	**1.248**	**2.88**	**30**
7.890	**1.032**	**2.21**	**1.019**	**3.31**	**31**
8.314	**1.001**	**2.31**	**0.978**	**3.43**	**31**
6.509	**1.114**	**2.46**	**0.878**	**3.35**	**32**
8.904	**1.016**	**2.22**	**0.937**	**3.40**	**33**
7.581	**1.140**	**2.37**	**0.950**	**3.45**	**34**
5.844	**1.054**	**2.50**	**0.993**	**3.32**	**35**
5.889	**1.104**	**2.43**	**1.043**	**3.29**	**36**
7.601	**1.015**	**2.34**	**0.896**	**3.33**	**37**
6.699	**1.147**	**2.47**	**0.864**	**3.39**	**38**
4.611	**1.105**	**2.53**	**1.107**	**3.23**	**39**
5.874	**1.024**	**2.58**	**0.943**	**3.37**	**40**
6.186	**1.017**	**2.46**	**0.915**	**3.27**	**41**
6.135	**0.971**	**2.48**	**0.889**	**3.25**	**42**
6.989	**1.139**	**2.49**	**0.911**	**3.47**	**43**
7.670	**1.022**	**2.39**	**1.017**	**3.46**	**44**
8.116	**0.997**	**2.29**	**1.014**	**3.40**	**45**
7.053	**1.080**	**2.47**	**0.940**	**3.44**	**46**
6.515	**1.054**	**2.50**	**0.925**	**3.38**	**47**
6.172	**1.095**	**2.42**	**1.019**	**3.31**	**48**
6.417	**1.179**	**2.36**	**0.949**	**3.29**	**49**
6.740	**1.102**	**2.40**	**0.884**	**3.32**	**50**
7.963	**1.028**	**2.23**	**1.072**	**3.37**	**51**
5.507	**0.880**	**1.48**	**1.825**	**2.55**	**52**
6.635	**1.036**	**2.46**	**0.951**	**3.36**	**53**

2- Internal consistency: Internal consistency was calculated using several methods:

A- The relationship of the score of the paragraph to the total score of the scale: Use the correlation coefficient (Pearson) to extract the correlation between the degree of each paragraph of the scale with its total score, and this means that the paragraph measures the same concept that the total score measures, and one of the advantages of this method is that it provides a homogeneous scale In his paragraphs, as the higher the paragraph correlation coefficient with the total degree, the greater the probability of its inclusion in the scale. For this purpose, the statistical analysis sample questionnaires of (400) teachers and schools were used. The statistical treatment showed that all the scale paragraphs are statistically significant at the level of significance (0.05) and the degree of freedom (398), as all the values of the coefficients of their correlation with the total degree were greater than the tabular value of (0.098), as show in table (2).

Table 2. Coefficient of correlation between the degree of each paragraph total score of scale

Pearson correlation coefficient	Paragraph number	Pearson correlation coefficient	Paragraph number	Pearson correlation coefficient	Paragraph number
0,325	**37**	**0.267**	**19**	**0.333**	**1**
0,350	**38**	**0.463**	**20**	**0.352**	**2**
0,351	**39**	**0.405**	**21**	**0.187**	**3**
0,260	**40**	**0.239**	**22**	**0.210**	**4**
0,303	**41**	**0.190**	**23**	**0.236**	**5**
0,301	**42**	**0.246**	**24**	**0.560**	**6**
0,295	**43**	**0.183**	**25**	**0.458**	**7**
0,365	**44**	**0.148**	**26**	**0.293**	**8**
0,390	**45**	**0.374**	**27**	**0.355**	**9**
0,400	**46**	**0.299**	**28**	**0.374**	**10**
0,364	**47**	**0.321**	**29**	**0.400**	**11**
0,339	**48**	**0.215**	**30**	**0.468**	**12**

0,325	**49**	**0.385**	**31**	**0.436**	**13**
0,336	**50**	**0.394**	**32**	**0.468**	**14**
0,352	**51**	**0.326**	**33**	**0.355**	**15**
0,421	**52**	**0.412**	**34**	**0.431**	**16**
0,292	**53**	**0.400**	**35**	**0.477**	**17**
0,339	**54**	**0.314**	**36**	**0.249**	**18**

B. The relationship of paragraph degree correlation with the degree of the component to which it belongs and the relationship of paragraph degree correlation with the degree of the subdomain of each component: For the purpose of calculating the value of the correlation coefficient between the degree of the paragraph and the total degree of the component to which it belongs and the degree of the subdomain of each component, Pearson correlation coefficient was applied to find the values of the correlation coefficient, and this the index indicates that the scale paragraphs follow the same path as the field. It was found that all the paragraphs are statistically significant at the level of significance (0.05) and the degree of freedom (398), as all the values of the correlation coefficients were greater than the tabular value (0.098), as show inTable (3).

Table 3. Correlation coefficients between each paragraph and the component to which it belongs, and the paragraph correlation with the subdomain of each component

The paragraph is related to the component subdomain to which it belongs	Paragraph linked to the main component	Paragraph number	Subdomain Component	Component	Component number
0.514	**0.496**	**1**			
0.508	**0.310**	**2**	**Nuclear chemistry**		
0.622	**0.184**	**3**		**Cognitive component**	**1**
0.608	**0.239**	**46**			
0.466	**0.270**	**10**	**Green chemistry**		
0.781	**0.642**	**11**			
0.774	**0.577**	**12**			
0.630	**0.323**	**19**	**Medicinal chemistry**		
0.700	**0.393**	**20**			
0.617	**0.414**	**21**			
0.700	**0.458**	**28**	**Nano technology**		
0.744	**0.535**	**29**			
0.785	**0.548**	**30**			
0.721	**0.558**	**37**			
0.644	**0.427**	**38**	**Electronic waste**		
0.657	**0.592**	**39**			
0.606	**0.495**	**52**			
0.681	**0.314**	**4**			
0.600	**0.262**	**5**	**Nuclear chemistry**	**Emotional component**	**2**
0.685	**0.512**	**6**			
0.627	**0.465**	**47**			
0.714	**0.379**	**13**			
0.692	**0.348**	**14**	**Green chemistry**		
0.659	**0.336**	**15**			
0.627	**0.320**	**49**			
0.609	**0.241**	**22**			
0.583	**0.429**	**23**	**Medicinal chemistry**		
0.708	**0.383**	**24**			
0.502	**0.307**	**31**			
0.561	**0.330**	**32**	**Nano**		

0.666	**0.385**	**33**	**technology**			
0.570	**0.344**	**40**				
0.484	**0.312**	**41**	**Electronic waste**			
0.600	**0.433**	**42**				
0.635	**0.388**	**53**				
0.480	**0.374**	**7**				
0.580	**0.402**	**8**	**Nuclear chemistry**			
0.579	**0.430**	**9**				
0.590	**0.466**	**48**		**The**	**behavioral component**	**3**
0.650	**0.381**	**16**	**Green chemistry**			
0.613	**0.420**	**17**				
0.667	**0.414**	**18**				
0.502	**0.378**	**25**				
0.613	**0.476**	**26**	**Medicinal chemistry**			
0.634	**0.448**	**27**				
0.611	**0.400**	**50**				
0.542	**0.358**	**34**				
0.437	**0.389**	**35**	**Nano technology**			
0.598	**0.373**	**36**				
0.634	**0.390**	**51**				
0.500	**0.432**	**43**				
0.588	**0.506**	**44**	**Electronic waste**			
0.620	**0.392**	**45**				
0.581	**0.418**	**54**				

C. The relationship of the field degree to the degree of the main component to which it belongs and to the total degree of the scale:

For the purpose of calculating the value of the correlation coefficient between the degree of the subdomain and the degree of the main component to which it belongs and the degree of the subfield and the total degree of the scale, the Pearson correlation coefficient was applied to find the correlation values, and it was found that all the values of the correlation coefficients statistical function at the level of significance (0.05) and degree of freedom (398), as all the values of the correlation coefficients were greater than the tabular value (0.098).as show in table (4).

Table 4. Correlation coefficients between the subdomain of the main component to which it belongs and the overall degree of the scale

Subdomain link to the college degree scale	**The subdomain is linked to the main component to which it belongs**	**Component subdomain**	**Component**	**Component number**
0.482	**0.550**	**Nuclear chemistry**		
0.625	**0.742**	**Green chemistry**		
0.526	**0.582**	**Medicinal chemistry**	**Cognitive component**	**1**
0.585	**0.692**	**Nano technology**		
0.653	**0.785**	**Electronic waste**		
0.533	**0.598**	**Nuclear chemistry**	**Emotional component**	**2**
0.319	**0.514**	**Green chemistry**		
0.424	**0.546**	**Medicinal chemistry**		
0.530	**0.591**	**Nano technology**		
0.669	**0.645**	**Electronic waste**		
0.600	**0.749**	**Nuclear chemistry**		
0.447	**0.629**	**Green chemistry**		
0.613	**0.721**	**Medicinal chemistry**	**The**	**3**

0.615	**0.681**	**Nano technology**	**behavioral**
0.606	**0.757**	**Electronic waste**	**componen t**

D.Matrix of internal correlations for the independence of the main components. In order to identify the extent of independence of the main components in their measurement of the concept of awareness of chemical innovations, internal correlation coefficients were found between the total score of the scale and the total scores of the main components. In its calculation, the researcher relied on the correlation coefficient, "Pearson", because the degrees are continuous and gradual. This is because the correlations of the components to the overall degree of the scale are basic measures of homogeneity, because they help to define the field of behavior to be measured (Anistasi, 1976,155). To achieve this, the researcher adopted the previous sample forms and the results indicated that the correlation coefficients of each component's degree to the total degree of the scale in addition to the relationship of the components to each other are statistically significant, at a level of significance (0.05) and with a degree of freedom (398) where the critical value is equal to (0.98). This indicates that the components are interrelated and measure one thing and are dealt with as a single overall score, and Table (5) shows that.

Table 5. The internal correlation matrix

The behavioral component	**Emotional component**	**Cognitive component**	**Total marks**	**Components**
0.818	**0.847**	**0.854**		**Total marks**
0.496	**0.648**			**Cognitive component**
0.534				**Emotional component**
				The behavioral component

7.3.2.2. Scales Reliability:

Stability means the accuracy of the scale or its consistency, and the reliability was calculated by two methods of retesting and Vackronbach as follows:

A. Test-retest method: For the purpose of extracting stability in this way, the scale was re-applied to the stability sample that consisted of (50) teachers and schools with a time interval of (14) days from the first application, and re-applying the scale for the purpose of identifying its stability must be That it does not exceed two weeks from the first application, then the Pearson correlation coefficient was calculated between the degrees of the first and second application, and the correlation coefficient was (0.84) for the scale.

B. Cronbach's Alpha equation: The reliability was extracted in this way from the degrees of the basic sample questionnaires, and by using the Cronbach equation the alpha coefficient was (0.81), which is a good stability coefficient.

8. Presentation, Explanation and Discussion of Results:

The first aim: to identify the awareness of chemical innovations among teachers of chemistry.

To identify awareness of chemical innovations among chemistry teachers, use the t-test for one sample to calculate the significance of the difference between the two averages, and Table (6) illustrates that.

Table 6. The arithmetic mean, standard deviation, and t-value of the Chemical Innovation Awareness scale

The function (0.05)	***T-value**		**Hypothesized mean**	**standard deviation**	**Average arithmetic**	**the sample**
	Tabular	**Calculated**				
The function of the hypothesis	**1.96**	**-6.422**	**162**	**19.955**	**155.592**	**400**

Table (6) shows that the awareness of chemical innovations among the research sample is weak, and the researcher explains this result to the interest of chemistry teachers in the academic content more than their interest in knowing chemical innovations and their focus on the chemical information that they possess, which they explain and clarify to the students that is included in the subject. Likewise, the absence of the book of chemistry and its lack of inclusion of chemical innovations and its containment of traditional chemical information, facts and concepts makes chemistry teachers not have awareness of these innovations. To be an important goal of science teaching (Al-Saadi 10,2009).

The second aim: To identify the statistically significant differences in the awareness of chemical innovations among chemistry teachers according to the sex variables (males, females) and years of service (less than 15 years, more than 15 years).

To ascertain the differences in awareness of chemical innovations according to gender and years of service, the researcher used the double-sided analysis test, and the results were as shown in Table (7).

Table7. Results of the binary variance analysis to find out statistically significant differences in the scale of awareness of chemical innovations according to the gender variable and years of service.

Significance (0.05)	The Fatality Ratio	Average of squares	Degrees of freedom	Sum of squares	The source of the contrast
Not a function	0.673	268.869	1	268.869	Sex
Not a function	0.980	391.275	1	391.275	Years of service
Not a function	0.070	27.943	1	27.943	Sex * years of service
		399.338	396	158137.741	The error
			399	158825.828	total

The results of the two-factor analysis of variance showed the following data:

1- Gender: There are no statistically significant differences in awareness of chemical innovations according to the gender variable, as the value of the calculated FFR (0,673) for the gender variable is smaller than the tabular value of the FPR of (3,84) at the level of significance (0.05). And two degrees of freedom (1, 396). The researcher explains this result to the teachers 'acquisition of the same information at the university and the same practical experiences and training programs at the school, as all chemistry teachers follow one ministry that has the same policies followed, in addition to the commitment of chemistry teachers to the textbook and the information that It makes them not interested in chemical innovations, and this is what led to the absence of the differences between them.

2- Years of service variable: There are no statistically significant differences in awareness of chemical innovations according to the years of service variable, as the value of the calculated QF ratio (0.980) for the years of service variable is smaller than the tabular FP ratio value of (3.84) at the level of significance (0 05) and two degrees of freedom (1, 396), and the researcher explains this result that increasing the number of years of service does not necessarily lead to an increase in their awareness of chemical innovations, and the content of chemistry books contains information, facts and traditional chemical concepts present in them, which makes the teacher important His service increased, focusing on the existing information inside the book and developing himself on this existing information in order to clarify it to students without paying attention to chemical innovations such as (nuclear chemistry, green chemistry, medicinal chemistry, nanotechnology, electronic waste), which led to a lack of differences between them.

3- Interaction between gender * years of service: There are no statistically significant differences according to the interaction between gender and years of service, as the value of the calculated percentage (0.070) for the interaction between (gender * years of service) is smaller than the tabular FP ratio value of (3.84). At a level of significance (0.05) and two degrees of freedom (1, 396), the researcher explains this absence to the absence of significant differences, meaning that the level of the two variables between groups do not have symmetric effects within the interaction in terms of gender (males, females) and years of service (less From 15 years, over 15 years) and this resulted in no interaction between gender and years of service.

8.1. Conclusions: A number of conclusions have been reached, as follows:

1. Lack of awareness of chemical innovations among chemistry teachers.
2. Awareness of chemical innovations is not affected by the variable of gender and years of service for chemistry teachers.

8.2. Recommendations: Based on the findings of the research, the researcher recommends the following:

1. The need to take advantage of chemical innovations in the programs of preparing chemistry teachers by the Ministry of Education before service and after service.
2. The necessity to organize training and educational courses and workshops for chemistry teachers to introduce chemical innovations and their fields.

8.3. Proposals: To complement this study, the researcher suggests the following: Conducting a study similar to the current study on another community, such as students, for different stages of study.

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