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Level of Using Artificial Intelligence to Enhance the Interaction of College of Basic Education Students at University of Telafer During Mathematical Problem Solving

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Abstract

This study investigated the level of artificial intelligence (AI) utilization in enhancing classroom interaction among College of Basic Education students at University of Telafer during mathematical problem-solving activities. A descriptive methodology was employed with 46 undergraduate students from Mathematics and Arabic Language departments during the 2024-2025 academic year. Data were collected through a validated 25-item questionnaire measuring AI application frequency, classroom interaction patterns, and mathematical problem-solving engagement using a three-point Likert scale. The instrument demonstrated satisfactory reliability (Cronbach's alpha = 0.77) and construct validity through face validity assessment by expert reviewers and internal consistency verification. One-sample t-test analysis revealed statistically significant differences ($p < 0.05$) in mean scores, with the calculated t-value (6.8) exceeding the critical value (2.02) at 45 degrees of freedom. Students demonstrated enhanced engagement levels ($M = 43.58$, $SD = 37.57$) when AI tools were integrated into mathematical problem-solving activities. AI applications, including adaptive learning systems and interactive platforms, effectively facilitated immediate feedback, personalized learning experiences, and increased student confidence in classroom participation. These findings support the implementation of AI technologies in mathematics education to create dynamic, student-centered learning environments that promote active participation, reduce student hesitation in asking questions, and foster deeper conceptual understanding in mathematical problem-solving. Educational institutions should develop strategic plans for AI integration, provide professional development for instructors, and invest in AI-enhanced learning platforms to improve educational outcomes in mathematics education.

Keywords: Artificial Intelligence; College of Basic Education Students; Classroom Interaction; Mathematical Problems.

1 | Introduction

The use of artificial intelligence as a vital technological tool can contribute to improving and developing the educational process in general, and enhancing classroom interaction in particular. In this context, university instructors face significant challenges related to benefiting from modern technologies in education, as many of them still lack the necessary competencies to use artificial intelligence tools in their teaching. This competency gap may negatively impact the quality of education and academic interaction between instructors and students, hindering the sustainable development of the educational process. Therefore, it becomes



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necessary to research how the use of artificial intelligence affects the development of university instructor capabilities and determine its contribution to improving teaching methods and developing instructor skills in various aspects of education. In the absence of precise studies addressing the impact of artificial intelligence on enhancing classroom interaction in Iraqi universities in general and University of Telafer in particular, the research problem centered on answering the following research question:

What is the level of using artificial intelligence to enhance the interaction of College of Basic Education students at University of Telafer during mathematical problem solving?

2 | Research Significance

Universities play an important role in preparing qualified human resources through their scientific foundations in education and scientific research, which requires that the role of universities evolve to meet contemporary global challenges and achieve comprehensive quality for their educational outputs. The technological development movement is one of the fundamental drivers of development and modernization processes in all fields, including the field of education, especially with the emergence of digital technology and the communications revolution it brought about. Therefore, it was necessary to benefit from modern technological innovations and multiple communication means to provide educational services that match the changes occurring in the educational climate, including computers and the internet and the great possibilities they offer that can be employed in the educational process [1].

Artificial intelligence aims to develop systems capable of intelligent thinking similar to humans. It includes techniques such as machine learning, neural networks, natural language processing, and computer vision, aiming to enable intelligent systems to learn and make decisions in the field of education. Artificial intelligence carries enormous opportunities as it can customize learning experiences for each student, develop innovative educational content, provide immediate feedback, improve classroom management, and provide guidance for personal improvement. Artificial intelligence contributes to improving learning and teaching processes and enhances interaction and understanding in the educational environment [2].

The success of the educational process depends largely on the nature of classroom interaction between the teacher and students, and among students themselves. Sometimes this interaction occurs naturally, and at other times modifications must be made to provide interaction. Many educators believe that the topic of classroom interaction in the educational process is one of the most important topics that both teachers and students should learn because of its importance in that it: is considered one of the positive educational innovations that contributed to transforming the teacher from the role of lecturer and knowledge holder who is responsible for teaching to the role of guide, encourager, and supervisor of the teaching process. It also contributed to changing the view of the student from a passive recipient responder with no power to an active and effective participating student with a positive and important role [3].

The attention to solving mathematical problems in particular has become a matter that educators do not care about, which has led to a decline in students' academic achievement. This is due to several reasons that have been diagnosed by local, Arab, or foreign studies and research, including those related to the mechanisms used in solving mathematical problems, as well as following traditional methods in that and relying on textual problems without change, which pushed students toward stereotypical thinking. One of the most important and prominent of these reasons is what lies behind the traditional teaching methods used in teaching in general and mathematical problems in particular, and the lack of attention to diversifying questions and relying on the traditional pattern, especially mathematical ones. In light of the above, the importance of the current research can be stated through the following:

1. It addresses an important aspect of the educational process, as it focuses on artificial intelligence and its techniques and mechanisms for integrating it into the educational process.
2. It is a modest effort in this area that can cast its shadows toward opening diverse horizons for academics to strive to show the importance of artificial intelligence and its role in education.

3 | Research Objective

The current research aims to identify (level of using artificial intelligence to enhance the interaction of College of Basic Education students at University of Telafer during mathematical problem solving)?

4 | Research Hypothesis

The researchers formulated the following main null hypothesis:

(There is no statistically significant difference at the significance level of 0.05 in the level of using artificial intelligence to enhance the interaction of College of Basic Education students at University of Telafer during mathematical problem solving).

5 | Research Boundaries

The current research is limited to the following:

Human Boundaries: College of Basic Education students in Mathematics and Arabic Language departments for morning studies at University of Telafer.

Spatial Boundaries: University of Telafer – College of Basic Education - Mathematics Department - Arabic Language Department

Temporal Boundaries: Academic year (2024-2025).

6 | Term Definitions

First: Artificial Intelligence defined by Shawqi (2017)

"It is behavior and certain characteristics of computer programs that make them simulate human mental capabilities and their work patterns. The most important of these characteristics are the ability to learn, infer, and react to situations not programmed in the machine" [4].

Second: Classroom Interaction defined by Abu Jado (2015)

"It is the opinions, activities, and dialogues that take place in the classroom in an organized and purposeful manner to increase learner motivation and develop their real desire to learn for the purpose of communication and exchange of ideas and information" [5].

7 | Theoretical Framework

Artificial intelligence is considered one of the most prominent features of the digital age due to the amazing possibilities it offers that seek to find faster, smarter, more efficient, and accurate ways in many fields, including the educational field, which required the necessity of integrating artificial intelligence and its applications in the educational learning process [6].

Artificial intelligence is an effective tool for creating an interactive educational environment that encourages students to participate and motivate them. It allows the integration of interactive activities such as games and simulations in the educational process and works to attract students' attention and make them more interactive with content. It can also contribute to providing a safe environment for students to practice their skills and try their ideas without fear of making mistakes.

Artificial intelligence is a branch of computer science and the cornerstone upon which the technology industry sector relies in the twenty-first century. It consists of two words: intelligence, which refers to the ability to perceive new situations and understand them through the basics of intelligence, which are learning and perception, and artificial, which means the results that appear as a result of performing a specific activity or action [7].

Artificial intelligence is based on enhancing administrative work at the heart of the university and is considered one of the most important indicators of its success and a basis for quality in its performance. The acceleration of technology and knowledge gives quality great and distinctive importance, as most universities seek to achieve it with the aim of enabling them to achieve all their goals in competition and improve their performance in general [8].

Classroom Interaction Patterns are those patterns or forms that classroom interaction takes, similar to the forms that social interaction takes, because the classroom constitutes an integrated social system. These forms are:

1. Exchange: A process undertaken by an individual or group of individuals to achieve a goal from which material or moral reward is expected.
2. Cooperation: Joint behavior of a group of individuals to achieve a goal from which a certain benefit is desired. Cooperation is a positive trait in classroom interaction, as it reduces conflict processes and leads to harmony among classroom members.
3. Submission or Obedience: Perhaps one of the greatest difficulties is finding a culture or social organization without obedience being part of it, because obedience is related to social norms, values, laws, regulations, and authority.
4. Coercion or Compulsion: This process has two sides: the coercer and the coerced. This process can take the form of self-interaction, as what we call willpower is a form of self-control. Manifestations of self-coercion in the classroom include what is called perseverance, maintaining order, and listening.
5. Conflict: The process in which an individual tries to destroy another individual or tries to reduce their status. A group can also conflict with another group instead of the individual [9].

The Teacher's Role in Classroom Interaction: The teacher is the main driver of classroom interaction and the most important factor in its success. Therefore, the teacher must perform the following roles to achieve it in a way that ensures the effectiveness of the educational learning process:

1. Planning: Preparation for classroom activities.
2. Classroom Management: Controlling student behavior during classroom activities.
3. Clarity of Instructions: Directions that help student learning [10].

8 | Previous Studies

8.1 | Studies on Artificial Intelligence and Classroom Interaction

Abu Muqaddam's study (2024) [11] aimed to determine the degree of use of artificial intelligence applications in self-learning among graduate students at Jordanian universities. The descriptive approach was used, relying on a questionnaire whose validity and reliability were verified by applying it to a sample of (452) graduate students at Jordanian universities during the first semester of the 2023/2024 academic year. After statistically analyzing the study results, the following results were obtained:

1. There is a statistically significant difference at a significance level of (0.05) in the use of artificial intelligence applications, which showed an increase in classroom interaction among students.
2. There is a statistically significant difference at a significance level of (0.05) in the use of artificial intelligence applications in terms of self-learning.

In his study (2021), Al-Muqaiti [12] identified the reality of employing artificial intelligence and its relationship to the quality of performance of Jordanian universities from the perspective of faculty members. The study sample consisted of (370) faculty members. A descriptive correlational approach was used, and a questionnaire was developed consisting of three parts: the first included demographic data; the second measured the degree

of employing artificial intelligence, consisting of (33) paragraphs distributed across the administrative and academic fields; and the third measured the degree of quality of performance of Jordanian universities, consisting of (28) paragraphs. Their validity and reliability were verified. After analyzing the data, the results showed the following:

1. There is a statistically significant difference at a significance level of (0.05) in the use of artificial intelligence applications, as it was reflected in the quality of these universities and increased student engagement.
2. There is a statistically significant difference at a significance level of (0.05) in the use of artificial intelligence applications, as it showed an increase in the academic field.

8.2 | Studies Related to Artificial Intelligence, Problem Solving, and Thinking Development

In 2023, Abu Zaid [13] presented a study to identify the impact of using artificial intelligence-based applications on developing mathematical equation-solving skills among eighth-grade students in the Sahab District. To achieve the study's objective, students were divided into two groups: the first, an experimental group, taught using artificial intelligence based on the Microsoft Math Solver program, and the second, an experimental group, taught using the traditional method. The researcher prepared a research tool consisting of a mathematical problem-solving test for eighth-grade students in Jordan. After collecting and statistically analyzing the data, the results showed the following:

There is a statistically significant difference at the significance level (0.05) in the use of artificial intelligence applications in the Microsoft Math Solver program between the experimental and control groups in the mathematical problem-solving skill test, in favor of the experimental group.

Abdullah's study (2024) [14] aimed to identify the development of skills in employing artificial intelligence applications in teaching among secondary school mathematics teachers through a training program and to measure its impact on the computational thinking skills of their students. To achieve the objectives of this study, the researcher prepared a questionnaire to measure the degree of secondary school mathematics teachers' use of artificial intelligence applications and tested students' computational thinking skills. The researcher also used a descriptive approach. After collecting and statistically analyzing the data, the following results emerged:

1. There is a statistically significant difference at a significance level of (0.05) in the use of artificial intelligence applications, as these applications demonstrated students' superiority in their computational thinking.
2. There is a statistically significant difference at a significance level of (0.05) in the use of artificial intelligence applications, as these applications demonstrated students' superiority in solving computational problems.

9 | Research Procedures

9.1 | Methodology

The researchers believe that the appropriate methodology for the current study is the descriptive method, as it depends on studying the phenomenon as it exists in reality and is concerned with describing it accurately, expressing it qualitatively or quantitatively. Qualitative expression describes the phenomenon and shows its characteristics, while quantitative expression gives us a numerical description of the phenomenon's amount or size. This method is not limited to data collection only but goes beyond that as it includes a degree of interpretation of this data. In the current study, the researchers used the descriptive method as it is the appropriate method to achieve research objectives.

9.2 | Study Population

The research population consisted of University of Telafer students (College of Nursing - College of Agriculture - College of Basic Education) totaling (900) male and female students for morning studies for the academic year (2024-2025).

9.3 | Study Sample

A random sample was taken from University of Telafer students from the College of Basic Education for Mathematics and Arabic Language departments, totaling (46) male and female students for morning studies for the academic year (2024-2025). This sample is considered to be of a direct nature, from the level of reality, and taken from the university students themselves.

9.4 | Study Tool

Questionnaire on Artificial Intelligence, Classroom Interaction, and Mathematical Problem Solving. The tool was prepared by the researchers to measure the level of artificial intelligence application, classroom interaction, and mathematical problem solving among College of Basic Education students at University of Telafer. The tool consisted of (25) items showing the extent of staff commitment to this. The scale consisted of three alternatives (always, sometimes, rarely), and the psychometric properties of the tool were verified as follows:

First: Tool Validity

1. Face Validity:

The researchers presented the tool to a group of experts with experience and specialization in science teaching methods to ensure the face validity of the tool and its suitability for the purpose it was designed for, taking their suggestions and opinions. The researchers adopted an 80% rate as a criterion for accepting or rejecting items. All items obtained this rate, thus acquiring face validity for the tool.

2. Internal Construct Validity:

Internal construct validity was verified by presenting it to an exploratory sample of (100) male and female students from Telafer University's College of Basic Education to calculate the correlation coefficient between each tool item. Results indicated that all tool items were statistically significant at the significance level (0.05), ranging from (0.40) to (0.70), which are statistically acceptable rates, thus the tool acquired internal consistency.

Second: Tool Reliability

To verify tool reliability, the researchers applied the tool to an exploratory sample consisting of (100) male and female students at Telafer University's College of Basic Education. Using Cronbach's Alpha equation, the overall tool reliability was verified, with a reliability coefficient of (0.77), which is statistically acceptable. Thus, the tool's validity and reliability were verified, and it became ready for application to the main research sample.

Third: Tool Scoring

The blended learning questionnaire in its final form, after verifying its validity and reliability, consisted of (25) three-alternative items (always - sometimes - rarely) with scores distributed as (3, 2, 1) respectively. The highest scale score is (75), the average score is (50), and the lowest score is (25).

Fourth: Tool Application

The researchers applied the tool (questionnaire on artificial intelligence, classroom interaction, and mathematical problem solving) to their main research sample: College of Basic Education students /

University of Telafer in Mathematics and Arabic Language departments for morning studies for the academic year (2024-2025).

Fifth: Statistical Methods

1. Cronbach's Alpha test to calculate tool reliability
2. T-test for one sample

10 | Results and Discussion

"There is no statistically significant difference at the significance level (0.05) in the level of using artificial intelligence to enhance the interaction of College of Basic Education students at University of Telafer during mathematical problem solving"

To verify this hypothesis, the researchers extracted the arithmetic mean and standard deviation of the scale for sample individuals, then applied the t-test for an independent sample. Results were included in Table 1.

Table 1. T-test Results in Using Artificial Intelligence to Enhance College of Basic Education Student Interaction at University of Telafer During Mathematical Problem Solving

Sample	Number	Arithmetic Mean	Standard Deviation	Variance	Calculated t-value	Tabulated t-value	Significance Level
College of Basic Education Students	46	43.58	37.57	6.13	6.8	2.1	Statistically Significant

Table (1) shows that the calculated t-value (6.8) is greater than the tabulated value at significance level (0.05) and degree of freedom (45), which equals (2.02). This indicates a statistical significance between the mean scores of the artificial intelligence, classroom interaction, and mathematical problem-solving scale development. Thus, the null hypothesis is rejected and its alternative is accepted.

11 | Results Interpretation

The researchers see clear superiority for the research sample through the scientific mechanism where artificial intelligence systems (such as intelligent adaptive systems or chatbots) analyze student responses immediately and provide detailed feedback that corrects errors, guides toward correct solutions, and suggests exercises adapted to student level. This generated strong motivation for students toward solving more mathematical questions, as artificial intelligence systems provide interactive interfaces like voice dialogues or animations, making problem solving similar to an educational game that stimulates sensory perception and student attention. Artificial intelligence systems also simulate mathematical problems in real-life contexts, enhancing students' deep understanding and stimulating their classroom interaction excitingly, reducing time spent knowing student performance level because the educational machine supported by artificial intelligence applications provides immediate feedback, all of which was clearly reflected in student performance level.

12 | Conclusions

Developing staff capabilities in blended learning mechanisms and showing the importance achieved in this. The necessity of preparing adequate plans by the university institution toward using artificial intelligence and drawing policies leading to its successful implementation. Developing instructor and student skills through organizing conferences, seminars, and workshops in university corridors that would contribute to spreading awareness of the necessity of using artificial intelligence programs and applications. Conducting a study similar to the current study in secondary education and showing the importance of applying artificial intelligence in those stages.

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Data Availability

The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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Appendix (1)

Questionnaire on Artificial Intelligence, Classroom Interaction, and Mathematical Problem Solving:

No.	Items	Always	Sometimes	Rarely
1	I use artificial intelligence to understand steps for solving complex mathematical problems			
2	I can use AI tools (applications or platforms) to discuss solutions with my colleagues			
3	I feel more confident in classroom participation while explaining problems using AI techniques			
4	AI provides simplified explanations that increase my interaction with the subject			
5	I resort to AI when struggling with a mathematical problem before asking the teacher			
6	I contribute to increasing the speed of completing mathematical assignments through AI			
7	I share AI-suggested solutions in group discussions			
8	AI reduces my hesitation in asking questions during lectures			
9	I present diverse ideas suitable for my level that motivate my interaction with the subject using AI			
10	I consider AI complements the teacher's explanation without replacing them			
11	I discover my mistakes in mathematical solutions and exercises through AI better			
12	I use AI to simulate exam questions to improve my performance			
13	I propose ideas with creative solutions through following AI programs			
14	I communicate with colleagues through AI platforms to exchange solutions			
15	I notice most of my mistakes in mathematical solutions through immediate feedback from AI			
16	I prefer using AI over traditional methods for solving difficult problems			
17	I analyze mathematical problems into smaller steps with AI program assistance			
18	I use AI tools to present demonstrations while discussing solutions			
19	I collaborate with colleagues on mathematical projects I'm assigned using AI programs			
20	I feel that AI improves my learning independence			
21	AI reduces my frustration when failing to solve a problem			
22	I use AI to generate additional examples to understand mathematical concepts, improving my classroom interaction			
23	I connect mathematical problems to real applications with AI assistance to make them more exciting			
24	I feel my interaction inside the classroom is better after using AI tools			
25	AI provides customized learning resources that suit my individual needs			

Appendix (2)

Raw Data (Questionnaire on Artificial Intelligence, Classroom Interaction, and Mathematical Problem Solving consisting of 25 items)

No.	Score	No.	Score	No.	Score
1	55	17	54	33	55
2	60	18	50	34	59
3	58	19	59	35	54
4	55	20	45	36	53
5	61	21	48	37	55
6	54	22	49	38	59
7	58	23	53	39	65
8	55	24	65	40	68
9	54	25	64	41	69
10	55	26	54	42	67
11	54	27	60	43	63
12	49	28	64	44	64
13	50	29	50	45	65
14	53	30	55	46	66
15	45	31	51		
16	51	32	60		

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