

DEVELOPING CRITICAL THINKING WITH AI SUPPORT: THE EFFECTIVENESS OF INTEGRATING INQUIRY-BASED LEARNING (IBL) AND CHATGPT IN EFL CLASSES

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ABSTRACT: This article examines the integration of ChatGPT and the Inquiry-Based Learning (IBL) approach and its significance in developing students' critical thinking skills. First, the article provides a detailed analysis of the empirical impact of using the ChatGPT platform within the IBL approach on students' ability to analyze and evaluate information and draw deductive conclusions. Second, the research findings clearly demonstrate the effectiveness of the purposeful and systematic integration of generative artificial intelligence tools into the educational process. Third, based on advanced trends in digital didactics, the compatibility of the ChatGPT and IBL models and their pedagogical potential for developing critical thinking skills in the modern educational environment are highlighted, and relevant recommendations are proposed.

Keywords: ChatGPT, artificial intelligence, Inquiry-Based Learning, critical thinking, generative AI, educational technologies, independent learning

Introduction

Today, the main task of the education system is not only to provide students with ready-made knowledge, but also to develop them as individuals who can think independently, analyze information, find well-grounded solutions to problems, and defend their views with evidence. In the context of globalization, digital transformation, and the rapid development of artificial intelligence technologies, the requirements imposed on the educational process are also changing fundamentally. The learning process is no longer limited to assimilating information provided by the teacher; rather, it is becoming a process closely connected with students' inquiry, questioning, problem identification, evidence analysis, and independent conclusion-making.

Modern pedagogical approaches place particular emphasis on increasing students' active participation in the educational process, encouraging independent inquiry, and enabling them to acquire knowledge through practical activity. One such approach is Inquiry-Based Learning, that is, learning based on inquiry. In this approach, the student is not a passive recipient of ready-made knowledge, but an active participant who identifies problems, formulates questions, analyzes information, and develops conclusions.

The theoretical roots of this approach are directly related to constructivist learning theory. By the 1950s and 1960s, the development of constructivist learning theory had a strong influence on the formation of the

IBL approach. In particular, Jean Piaget substantiated that knowledge is actively constructed by the individual, while Lev Vygotsky explained that knowledge is formed through social cooperation and communication [1; 2]. These theoretical views laid the foundation for interpreting the learner not as a passive listener, but as an active subject who independently seeks knowledge, processes it, and applies it in practical activity.

In the 2016 report "Artificial Intelligence and Life in 2030," published by researchers at Stanford University, education was specifically identified as one of the areas in which artificial intelligence would have the greatest future impact [10]. The report emphasized that artificial intelligence technologies could create learning systems adapted to students' individual needs, personalize the learning process, and improve educational effectiveness. In this regard, artificial intelligence tools are viewed not merely as assistive technologies, but as important pedagogical tools that support students' independent inquiry and thinking processes.

The launch of the ChatGPT platform by OpenAI in November 2022 marked a new stage in the application of artificial intelligence in education. Within a short period, ChatGPT began to be widely used by millions of users worldwide for tasks such as creating learning materials, answering questions, analyzing texts, improving written work, and supporting independent learning [11].

Recent studies on the integration of Inquiry-Based Learning and ChatGPT show that inquiry-based learning activities organized with the support of artificial intelligence contribute to the development of students' skills in asking questions, analyzing information, evaluating arguments, and reflective thinking [14; 15; 16]. In particular, among students learning English as a foreign language, ChatGPT-supported IBL activities have been reported to improve critical thinking and the quality of academic writing. This is because, in such an approach, students do not merely accept a ready-made answer; rather, they actively participate in formulating questions, checking and comparing answers, and substantiating conclusions. Nevertheless, the impact of integrating ChatGPT and Inquiry-Based Learning on the development of critical thinking has not yet been studied in sufficient depth. In particular, the ways in which generative artificial intelligence tools affect students' processes of generating questions, analyzing problems, drawing

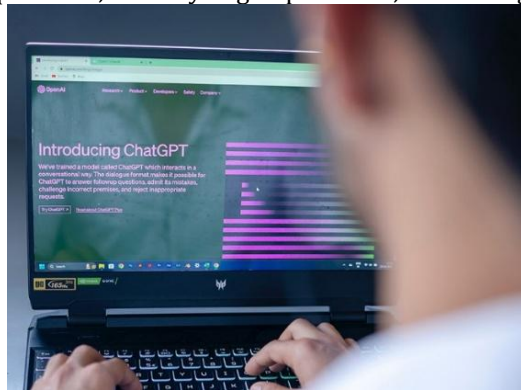


Figure 1. Use of ChatGPT as an AI-supported learning tool in the experimental group.

In the experimental group, lessons were organized on the basis of the Inquiry-Based Learning approach. During this process, students were engaged in activities such as formulating problem-based questions related to the topic, searching for information, analyzing evidence, comparing different viewpoints, constructing arguments, and drawing conclusions [18; 19]. ChatGPT was used as an assistive artificial intelligence tool supporting students' inquiry process.

The research design was developed on the basis of an experimental approach involving comparative analysis of pre-test and post-test results. At the initial stage of the study, a pre-test was administered to determine the students' initial level of critical thinking skills. At the next stage, Inquiry-Based Learning activities using ChatGPT were organized in the experimental group, while the traditional educational process continued in the control group. At the end of the study, a post-test was administered to both groups and the results were compared. In addition, students' reflective writings and semi-structured interviews were analyzed, supplementing the quantitative findings with qualitative data.

conclusions, and developing reflective thinking require separate scientific investigation.

Methodology

In this study, a quasi-experimental research design was employed to determine the effect of Inquiry-Based Learning (IBL) activities organized with the support of ChatGPT on students' critical thinking skills [17]. This approach makes it possible to evaluate the effectiveness of a new pedagogical technology in the educational process by comparing the results of experimental and control groups.

The study was conducted for 10 weeks at General Secondary School No. 169 in Tashkent. A total of 56 students participated. The participants were divided into two groups: the experimental group consisted of 30 students, while the control group consisted of 26 students. Before the study began, the English proficiency levels and critical thinking indicators of both groups were determined through a pre-test, and their initial results were found to be comparable.



Figure 2. Traditional classroom instruction in the control group.

In the control group, lessons were conducted using traditional teaching methods. ChatGPT or other artificial intelligence tools were not used in this group. Students learned on the basis of materials provided by the teacher, textbooks, and conventional assignments. This made it possible to compare the results of the experimental group with the traditional form of education.

The Delphi model developed by Facione was used as the basis for determining the criteria for assessing critical thinking skills [20]. Within the study, the main components of this model—analysis, inference, evaluation, and reflection—were examined. These indicators were assessed through students' pre-test and post-test results, and the effectiveness of the ChatGPT-supported Inquiry-Based Learning approach used in the experimental group was comparatively analyzed against the results of the control group.

The study also employed quantitative and qualitative methods in an integrated manner. Quantitative data were generated from students' pre-test and post-test results and analyzed using IBM SPSS Statistics. Group means and standard deviations were determined through descriptive statistics. Differences between pre-experiment and post-experiment results were compared using a paired-samples t-test, while the results of the experimental and control groups were compared using an independent-samples t-test [21]. Cohen's d effect size was calculated to assess the practical significance of the results [22].

Results

At the beginning of the study, a preliminary test (pre-test) was administered to determine the critical

thinking levels of the experimental and control groups. The results showed that there was no significant difference between the two groups. This confirmed that the groups had comparable levels of knowledge and skills at the beginning of the study.

Table 1. Pre-test and post-test results of the experimental and control groups

Group	n	Pre-test M	SD	Post-test M	SD	Increase
Experimental	30	61.8	8.4	81.3	7.2	+19.5
Control	26	62.1	8.1	69.4	7.8	+7.3

As shown in the table, the mean score of the experimental group increased from 61.8 to 81.3 points, representing an overall increase of 19.5 points. In the control group, the increase was limited to 7.3 points.

The results showed that Inquiry-Based Learning activities organized with the support of ChatGPT were more effective in developing students' critical thinking skills.

Table 2. Paired-samples t-test results

Group	t	p
Experimental	9.82	< .001
Control	3.11	.004

The paired-samples t-test results showed that the change observed in the experimental group was highly statistically significant ($t = 9.82$, $p < .001$).

Although a certain degree of improvement was also observed in the control group, the magnitude of its effect was considerably lower.

Table 3. Independent-samples t-test for post-test results

Group	M	SD
Experimental	81.3	7.2
Control	69.4	7.8

The difference between the groups in the post-test results was found to be statistically significant. This result indicates that ChatGPT-supported IBL

activities were more effective than traditional teaching methods.

Table 4. Changes in critical thinking components (%)

Component	Pre-test	Post-test	Increase (%)
Analysis	60	82	+22
Inference	58	79	+21
Evaluation	63	84	+21

Reflection	61	80	+19
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According to the results, the greatest improvement was observed in analysis and evaluation skills. Students demonstrated significant development in critically analyzing information, comparing evidence, and evaluating alternative viewpoints. When Cohen's d effect size was calculated, a value of $d = 1.54$ was obtained. This indicates a large effect size and confirms the practical effectiveness of the applied methodology.

The analysis of qualitative data also supported the quantitative results. Most students stated that ChatGPT helped them formulate complex questions, compare different sources, and study topics in greater depth. In their reflective writings, students noted that they attempted to express more evidence-based opinions than before.

Discussion

The findings showed that Inquiry-Based Learning activities organized with the support of ChatGPT had a positive effect on students' critical thinking skills. The improvements observed in the experimental group in the components of analysis, inference, evaluation, and reflection indicate that ChatGPT functioned effectively as an assistive tool that guided students to ask questions, compare answers, analyze evidence, and draw independent conclusions. The relatively lower results in the control group indicate that opportunities for independent inquiry and reflective thinking are more limited under traditional educational conditions.

These findings are consistent with the observations reported by C. K. Lo (2023) in a review of the literature on the use of ChatGPT in education. The author emphasizes that generative artificial intelligence tools can support students' independent learning, clarification of ideas, and active participation in the learning process [24]. The fact that students in the experimental group achieved higher results than those in the control group also provides practical support for this view.

The findings concerning the Inquiry-Based Learning approach are also consistent with the inquiry cycle described by M. Pedaste and T. de Jong (2015). In this approach, the student participates as an active subject of learning through the processes of posing questions, searching for information, analyzing evidence, and drawing conclusions [25]. In the present study, IBL activities integrated with ChatGPT strengthened these processes and activated students' critical-thinking-oriented activity.

At the same time, the results show that ChatGPT alone does not independently develop critical

The analysis of semi-structured interviews and reflective writings conducted with the students showed that learning engagement and interest in independent inquiry increased in the experimental group. Most students stated that they had become more interested in independently studying topics and had developed the habit of searching for and verifying information. Positive changes were also observed in students' skills of asking questions, comparing different viewpoints, and drawing evidence-based conclusions. During the interviews, many participants noted that they had realized the need not to accept ChatGPT responses immediately, but to compare them with other sources

thinking. The positive effect is primarily associated with the purposeful and controlled integration of the artificial intelligence tool with Inquiry-Based Learning activities. Therefore, ChatGPT produces effective results when it is used in the educational process not as a tool that provides ready-made answers, but as a pedagogical assistant that encourages questioning, verification, comparison, and reflection.

Conclusion

This study was aimed at examining the effectiveness of Inquiry-Based Learning (IBL) activities organized with the support of ChatGPT in developing students' critical thinking skills. The findings showed that students in the experimental group achieved higher results than the control group in analysis, inference, evaluation, and reflection skills. It was also found that students developed greater interest in independent inquiry, a culture of questioning, and evidence-based reasoning skills.

The findings demonstrated that ChatGPT can be effectively used in the educational process not as a tool for providing ready-made answers, but as a pedagogical assistant that supports students' inquiry and thinking activities. In particular, when used together with the Inquiry-Based Learning approach, artificial intelligence helps students explore topics in greater depth, analyze different viewpoints, and draw well-founded conclusions. At the same time, the study also showed the importance of developing students' skills in verifying information and critically evaluating sources when using ChatGPT. This means that the teacher's guiding and supervisory role must be preserved. ChatGPT-supported Inquiry-Based Learning emerged as an effective pedagogical tool for developing students' critical thinking skills

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