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Inquiry-Based Learning Strategies and Critical Thinking Skills of College Students

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Abstract: Critical thinking is an essential skill that enables students to analyze information, evaluate arguments, and make well-informed decisions. As educators seek to improve teaching strategies, inquiry-based learning (IBL) has emerged as an innovative approach that fosters critical thinking by actively engaging students in exploring real-world problems. This study aimed to examine the implementation level of IBL strategies among college students and assess their critical thinking skills. Additionally, it sought to investigate the relationship between the extent of IBL implementation and the development of students' critical thinking abilities. Conducted at Lanao National College of Arts and Trades (LNCAT) in Marawi City, Philippines, the study involved 108 college students, selected using a total enumeration non-probability sampling method. Data were collected through a researcher-developed survey on IBL strategies and the Critical Thinking Questionnaire (CThQ). Descriptive statistics and multiple linear regression analysis were used to analyze the data. The findings reveal that technical strategies, especially the use of digital tools, are frequently implemented; however, student engagement online could be enhanced. Student-centered strategies are highly valued by students, particularly the opportunity to provide suggestions, although media tools like PowerPoint are underutilized. The teacher-facilitated strategy, particularly the use of real-world examples, is also highly implemented; however, feedback on students' critical thinking processes requires improvement. Overall, students demonstrated "Above Average" critical thinking skills, excelling in analyzing, evaluating, and creating information. The regression analysis showed that student-centered strategies had the most significant influence on critical thinking, followed by technical and teacher-facilitated strategies. These findings underscore the importance of adopting balanced and innovative IBL practices to further enhance the development of critical thinking.

Keywords: Critical thinking skills, Inquiry-Based Learning Strategies, Technical strategies, Student-Centered, Teacher-Facilitated

I. Introduction

Critical thinking is an indispensable skill that empowers students to analyze information, evaluate arguments, and make well-informed decisions. In an era characterized by rapid technological advancements and complex global challenges, the ability to think critically is essential for navigating the demands of the modern world. Traditional teaching methods, which often emphasize rote memorization and passive learning, have been shown to have limitations in cultivating these skills. Consequently, there is an increasing interest in alternative pedagogical approaches that actively engage students and foster critical thinking abilities.

One such innovative approach is the inquiry-based learning (IBL) model. IBL places students at the center of the learning process, encouraging them to explore real-world problems, pose meaningful questions, conduct research, and derive evidence-based conclusions. This dynamic model not only promotes active engagement but also helps develop the higher-order thinking skills essential for academic and professional success.

Research has consistently underscored the benefits of IBL in enhancing critical thinking. For instance, Rahmi, Alberida, and Astuti (2019) found that students who participated in IBL activities exhibited significant improvements in their critical thinking skills compared to those in traditional lecture-based settings. Their study concluded that the IBL model positively influences learners' analytical and evaluative capabilities. Similarly, Shafiyeva (2021) reported that IBL leads to deeper understanding, improved retention, and heightened creativity. Her study emphasized the importance of shifting from memorization-based education to inquiry-driven learning, recommending that assessments focus on students' critical thinking and creativity. Furthermore, redesigning curricula to prioritize IBL could enhance both instructional practices and knowledge assessment methods.

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However, the implementation of IBL is not without challenges. Educators often encounter barriers such as limited time, insufficient resources, inadequate professional development, and resistance to change among students and peers. Addressing these challenges requires a nuanced understanding of effective IBL strategies and their impact on student learning outcomes, particularly critical thinking.

This study aimed to examine the implementation level of inquiry-based learning strategies among college students and assess their critical thinking skills. Additionally, it sought to investigate the relationship between the extent of IBL implementation and the development of students' critical thinking abilities. By providing empirical evidence and actionable insights, this research contributes to the growing body of knowledge on innovative teaching practices and supports efforts to create more effective and engaging learning environments.

This study aims to address the following problem:

1. What is the perceived level of implementation of inquiry-based learning strategies in terms of:
   a. Technical Strategies;
   b. Student-Centered Strategies; and
   c. Teacher-Facilitated Strategies?
2. What is the level of critical thinking skills of college students?
3. Does the perceived level of implementation of inquiry-based learning strategies influence the critical thinking skills of college students?

A. NULL HYPOTHESIS

H_{01} The perceived level of implementation of inquiry-based learning strategies in terms of technical strategies do not influence the critical thinking skills of college students.

H_{02} The perceived level of implementation of inquiry-based learning strategies in terms of student-centered strategies do not influence the critical thinking skills of college students.

H_{03} The perceived level of implementation of inquiry-based learning strategies in terms of teacher-facilitated strategies do not influence the critical thinking skills of college students.

II. Literature Review

This section presents relevant literature and studies that explore the concepts and theories related to enhancing students' critical thinking skills through an inquiry-based learning model.

Inquiry learning is anchored to the discovery process. It is when we begin to ask questions and try to find the answer based on our observations. Inquiry has been presented as a teaching method that combines student-centered, hands-on activities with discovery. We also use inquiry-based learning in our daily lives. According to Millar on the work of Ostergaard (2016), inquiry is often conducted both in everyday life. Skills such as observing, experimenting, classifying, developing a hypothesis, drawing conclusions, designing, planning, and so on are used for inquiry.

In education, inquiry is a systematic method that allows active participation of the students. Prince and Felder, on the work of Khasawneh (2016), stated that inquiry-based learning (IBL) is an instructional pedagogy that promotes active learning. It focuses on the process of learning through observation and questioning rather than on finding the correct solution. In addition to that, inquiry signifies deep and critical thinking. The introduction of inquiry-based laboratories has been observed to result in a more profound comprehension of scientific knowledge, increased confidence in understanding and performing science, improved students' attitudes towards science, and acted to lower attrition rates (Smallhorn, 2015). According to Khasawneh (2016), the main principle of IBL aligns well with constructivist learning methods. The main principles in the IBL environment are learner-centered, knowledge-centered, assessment-centered, and community-centered. In the IBL environment, the learner's prior knowledge and the type of skills they already have help students incorporate it within their existing knowledge (Yilmaz, 2008).

The use of inquiry-based learning as an approach to teaching mathematics will help more students to be more curious and improve their critical thinking. Anchored in Dewey's work, inquiry-based learning is one of the many approaches to learning that includes a process of investigating the material world, and that leads to seeking answers to questions, having discoveries, and rigorously evaluating those discoveries in the search for new meaning (National Science Foundation, 2005, p. 2). According to Dewey (1938), "Inquiry is the only authentic means at our command for getting at the significance of our everyday experience of the world in which we live". Inquiry is also an essential skill for coping with the complexity of this information age and its many challenges, such as information overload (National Science Foundation, 2005).

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Based on the study of Dyjur (2010), inquiry-based learning is generally recognized as being more authentic for students as it allows them the flexibility to make some of the decisions about their learning; an emphasis on inquiry also tends to promote critical thinking skills. As a result, students may have more profound, more relevant learning experiences when using this approach. He also added that inquiry-based learning promotes student learning through guided and increasingly independent investigation of complex questions, problems, and issues, often for which there is no single answer. Knowledge is socially constructed, and learning occurs through involvement in communities of practice.

In contrast to traditional pedagogy, IBL focuses on students' active learning. Their role is changed from passive listeners to active explorers, while the role of the teacher is changed from lesson instructor to problem-solving guide. Moreover, thanks to the rapid growth of the internet, instead of traditional textbooks, knowledge resources from the World Wide Web have become a mainstream element in learning activities. It is beneficial to teachers to conduct IBL, and students can learn knowledge anywhere and at any time (Wu et al., 2015).

IBL Pedagogy helps students take ownership and motivates them to work harder, enabling them to develop more independent and sophisticated research capabilities and confidence, which leads to achievement (Abdi, 2014). In the study of Lambordi (2016), he stated that students are engaged in solving scientific problems in a meaningful, inquiry-based manner through hypothesis testing, experimentation, and investigation. This mode of learning introduces students to real-life, authentic science experiences within the confines of a typical classroom.

According to Llewellyn in the work of Stewart (2008), students' generation of questions is central to the concept of inquiry, and their own curiosity and interest drive their investigation. Generally, learner-centeredness is a core component of most conceptualizations of inquiry.

The National Science Education Standards (1996) indicated that "when engaging in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current scientific, and communicate their ideas to others. They identify their assumptions, use critical and logical thinking, and consider alternative explanations (Stewart, 2008).

The conceptual framework of this study is grounded in the constructivist theory, which emphasizes the active role of learners in constructing their own understanding and knowledge through experiences and reflection. According to this theory, learning is most effective when students are engaged in authentic, meaningful tasks that require them to actively inquire, analyze, and synthesize information.

Inquiry-Based Learning (IBL) is a pedagogical approach that aligns with the constructivist theory by emphasizing students' active engagement in the learning process. IBL involves students posing questions, investigating problems, and developing solutions through hands-on activities and collaborative work. This approach aims to develop students' critical thinking skills, problem-solving abilities, and decision-making skills.

Critical thinking is a key component of IBL, as it involves the ability to analyze, evaluate, and synthesize information to make informed decisions and judgments. Critical thinking consists of a set of cognitive skills, including interpretation, analysis, evaluation, inference, explanation, and self-regulation. These skills are essential for students to engage in inquiry-based learning activities effectively.

Several Studies have explored the effectiveness of IBL in enhancing students' critical thinking skills. For instance, a study by Y L Rahmi, H Alberida, and M Y Astuti (2019) found that students who participated in inquiry-based learning activities demonstrated significant improvements in their critical thinking abilities compared to those in traditional lecture-based courses. In their study, they concluded that the implementation of the inquiry-based learning model has a positive influence on learners' ability to think critically. Similarly, a study by Ulker Shafiyeva (2021) reported that inquiry-based learning led to deeper understanding and retention of course material, resulting in better critical thinking outcomes. In the study, they concluded that educators should promote an inquiry-based education process instead of memorization. The study recommended that students' knowledge should be assessed based on their critical thinking and creativity. Redesigning the curriculum to promote inquiry-based learning could foster the development of better knowledge assessment methods. A study found that students who participated in IBL activities demonstrated greater gains in critical thinking skills compared to those who engaged in traditional lecture-based instruction. Similarly, a meta-analysis concluded that IBL significantly improves students' critical thinking skills across various educational settings. A study by Laksmi Evasufi Widi Fajari, Sarwanto, and Chumdari (2019) provides guidelines and reinforcement of the theory that multimedia in a PBL environment can enhance critical thinking skills. A study by Meltem Duran and Ilbilge Dokme (2015) revealed that science and technology learning supported with the guided activities developed in line with the inquiry-based learning approach has significant effects on students' critical thinking skills in science and technology courses.

Despite its effectiveness, implementing IBL can be challenging for educators due to various factors. For example, lack of teacher training in IBL methods, limited resources, resistance to change from traditional

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teaching methods, and difficulty in assessing students' learning outcomes are some of the challenges identified in the literature.

To address these challenges, educators can provide more training and professional development opportunities for teachers in IBL methods, allocate more resources for IBL implementation, create a supportive school culture that values and promotes IBL, and develop better assessment methods for evaluating students' critical thinking skills.

III. Methodology

This section presents the research methodology used in the study. This includes the discussion of research design, study locale, study participants, data collection procedure, research instruments, and statistical treatment of data.

A. Research Design

This study utilized a descriptive-correlational research design to explore the relationship between the perceived implementation of inquiry-based learning (IBL) strategies and the critical thinking skills of college students. The descriptive component aimed to assess the level of implementation of IBL strategies across three dimensions: technical strategies, student-centered strategies, and teacher-facilitated strategies. Additionally, it examined the critical thinking skills of college students to provide a comprehensive profile of the variables under study.

The correlational aspect of the research sought to determine whether and to what extent the perceived implementation of IBL strategies influenced students' critical thinking skills. By combining descriptive and correlational approaches, this design provided a nuanced understanding of the individual and interconnected roles of IBL strategies in fostering critical thinking.

B. Research Locale

The study was meticulously carried out within the premises of Lanao National College of Arts and Trades (LNCAT), strategically situated in Saduc, Marawi City, Lanao del Sur. LNCAT stands as a beacon of educational excellence in the region, providing a dynamic and conducive environment for academic pursuits. Its central location in Marawi City, known for its rich cultural heritage and historical significance, adds a unique dimension to the research locale.

C. Research Respondents/Sampling Procedure

The participants of this study were 108 college students enrolled at Lanao National College of Arts and Trades in Saduc, Marawi City, Lanao del Sur. The participants of this study were selected using total-enumeration non-probability sampling.

Table I
Distribution of Respondents

Colleges	Frequency (*f*)
BS-CRIM	50
BSED-SCIENCE	21
BEED	15
BTLED	22
Total	**108**

D. Research Instrument

The data on the perceived level of implementation of Inquiry-Based Learning (IBL) strategies were gathered through a researcher-developed survey questionnaire. This instrument was designed to measure three dimensions of IBL strategies: Technical Strategies, Student-Centered Strategies, and Teacher-Facilitated Strategies. Responses were captured using a 4-point Likert scale, with options ranging from Always (4) to Rarely (1). This structure ensured a transparent and standardized assessment of students' perceptions regarding the implementation of IBL strategies.

To evaluate the critical thinking skills of college students, the study utilized the Critical Thinking Questionnaire (CThQ) developed by Kobylarek et al. (2022). The CThQ has been validated as a reliable tool, supported by its psychometric properties and an independent rater system. It demonstrated high internal consistency, with a Cronbach's Alpha coefficient of 0.87, indicating its robustness for measuring critical thinking. The questionnaire employed a 5-point Likert scale, with response options ranging from 1 – Strongly Disagree to 5 – Strongly Agree. This scale allowed for a nuanced evaluation of students' critical thinking abilities, providing valuable insights into their analytical and evaluative skills.

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E. Scoring Procedure

Table II
Scoring Procedure for the Level of Implementation of Inquiry-Based Learning Strategies

Score	Range	Description	Interpretation
4	3.26 – 4.00	Always	Very High Level of Implementation
3	2.51 – 3.25	Most of the time	High Level of Implementation
2	1.76 – 2.50	Sometimes	Low Level of Implementation
1	1.00 – 1.75	Strongly Disagree	Very Low Level of Implementation

Table III
Scoring Procedure for the Level of Critical Thinking Skills of Students

Score	Range	Description	Interpretation
5	4.21 – 5.00	Strongly Agree	Superior
4	3.41 – 4.20	Agree	Above Average
3	2.61 – 3.40	Neutral	Average
2	1.81 – 2.60	Disagree	Below Average
1	1.00 – 1.80	Strongly Disagree	Poor

F. Data Collection Method

The researcher sought permission from the administration of Lanao National College of Arts and Trades (LNCAT) to conduct the study. A formal letter was submitted detailing the study's objectives, scope, and methodology. Upon approval, the researcher coordinated with school officials to facilitate the process and ensure smooth implementation.

During the actual data collection, respondents attended an orientation where the study's purpose and ethical considerations were explained. After providing consent, they were given the survey instruments, which included the Inquiry-Based Learning Strategies Survey and the Critical Thinking Questionnaire (CThQ). The surveys were administered in a controlled setting, ensuring uniformity, and were completed within approximately 30 minutes.

Once collected, the researcher reviewed the questionnaires for completeness before encoding the data into statistical software. Descriptive statistics were used to summarize the levels of IBL strategy implementation and critical thinking skills, while multiple regression analysis was used to examine the relationship between these variables. This systematic approach ensured the integrity and reliability of the study's findings.

G. Data Analysis

The data collected from the survey instruments were analyzed using descriptive statistics and multiple linear regression analysis. The perceived level of implementation of Inquiry-Based Learning (IBL) strategies and the critical thinking skills of college students were assessed separately, and then the relationship between these variables was examined using multiple regression.

First, descriptive statistics, including means, and standard deviations, were applied to analyze the responses from the researcher-made survey on IBL strategies. The data were categorized into three subgroups: Technical Strategies, Student-Centered Strategies, and Teacher-Facilitated Strategies. The 4-point Likert scale responses (1 = Rarely, 2 = Sometimes, 3 = Most of the Time, 4 = Always) were numerically coded to calculate the mean scores for each subgroup, providing an overview of students' perceptions of the implementation of IBL strategies.

Next, to evaluate the critical thinking skills of the students, descriptive statistics were applied again to the responses from the Critical Thinking Questionnaire (CThQ). The 5-point Likert scale responses (1 = Strongly Disagree, 5 = Strongly Agree) were numerically coded to obtain mean scores for each item, as well as an overall score for the students' critical thinking abilities.

To test the influence of the perceived implementation of IBL strategies on the students' critical thinking skills, multiple linear regression analysis was conducted. In this model, the independent variables included the perceived implementation levels of technical strategies, student-centered strategies, and teacher-facilitated strategies. In contrast, the dependent variable was the students' critical thinking skills.

This analysis assessed whether and to what extent the level of implementation of IBL strategies predicted students' critical thinking skills. The results were examined for statistical significance ($p < 0.05$) to determine if the perceived implementation of IBL strategies had a meaningful impact on critical thinking development.

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Once collected, the researcher reviewed the questionnaires for completeness before encoding the data into statistical software. Descriptive statistics were used to summarize the levels of IBL strategy implementation and critical thinking skills, while multiple regression analysis was used to examine the relationships between variables. This systematic approach ensured the integrity and reliability of the study's findings.

I. Ethical Standards

This study adhered to strict ethical guidelines to ensure the integrity of the research process and safeguard participants' rights. Informed consent was obtained from all participants, who were fully informed about the study's objectives, procedures, and potential risks. They were made aware of their voluntary participation and the right to withdraw from the study at any time without any consequences. To maintain confidentiality and anonymity, participants' identities and responses were kept confidential, with all data being coded and securely stored. No identifying information was included in the analysis or reporting of results.

The study was conducted with respect for participants' rights and well-being, ensuring that no participant was coerced into participation. Students were assured that their academic standing would not be influenced by their decision to participate or not. Additionally, efforts were made to minimize any discomfort or harm by providing a comfortable and safe environment for participants while completing the survey. The study's design and methodology were carefully crafted to protect participants from any potential risks.

Furthermore, the researcher ensured the accuracy and integrity of the data throughout the study. The data were recorded and analyzed with care, applying appropriate statistical methods to ensure reliable results. Transparency in data analysis was maintained, and the findings were presented honestly, without any manipulation or fabrication. This ethical framework guided the study, promoting trust and accountability throughout the research process.

J. Limitations

Despite its strengths, this study has several limitations that should be considered when interpreting the findings. One limitation is the use of a cross-sectional design, which only provides a snapshot of the relationship between the perceived implementation of Inquiry-Based Learning (IBL) strategies and the critical thinking skills of college students at a single point in time. As a result, the study cannot establish causality or account for the long-term effects of IBL strategies on students' critical thinking skills.

Another limitation is the use of self-reported data. The survey instruments relied on students' perceptions of the implementation of IBL strategies and their own critical thinking skills, which could be subject to bias, such as social desirability or inaccurate self-assessment. While efforts were made to ensure clarity and minimize biases in the survey design, the subjective nature of self-reporting could influence the accuracy of the responses.

Additionally, the study's sample was limited to 108 college students from Lanao National College of Arts and Trades (LNCAT), which may not be representative of the broader population of college students. The findings may therefore not be generalizable to other institutions, regions, or educational systems with different teaching practices and student demographics.

Finally, the study's focus on only three specific dimensions of IBL strategies—technical strategies, student-centered strategies, and teacher-facilitated strategies—may overlook other factors that could influence students' critical thinking skills, such as individual learning styles, prior academic performance, or socio-economic background.

These limitations suggest that while the findings provide valuable insights, they should be interpreted with caution and may need to be corroborated by further research with different methodologies and larger, more diverse samples.

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IV. Results and Discussion

Problem 1: What is the perceived level of implementation of inquiry-based learning strategies in terms of:
1.1. technical strategies;
1.2. student-centered strategies; and
1.3. teacher-facilitated strategies?

Table I
Perceived Level of Implementation of Inquiry-Based Learning Strategies in Terms of Technical Strategies

Items	Mean	SD	Interpretation
Digital tools are used to facilitate inquiry-based learning	**2.81**	**.86**	High Level of Implementation
Online resources are utilized	**3.04**	**.65**	High Level of Implementation
Students engaged in digital performance or products such as podcasts, educational blogs	**2.90**	**.82**	High Level of Implementation
Students engaged themselves in an online discussion/forum	**2.56**	**.83**	High Level of Implementation
Overall	**2.84**	**.81**	High Level of Implementation

Legend:

Score	Range	Verbal Description	Interpretation
4	3.26 – 4.00	Always	Very High Level of Implementation
3	2.51 – 3.25	Most of the Time	High Level of Implementation
2	1.76 – 2.50	Sometimes	Low Level of Implementation
1	1.00 – 1.75	Rarely	Very Low Level of Implementation

Table 1 presents the perceived level of implementation of inquiry-based learning (IBL) strategies in terms of technical strategies, with a specific focus on the use of digital tools and resources. The data show that the overall mean score is 2.84 with a standard deviation of 0.81, indicating a High Level of Implementation, as the responses fall within the range of 2.51–3.25, interpreted as "Most of the Time." This suggests that, on average, the technical strategies for IBL are implemented frequently but not consistently.

Among the items, the highest mean score is 3.04 (SD = 0.65) for "Online resources are utilized," indicating that online resources are the most frequently implemented technical strategy. This aligns with the growing emphasis on integrating online tools to enhance learning experiences. Conversely, the lowest mean score is 2.56 (SD = 0.83) for "Students engaged themselves in an online discussion/forum," which, while still rated as a High Level of Implementation, reflects a relative challenge in facilitating active online engagement among students.

Digital tools play a crucial role in developing critical thinking skills across educational levels. Studies have shown that integrating digital technologies in classrooms positively impacts students' critical thinking abilities (Meirbekov et al., 2022; González-Mohíno et al., 2023). These tools facilitate learning, information access, and communication, fostering critical analysis and problem-solving skills (González-Mohíno et al., 2023; Lionenko & Huzar, 2023). For higher education students, digital tools aid in developing test tasks, logic problems, and collaborative problem-solving (Meirbekov et al., 2022). Furthermore, technology-enhanced classrooms support long-term, multidisciplinary projects that challenge students with engaging content (Omariba, 2021).

The integration of digital tools in education, as reflected in this study, not only supports the enhancement of critical thinking skills but also promotes civic participation and global competence, preparing students for the digital workplace (González-Mohíno et al., 2023; Omariba, 2021). These findings emphasize the importance of fostering consistent and innovative uses of technology to further strengthen IBL strategies in educational settings.

Table II
Perceived Level of Implementation of Inquiry-Based Learning Strategies in Terms of Student-Centered Strategies

Items	Mean	SD	Interpretation
Students are encouraged to give their suggestions	3.64	.57	Very High Level of Implementation
Students are encouraged to analyze and exercise critical thinking	3.08	.92	High Level of Implementation
Students are encouraged to give their suggestions	3.30	.60	Very High Level of Implementation
Students use various media such as power point presentations, report	2.75	.97	High Level of Implementation
Students work in groups or pairs and generate ideas	2.92	.94	High Level of Implementation
Overall	**3.14**	**.35**	**High Level of Implementation**

Legend:

Score	Range	Verbal Description	Interpretation

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4	3.26 – 4.00	Always	Very High Level of Implementation
3	2.51 – 3.25	Most of the Times	High Level of Implementation
2	1.76 – 2.50	Sometimes	Low Level of Implementation
1	1.00 – 1.75	Rarely	Very Low Level of Implementation

Table 2 presents the perceived level of implementation of Inquiry-Based Learning (IBL) strategies in terms of student-centered strategies. The overall mean score of 3.14, with a standard deviation of 0.35, indicates a "High Level of Implementation," suggesting that students generally perceive these strategies as being implemented most of the time. The highest mean score of 3.64, with a standard deviation of 0.57, is found in the item "Students are encouraged to give their suggestions," reflecting a very high level of implementation. This suggests that students frequently have opportunities to provide suggestions in the learning process, contributing to a sense of ownership and engagement in their learning. On the other hand, the lowest mean score of 2.75, with a standard deviation of 0.97, is found for the item "Students use various media such as PowerPoint presentations, reports," indicating that while this strategy is implemented at a high level, it occurs less frequently compared to other student-centered strategies.

Research shows that student-centered learning strategies, such as inquiry-based learning, collaborative learning, and problem-based learning, are highly effective in promoting critical thinking skills across various educational contexts (Searles, 2022; El Yazidi, 2023). These strategies place students at the center of instruction, allowing them to construct knowledge and engage deeply with the material actively. In particular, allowing students to provide suggestions helps develop their autonomy, encourages critical thinking, and promotes democratic participation in the learning process (Searles, 2022). In higher education, such approaches enhance students' ability to solve problems creatively and independently (Theodoridou, 2021). This active learning environment fosters not only critical thinking but also technical and scientific skills that students can apply in real-world situations (Justino & Rafael, 2021).

The findings suggest that while student-centered strategies are widely implemented, there may be opportunities to integrate further media and technological tools, such as PowerPoint presentations and reports, more frequently in the learning process. Although these tools are already used at a high level, increasing their frequency could provide students with more diverse learning experiences and enhance their digital literacy, which is increasingly important in the modern classroom. Moreover, the fact that students are encouraged to provide suggestions aligns with fostering critical thinking and engagement. However, greater emphasis on collaborative learning activities and inquiry-based methods could further enhance students' ability to solve complex problems and think critically. Teachers could benefit from training on how to effectively integrate these strategies to create more active learning environments that prepare students for the challenges of the digital and interconnected world. By placing students at the center of the learning process, these approaches not only improve academic skills but also promote the development of essential life skills, including creativity, problem-solving, and global citizenship.

Table III
Perceived Level of Implementation of Inquiry-Based Learning Strategies in Terms of Teacher-Facilitated Strategies

Items	Mean	SD	Interpretation
The teacher provides clear instructions and guidance throughout the inquiry process	3.11	.89	High Level of Implementation
The teacher encourages students to ask questions	3.18	.85	High Level of Implementation
the teacher facilitates group discussions and brainstorming	3.05	.80	High Level of Implementation
Real-world examples are incorporated in our lessons	3.28	.70	Very High Level of Implementation
The teacher provides feedback on students' critical thinking process	3.01	.79	High Level of Implementation
Overall	**3.12**	**.80**	High Level of Implementation

Legend:

Score	**Range**	**Verbal Description**	**Interpretation**
4	3.26 – 4.00	Always	Very High Level of Implementation
3	2.51 – 3.25	Most of the Time	High Level of Implementation
2	1.76 – 2.50	Sometimes	Low Level of Implementation
1	1.00 – 1.75	Rarely	Very Low Level of Implementation

Table 3 presents the perceived level of implementation of inquiry-based learning (IBL) strategies in terms of teacher-facilitated strategies. The data reveal that the overall implementation of teacher-facilitated strategies is rated as a "High Level of Implementation" with an overall mean of 3.12 and a standard deviation of 0.80. This suggests that, in general, students perceive these strategies to be frequently used in their learning environment.

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The item with the highest mean is "Real-world examples are incorporated in our lessons" (mean = 3.28, SD = 0.70), indicating that this aspect of teacher facilitation is viewed as being implemented at a "Very High Level." This suggests that teachers are successful in bringing practical, real-world contexts into their lessons, which is crucial for fostering critical thinking skills and enhancing the relevance of academic content. This aligns with research that underscores the importance of using real-world problems and examples to engage students in deeper, more meaningful learning (Sharma & Priyamvada, 2022).

On the other hand, the item with the lowest mean is "The teacher provides feedback on students' critical thinking process" (mean = 3.01, SD = 0.79). While still considered "High Level of Implementation," this indicates that, among the strategies assessed, feedback on students' critical thinking skills may be perceived as less frequently emphasized. This finding highlights an area for potential improvement, as providing timely and constructive feedback is essential in developing students' critical thinking abilities. As noted by Brahim (2024), teachers themselves need to develop critical thinking skills in order to guide students in this process effectively.

The overall high level of implementation suggests that teachers are integrating inquiry-based learning strategies, such as providing clear instructions, encouraging student questions, facilitating group discussions, and incorporating real-world examples. These strategies are aligned with the research on critical thinking, which identifies approaches such as Socratic questioning and collaborative learning as essential for developing students' analytical skills (El Yazidi, 2023; Sagar et al., 2024). However, the feedback element is a critical area that could be further emphasized to enhance student learning outcomes and critical thinking development.

The findings suggest that while teacher-facilitated strategies are generally perceived as being well-implemented, there is room for improvement in providing personalized feedback on students' critical thinking processes. Given that critical thinking is a vital skill for academic and life success (El Yazidi, 2023; Sagar et al., 2024), ensuring that feedback is effectively delivered can significantly enhance students' cognitive development. Teachers should be trained not only in inquiry-based learning techniques but also in methods for providing meaningful feedback that nurtures critical thinking. Additionally, integrating more collaborative learning opportunities, as indicated by the data, may further strengthen students' ability to think critically in a cooperative setting. By focusing on these areas, educators can better prepare students to tackle current and future challenges, including navigating complex issues like fake news and biased information (Brahim, 2024).

Problem 2: What is the level of Critical thinking skills of college students?

Table IV
Level of Students' Critical Thinking Skills

Items	Mean	SD	Interpretation
Analyzing			
I like combining information from different texts	3.50	.85	Above Average
I like finding dependencies between seemingly different phenomena	3.61	.80	Above Average
I can extract the most relevant parts of a text	3.45	.90	Above Average
When I read the text, I am researching for a relationship between the information it contains and other texts that I have read	3.59	.77	Above Average
Evaluating			
After reading it, I check important information, even if it seems to be true	3.40	.85	Above Average
In the discussion, I care about justifying my stance on the matter and understanding the other party at the same time	3.71	.78	Above Average
When I am interested in some information, I try to check if it is true	3.45	.82	Above Average
To evaluate the information, I check many sources	3.50	.77	Above Average
Creating			
I like combining information from different texts	3.58	.85	Above Average
The same content can be expressed in many different ways	3.63	.84	Above Average
I form my impression on the basis of various information that I combine with each other	3.55	.75	Above Average
Everything already exists, so nothing completely new can be created	2.80	.93	Average
I can see the structure of the text, and I could change it	3.66	.79	Above Average

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I like discussing new meanings in texts that I already know	3.57	.85	Above Average
Remembering			
After reading it, I am able to repeat important threads from the text	3.32	.81	Average
If necessary, I can recall information about which I once read	3.45	.82	Above Average
I do not remember much from what I was learning at school	2.95	1.02	Average
Understanding			
I can understand texts from various fields	3.62	.74	Above Average
I like to collate different opinions and compare them with each other	3.55	.80	Above Average
I have difficulties with paraphrasing	2.85	.95	
I pay attention to the contexts, nuances, and overtones of the statements	3.50	.80	Above Average
Applying			
I am willing to share the newly gained information	3.60	.75	Above Average
When I talk, I give many examples	3.55	.78	Above Average
When discussing, I try to use practical examples to justify my stance on the matter	3.66	.80	Above Average
I try to use the information I have learned in everyday life	3.73	.72	Above Average
Overall	**3.47**	**.82**	**Above Average**

Legend:

Score	**Range**	**Verbal Description**	**Interpretation**
5	4.21 – 5.00	Strongly Agree	Superior
4	3.41 – 4.20	Agree	Above Average
3	2.61 – 3.40	Neutral	Average
2	1.81 – 2.60	Disagree	Below Average
1	1.00 – 1.80	Strongly Disagree	Poor

Table 4 presents the level of critical thinking skills of college students, with the overall mean score of 3.47 and standard deviation of 0.82, indicating that students demonstrate above-average critical thinking skills across various categories. The majority of the items fall into the Above Average category, with students showing solid abilities in analyzing, evaluating, creating, understanding, remembering, and applying information.

The Creating category shows the highest mean scores, particularly in items like "The same content can be expressed in many different ways" (3.63) and "I can see the structure of the text, and I could change it" (3.66). These results suggest that students are adept at combining, organizing, and transforming information. However, the item "Everything already exists, so nothing completely new can be created" (2.80) received a lower score, reflecting a more neutral stance on creativity. This may indicate a limitation in their perception of innovation, suggesting an area for development in fostering original thought and problem-solving skills.

In the Evaluating category, students rated highly on their ability to verify information, justify their stance, and check multiple sources, with a mean of 3.71 for "In the discussion, I care about justifying my stance on the matter and understanding the other party at the same time." This suggests that students are capable of engaging in critical debates and evaluating information thoroughly. Similarly, the analyzing and applying categories show students' competency in identifying relationships, extracting relevant parts of texts, and applying new information to everyday life.

On the other hand, the Remembering category presented the lowest mean scores, with items such as "After reading it, I am able to repeat important threads from the text" (3.32) and "I do not remember much from what I was learning at school" (2.95). These results may imply that while students have some level of recall, their ability to retain and revisit information may be less consistent. This highlights the need for strategies that encourage long-term retention and active recall, which are essential for deep learning and critical thinking development.

Overall, the results suggest that college students generally possess above-average critical thinking skills, but there are areas, especially in fostering creativity and memory recall, where further development is needed. This aligns with recent studies showing that enhancing critical thinking involves not just analytical and evaluative skills, but also creativity and effective memory retention (Cao, 2021; Sagar et al., 2023). By addressing these areas, educators can further improve students' ability to think critically in complex and dynamic contexts.

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Insights into promoting critical thinking may include integrating more creative problem-solving exercises, encouraging innovation, and incorporating activities designed to improve memory retention and the ability to synthesize new information. As highlighted by authors such as Brahim (2024) and Sharma & Priyamvada (2022), these approaches are essential for equipping students with the skills necessary to navigate an increasingly complex world. Critical thinking, therefore, remains a foundational component of education, fostering not just academic success but lifelong learning abilities.

Problem 3: Does the perceived level of implementation of inquiry-based learning strategies influence the Critical thinking skills of college students?

Table V
Regression Analysis

	Unstandardized Coefficients		Standardized Coefficients	t	p-value
	B	Std. Error			
(Constant)	*2.10*	*.34*	*.00*	*7.00*	*.001*
Technical Strategies	.18	.08	.25	2.25	.026*
Student-Centered Strategies	.35	.15	.40	2.33	.022*
Teacher-Facilitated Strategies	.20	.12	.30	2.08	.040*

**significant at p-value < 0.05*

The regression analysis in Table 5 indicates that the perceived level of implementation of inquiry-based learning (IBL) strategies significantly influences the critical thinking skills of college students, with all three types of strategies—technical, student-centered, and teacher-centered—showing a statistically significant relationship at $p<0.05$.

Among the strategies, student-centered approaches (B = .35, p = .022, β = .40) exhibit the strongest influence on critical thinking skills. This aligns with the notion that student engagement in active learning environments fosters critical analysis, problem-solving, and independent thought (Jones et al., 2020; Reddy & Panicker, 2021). Since the null hypothesis is rejected, the results suggest that student-centered strategies significantly contribute to the enhancement of students' critical thinking skills.

Similarly, technical strategies (B = .18, p = .026, β = .25) also significantly support critical thinking development. These findings underscore the role of structured and scaffolded tools, such as guided worksheets or software applications, in promoting analytical reasoning (Kirkland & Greene, 2019; Li & Yang, 2022). The null hypothesis is also rejected for technical strategies, indicating their significant role in strengthening students' analytical and problem-solving abilities.

Teacher-facilitated strategies (B = .20, p = .040, β = .30) have a moderate impact on critical thinking, emphasizing the importance of instructor guidance and direct instruction in facilitating critical engagement, particularly in complex tasks (Brown et al., 2021; Park et al., 2023). The null hypothesis is rejected in this case as well, highlighting that teacher facilitation remains essential in developing students' critical thinking skills.

These findings reinforce the importance of a balanced instructional approach in enhancing critical thinking. While student-centered strategies show the most substantial effect, the complementary roles of technical and teacher-centered methods cannot be ignored. Teachers should strive to integrate these strategies effectively, leveraging technical tools for scaffolding, engaging students actively in problem-based learning, and providing direct instruction when needed to clarify complex topics.

The results also suggest that professional development for educators should emphasize the implementation of diverse IBL strategies to cater to varying student needs. Furthermore, institutions should invest in resources and training that support both innovative student-centered approaches and robust technical applications, aligning with recent educational priorities (Garcia & De Leon, 2022; Chen et al., 2024).

In summary, the study highlights the multifaceted nature of IBL in fostering critical thinking skills and underscores the need for a nuanced, flexible pedagogical framework to maximize its benefits.

V. Conclusion

Based on the findings of this study, the following conclusions were drawn. The findings indicate that while technical strategies in inquiry-based learning, particularly the use of digital tools, are frequently implemented, there is room for improvement in fostering active student engagement online. Student-centered strategies in inquiry-based learning are generally perceived as being highly implemented, with students particularly valuing the opportunity to provide suggestions, which fosters engagement and ownership of their learning. However, the

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use of media tools like PowerPoint presentations and reports is less frequent, despite being implemented at a high level. Teacher-facilitated strategies in inquiry-based learning are generally perceived as highly implemented, particularly in the use of real-world examples to enhance lesson relevance and foster critical thinking. However, feedback on students' critical thinking processes is seen as less frequently emphasized, indicating an area for improvement. College students demonstrate "above-average" critical thinking skills overall, with strengths in analyzing, evaluating, and creating information. Students excel at transforming and organizing content, as shown by their high scores in the Creating category. However, their perception of creativity is somewhat limited, as indicated by a lower score in the item related to generating entirely new ideas. The regression analysis indicates that the perceived level of implementation of inquiry-based learning (IBL) strategies significantly influences college students' critical thinking skills. Among the three types of strategies, student-centered approaches have the strongest effect, followed by technical and teacher-facilitated strategies.

VI. Recommendation

Based on the findings and conclusions drawn from this study, the following are recommended:

1. To further enhance the implementation of inquiry-based learning (IBL) strategies, several recommendations can be made based on the findings. First, regarding the use of technical strategies and digital tools, schools should invest in comprehensive training for both teachers and students to ensure the effective use of digital platforms. This training should emphasize methods to encourage active student engagement online, such as through interactive platforms and collaborative digital activities. Consistently integrating digital tools into various learning contexts will help foster critical thinking skills and better prepare students for future challenges in a technology-driven world.
2. In terms of student-centered strategies, the findings suggest that while these strategies are highly valued, there is a need to increase the frequency of using media tools such as PowerPoint presentations and reports. Educators should be trained on how to integrate these tools more regularly and creatively into lessons. By doing so, they can further enhance students' digital literacy and foster a more engaging and creative learning environment. These strategies will not only support students' academic success but also help develop essential life skills like problem-solving and creativity.
3. For teacher-facilitated strategies, while the use of real-world examples is highly effective, the feedback provided on students' critical thinking processes was found to be less emphasized. To address this, teachers should focus on giving timely, constructive feedback that helps students reflect on and improve their critical thinking skills. Additionally, incorporating more collaborative learning opportunities will strengthen students' ability to engage with complex problems and foster peer-based problem-solving skills, further enhancing their critical thinking capabilities.
4. When it comes to the overall development of critical thinking skills, the findings indicate strengths in analyzing, evaluating, and creating information, but also suggest room for improvement in fostering creativity and memory recall. To address this, educators should incorporate activities designed to encourage creativity and promote long-term retention, such as problem-solving tasks that require innovative thinking and techniques that enhance memory recall. These strategies will not only improve academic performance but also better prepare students to tackle real-world challenges.
5. Finally, the regression analysis highlights the importance of a balanced approach in implementing IBL strategies. To optimize critical thinking outcomes, educators should combine student-centered learning with technical support and teacher facilitation. Professional development programs should focus on equipping teachers with diverse IBL strategies to cater to the varied needs of students, ensuring that all students can develop their critical thinking skills effectively. Institutions should provide continuous support and resources to help teachers integrate these strategies in ways that prepare students to face complex, real-world challenges.

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