



E-ISSN: 2789-1615
P-ISSN: 2789-1607
www.educationjournal.info
Impact Factor: 5.69
IJLE 2024; 4(1): 119-123
Received: 16-12-2023
Accepted: 23-01-2024

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The availability of concepts and applications of artificial intelligence in the content of the chemistry textbook for the fourth scientific grade

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DOI: <https://doi.org/10.22271/27891607.2024.v4.i1b.176>

Abstract

The goal of the current research is to know the extent to which the concepts and applications of artificial intelligence are included in the content of the chemistry textbook for the fourth scientific grade. To achieve the research goal, the researcher developed the analysis list (Al-Fayez, Al-Othman, and Al-Malhi, 2021) that includes five main applications and 27 sub-applications distributed among the main applications, and adopted The researcher used the descriptive method of content analysis, as the research community and its sample were from the chemistry textbook for the fourth scientific grade approved by the Iraqi Ministry of Education for the academic year 2023-2024 AD, and to verify the psychometric properties of the analysis list, it was presented to a group of arbitrators with specialization (curricula, teaching methods). Then the researcher analyzed the content of the book in light of it, relying on the explicit and implicit idea as a unit for recording and repetition as a unit for enumeration. The results of the analysis were that the book included (46) repetitions distributed unevenly over the five applications. According to what was mentioned, the researcher presented a set of recommendations and a number of proposals based on the results she reached to her.

Keywords: Artificial intelligence, artificial intelligence concepts, artificial intelligence applications, chemistry book

Introduction

The educational process in Iraq has recently witnessed a diverse series of reform processes to keep pace with the scientific and technological progress witnessed by the world, and in a manner commensurate with the developments that have occurred in society, to meet the needs and desires of students and to prepare them in a manner commensurate with the requirements of the labor market.

Since the curriculum is an essential pillar of the educational process and its great benefit stems from it being the container that contains the scientific material, which is considered one of the important and necessary means for achieving the objectives of the curriculum, and the curriculum is an important means of achieving the desired goals and desired changes, and thus the student must be provided with an appropriate amount of The knowledge, values, and skills that make it keep pace with the changes that occur in society. The textbook is an essential and important element, so it is necessary to develop it in a way that is compatible with the developments taking place at the present time. The chemistry book for the fourth scientific grade is among the books that were included in the process of development and modification, but it still needs to be modified. Further development because it was and still is focused on the amount of information the student receives.

Since the modern philosophy of education in the Iraqi education system emphasizes the necessity of strengthening and granting the ability to keep pace with progress and technological development and to deal with the data of the modern era to develop the educational process (Al-Waeli, 2015) ^[1]. Based on the recommendations of the study of (Al-Abri, 2019) ^[2] and (Al-Kharusi, 2019) ^[3], there is a need to review the curricula to develop a course according to artificial intelligence applications.

After reviewing the literature and previous studies in the field of chemistry teaching methods, the researcher did not find any analytical study of the content of the chemistry book for the fourth scientific grade in light of artificial intelligence applications. Hence, the researcher's research problem crystallized to find out the extent to which artificial

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intelligence applications are included in the content of the book. Based on the above, the research problem is determined by answering the following question:

What applications of artificial intelligence are included in the content of the chemistry book for the fourth scientific grade?

Research importance

The current research gains its originality - to the best of the researcher's knowledge - as it is the first study that addressed the degree of inclusion of the concepts and applications of artificial intelligence in the content of the chemistry textbook for the fourth scientific grade, providing a theoretical frame of reference for artificial intelligence as it is one of the modern and contemporary variables, which may contribute to the development of chemistry textbooks for the middle school according to For applications of artificial intelligence, and to identify weak points in the content of the book and work to address them when developing chemistry books, and helps chemistry teachers know and understand the applications of artificial intelligence and present them during teaching.

Research aims

The current research aims to determine the extent to which the concepts and applications of artificial intelligence are included in the content of the chemistry textbook for the fourth scientific grade.

Search limits

The current research is limited to

1. Objective limits

Chemistry book for the fourth scientific grade / twelfth edition of 2023 AD, provided by the Iraqi Ministry of Education.

Concepts and applications of artificial intelligence

2. Time limits: Academic year 2023-2024.

Definition of terms

- Artificial Intelligence was defined by (UNIS, 2012):** "One of the modern technologies developed in the twenty-first century, which includes a set of software that helps managers and workers in making decisions for all organized operations. It is characterized by sophistication and progress and provides computers with a set of activities that help them practice intelligent behavior." (Al-Younis, 2012) ^[4].
- Applications of artificial intelligence (Aldosari, 2020) ^[5]:** "A variety of methods, techniques, and tools for creating models and solving problems by simulating the behavior of natural people." Physics (Aldosari, 2020) ^[5].

(Al-Bashar, 2020) ^[6]: "Educational programs that have the ability to perform many tasks that mimic human behavior, such as learning, thinking, teaching, guidance, and the ability to make decisions in an organized, scientific manner."

(Al-Bashar, 2020) ^[6]: The researcher defines it procedurally: A group of applications included in the content of the chemistry textbook for the fourth scientific grade, which provide students with digital skills and help

them learn efficiently, and are measured using an analysis tool.

Theoretical background and previous studies

In this chapter, the researcher addresses two topics:

First: Artificial Intelligence

The concept of artificial intelligence

Artificial intelligence consists of two parts. The first is intelligence, which means the ability to understand and realize new circumstances. The keys to intelligence are thinking, understanding, and learning. The second means the created thing. Accordingly, it is defined as intelligence created by humans in machines, meaning it is "the science of modern machines."

Artificial intelligence is a branch of computer science that simulates the human mind through designed computer programs. It is also known as one of the basic pillars on which modern technology is built to carry out activities that require intelligence.

Artificial intelligence is one of the fields that seeks to understand human intelligence by creating computer programs that mimic human intelligence to perform some tasks that require thinking instead of it. (Al-Obaidi, 2015) ^[9].

Characteristics of artificial intelligence

Artificial intelligence has the following characteristics

- It achieves the desired goals of the educational process.
- It simplifies the learning process by saving the teacher time and effort.
- Identify the strengths and weaknesses of each student by determining his level of knowledge and speed of learning. (Musa and Bilal, 2019) ^[10].
- It provides immediate feedback to students by answering any question in seconds.
- Developing students' ability to solve problems in the absence of complete information.
- Developing students' ability to perceive and think. (Al-Toukhi, 2021) ^[11].
- Students acquire information, skills, and the mechanism for applying them.
- Complete tasks quickly and with high accuracy.
- Work for a long time without getting bored or tired. (Al-Dahshan, 2020) ^[13].

Objectives of artificial intelligence

The goals of artificial intelligence can be summarized as follows:

- It aims to understand human intelligence through creating computer programs that have the ability to simulate human behavior.
- Building programs that have the ability to perform tasks that are characterized by intelligence when performed by a human. (Al-Astal, Akal Walagha, 2021) ^[14]
- Information is processed by the calculator in a manner parallel to the human way of solving it.
- Designing intelligent computer systems with characteristics similar to human intelligence and seeking to solve problems by relying on processing non-algorithmic codes. (Khawalda, 2019) ^[15].

The researcher believes that the goal of artificial intelligence is to know the working mechanism of human intelligence,

determine its pros and cons, avoid the negatives, and translate them through computer programs that integrate human intelligence and the program's working mechanism in order to obtain good performance in various situations and find solutions to the problems they face with high efficiency and accuracy.

Types of artificial intelligence

- 1. Narrow artificial intelligence:** It is known as weak because it performs a set of simple, specific, narrow, and unsophisticated tasks, such as a self-driving car. That is, the tasks are performed within a specific environment and cannot be performed outside this environment, that is, in response to an action in a specific situation. (Abdel-Wahab, Al-Ghitani, and Yahya, 2019) ^[16]
- 2. Strong artificial intelligence:** It is known as general or advanced intelligence. It is more advanced than the first type and is characterized by the ability to perform most of the tasks performed by humans, that is, the ability to collect and analyze information such as instant chat robots. (Al-Toukhi, 2021) ^[11]
- 3. Superhuman artificial intelligence:** This type is the most developed, complex, and advanced in its systems. It has the ability to perform various tasks that seek to emulate human intelligence. (Boutilier, Caragiannis, Haber, Lu, Procaccia & Sheffet, 2015) ^[12]

Previous studies

The researcher discusses some previous studies that dealt with artificial intelligence applications, the most prominent of which are:

1. A study (Al-Faer, Al-Othman and Al-Malhi, 2021) ^[17] entitled "The degree of inclusion of concepts and applications of artificial intelligence in the content of computer and information technology curricula in public education in the Kingdom of Saudi Arabia," which aimed to know the degree of inclusion of concepts and applications of artificial intelligence in the content of computer curricula. Its sample represented all computer curricula, using the faithful analytical approach. To achieve the goal of the study, a card was built to analyze the content, and the results of the inclusion rate were very small.
2. A study (Al-Shaidi and Al-Saedi, 2022) ^[18] entitled "The degree of inclusion of concepts and applications of artificial intelligence in the content of mathematics curricula at the basic education stage in the Sultanate of Oman," which aimed to know the degree of inclusion of concepts and applications of artificial intelligence in the content of mathematics curricula. The research sample represented the content of mathematics curricula and its use. The researcher used a descriptive approach to content analysis, and a card was prepared for content analysis. The results were a weak degree of inclusion in the content of mathematics curricula.
3. A study (Al-Saedi, Al-Balushi, and Al-Kaabi, 2023) ^[19] entitled "The extent of the availability of artificial intelligence applications in social studies curricula in basic education schools in the Sultanate of Oman," which aimed to know the extent of inclusion of artificial intelligence applications in the content of social studies curricula, and the sample of the study represented the content Social studies curricula, a card

was built to analyze the content, and the results of inclusion were weak.

Despite the importance of artificial intelligence applications, to the researcher's knowledge, there is no study that addressed the analytical aspect of chemistry books and their content in light of artificial intelligence applications, especially the chemistry textbook for the fourth scientific grade, and this confirms the importance of the current study.

Research Methodology

It means "one of the survey methods that is important in revealing the extent of interest in the content." The researcher used the descriptive method and the content analysis method. (Al-Assaf, 2006) ^[21].

Research community

It means "a clearly defined group of books, documents, or people, and the researcher intends to study them and generalize the results in light of that, and the research community is determined by its nature and purposes." (Al-Zuhairi, 2017) ^[20].

The research community determined the content of the chemistry textbook for the fourth scientific grade, twelfth edition of the year 2023 AD, approved by the Ministry of Education for the academic year (2023, 2024), which consists of (148) pages for the academic year (2023 - 2024).

The research sample

The sample represents "a part or segment of the research community determined by the researcher, and it is selected in a scientific manner in a way that represents the original research community and achieves its purposes." (Abu Samra, 2019) ^[22]

The researcher took the chemistry book for the fourth scientific grade for the academic year (2023-2024) after excluding: the book's introduction, index, main titles, chapter fronts, list of contents, chapter review questions, and lesson review questions from the analysis process. The number of pages excluded was 25 pages, i.e. 16.89%, while the number of analyzed pages is 123 pages, i.e. 83.11% of the total content of the book.

Search tool

"Means and methods for collecting data by observation and measurement." (Al-Kilani and Al-Sharifin, 2007) ^[24]

In the current research, the researcher relied on the analysis list returned (Al-Fayez, Al-Othman, and Al-Malhi, 2021) ^[17], which consisted of five main applications and 35 sub-applications. After reviewing previous studies, the analysis list was developed in accordance with the content of the chemistry textbook for the fourth scientific grade approved by the Ministry of Education. Iraqi education, which ultimately consisted of five main applications, which are: (artificial intelligence applications, data analysis and structuring, deep learning, physical computing, artificial intelligence programming), and among them is sub-application 27. Thus, the analysis list for the current research agrees with the analysis list returned (Al-Fayez, Al-Othman, and Al-Malhi, 2021) ^[17] in the main applications only, but it differed in the sub-applications.

Psychometric properties

To ensure the validity and reliability of the analysis list, the

list was presented to a group of experts and arbitrators with specialization in the field of chemistry curricula and methods, and amendments were made, including deletion, addition, and modification, based on their opinions, to become suitable for the content of the chemistry textbook for the fourth scientific grade approved by the Iraqi Ministry of Education.

Steps in the analysis process

When conducting the analysis process, the following are determined:

The Aim: is to know the extent to which the concepts and applications of artificial intelligence are included in the content of the chemistry textbook for the fourth scientific grade.

Sample: The analysis sample represented the content of the chemistry textbook for the fourth scientific grade for the academic year 2023-2024 AD.

Units: The researcher adopted the explicit and implicit idea as a unit of analysis, which is compatible with the nature of the content of the book, and the repetition unit as a unit for enumeration of each paragraph of artificial intelligence applications.

Validity of the analysis

To verify the validity of the analysis process, the researcher presented a model of the analyzed material, represented by (Chapters Two and Five of the Book's Content), based on the analysis list in its final form. Then it was presented to a group of arbitrators specialized in the field of chemistry teaching curricula and methods.

Stability of the analysis

To verify the stability of the analysis process, and according to previous literature, 20% was chosen as a random sample of the analyzed material, amounting to 25 pages. The fourth chapter was chosen from the content of the book, and the researcher repeated the analysis process after 30 days, and the stability rate was 95%, which is a high percentage of agreement. He enlisted the help of his colleague's analyst to analyze the sample, and the percentage of agreement between the two analyzes was calculated using the Holsti equation. The percentage was 85%, which is a high percentage of agreement. (Al-Tamimi, 2011) ^[23].

Statistical methods

1. Percentage and frequencies (Percentage = Part / Whole) 100%.
2. **Holsti equation:** To calculate two types of analysis stability (over time and stability between analysts).
3. **Arithmetic mean:** To calculate the estimated ratios to compare the results.

Arithmetic mean = sum of values / number of values

Determine the spoken proportions

For the purpose of comparing the results of the analysis reached by the researcher and judging them, the paragraphs of the main and subsidiary applications of artificial intelligence were presented to a group of arbitrators with expertise in the field of curricula and teaching methods, and

they were asked to determine the percentage needed to be included in the content of the chemistry textbook for the fourth scientific grade. The average percentages spoken for each application was in the chemistry book it is as follows:

Artificial intelligence applications 22%.

Artificial Intelligence Programming 23%.

Physical Computing 29.5%.

Deep learning 16%.

Data analysis and structure 9.5%.

Results and discussion

Question text: What applications of artificial intelligence are included in the content of the chemistry book for the fourth scientific grade?

To answer the research question, the researcher analyzed the content of the chemistry textbook for the fourth scientific grade in light of the concepts and applications of artificial intelligence. The results were as follows:

Artificial intelligence applications received 9 repetitions, at a rate of 19.5%, when compared with the spoken percentage, which is 22%, which is a far percentage. Artificial intelligence programming received 10 repetitions, at a rate of 21.7%, when compared with the spoken percentage, which is 23%, which is a small percentage. And physical computing got 12. A repetition rate of 26.1%, and when compared to the reported percentage of 29.5%, which is a low percentage. Deep learning received 7 repetitions, a rate of 15.2%, and when compared to the reported percentage of 16%, the percentage is also low. As for the application of data analysis and structuring, it received 8 repetitions, a rate of 17.3%. Comparing it to the spoken ratio of 9.5.

The researcher believes that these percentages do not indicate the availability of the main and sub-applications of artificial intelligence in a sufficient and balanced manner in the content of the book because the number of repetitions is very small. In addition, the sub-applications did not all appear in the required manner, in addition to the fact that the sub-applications appeared in the content by chance and were not included. Intentionally, this indicates that the availability rate is very weak, and this means that the content is not interested in artificial intelligence applications and therefore needs more enrichment and attention to the main and secondary applications because of its importance in overcoming most chemical problems to facilitate the learning process, and this is consistent with the results of the study of (Al-Faer, Al-Othman and Al-Malhi, 2021) ^[17], (Al-Shaidi and Al-Saidi, 2022) ^[18], and (Al-Saidi, Al-Balushi, and Al-Kaabi, 2023) ^[19], for which the degree of inclusion was weak.

Conclusions

Conclusions reached by the researcher:

1. The book's content lacks interest in artificial intelligence applications.
2. The prevalence of the application of physical computing in the content of the book.
3. The application of deep learning is the least application of artificial intelligence included in the content of the book.

Recommendations

Through the research results, the researcher recommends the following:

1. Emphasizing the inclusion of artificial intelligence applications in the content of chemistry textbooks at the secondary level in equal proportions.
2. 2-The necessity of reviewing the chemistry textbook for the fourth scientific grade and including applications of artificial intelligence.
3. It is necessary to support the content of the chemistry book with more activities and games that are based on artificial intelligence.
4. Employing artificial intelligence applications in the educational process in general and in the field of chemistry education in particular.

Suggestions

Based on the research results, the researcher suggests the following:

1. Conduct a similar analytical study on including artificial intelligence applications in the content of science textbooks for the secondary stage.
2. Conduct an evaluation study of artificial intelligence applications among students at all levels of education.

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