

The Effectiveness of Implementing Multiple Intelligences Theory and The Six Thinking Hats Approach in Enhancing Academic Performance and Cultivating Critical Thinking Skills Among University Students

Amal Misfar AlQahtani¹ Ali Alwardany Ali Omar²Yasser Rabea Mohamed Mohamed Elmarassi³Amr Fikry Mohamed Salem⁴

¹Department of Basic Sciences, Deanship of Preparatory Year and Supporting Studies, Imam Abdulrahman Bin Faisal University, Corresponding author.

https://orcid.org/0000-0002-0613-1998

Email: amalqahtani@iau.edu.sa

²Education, Curriculum and Methods of Teaching Biology, Imam Abdulrahman bin Faisal University, Dammam, Saudi Arabia,

ORCID: https://orcid.org/0000-0002-7653-0193 , Email:aaomar@iau.edu.sa

³Department of Basic Sciences, Deanship of Preparatory Year and Supporting Studies, Imam Abdulrahman Bin Faisal University, ORCID: https://orcid.org/0009-0002-4154-9326

Email: yrelmaras@iau.edu.sa

⁴Psychology, Imam Abdulrahman bin Faisal University, Dammam, Saudi Arabia, ORCID: https://orcid.org/0009-0003-3146-3163

Email: afsalem@iau.edu.sa

Abstract

This study investigates the effectiveness of employing multiple intelligences theory and the six thinking hats approach in enhancing academic achievement and critical thinking skills among students at Imam Abdulrahman bin Faisal University. The researchers developed two teacher guides for the critical thinking unit within the communication and learning skills curriculum: one for the multiple intelligences theory and another for the six thinking hats approach. Additionally, academic achievement and critical thinking tests were created as assessment tools. The study sample consisted of two classes, with the first experimental group (36 students) instructed using the multiple intelligences theory and the second experimental group (37 students) instructed using the six thinking hats approach. Results indicated statistically significant differences at the 0.05 level in post-test achievement of the critical thinking unit, favoring the first experimental group. Furthermore, significant differences were found in the development of critical thinking skills, again favoring the multiple intelligences theory. Based on these findings, the researchers propose a series of recommendations to enhance educational practices.

Keywords: Multiple Intelligences, Six Thinking Hats, Critical Thinking Skills, Academic Achievement, Higher Education

Introduction:

Modern education has increasingly focused on training learners to practice thinking skills, enabling them to adapt to the demands of real life and solve daily problems. Thinking is one of the most distinctive characteristics of humanity. It is a mental activity that sets humans apart from other creatures. It involves reflection and deep consideration of the components of situations and experiences encountered by individuals in their surrounding environment. A person can only acquire knowledge by learning how to think critically. The growing emphasis on critical thinking has emerged in response to the numerous challenges and issues faced by societies due to rapid changes and developments that affect all aspects of contemporary life. Globalization and the accompanying information revolution have broken barriers and transcended national borders, inundating every area with a torrent of information. Various informational media, particularly the internet, bombard learners with a vast array of content that includes both valuable and worthless information, containing coherence and contradiction, simplicity and complexity, truth and falsehood, ethical and unethical, scientific and commercial. This underscores the urgent need to develop critical thinking skills within individuals, as critical thinking acts as a sieve or filter to purify ideas, allowing beneficial concepts to be embraced while harmful ones are rejected. Critical thinking is essential for every individual in our world. It is one of the greatest gifts that modern science has offered humanity, as it significantly aids us in selecting appropriate knowledge and making sound decisions (Orhan & Çeviker, 2023).

In the classroom, there is ample opportunity to train students in diverse thinking styles, where the teacher plays a vital role in facilitating dialogue and discussion with students. This includes distributing roles, posing questions, engaging students to listen, and encouraging them to think before answering any question. Additionally, the teacher can create a healthy atmosphere for calm, rational discourse (Alharbi, Elfeky & Ahmed, 2022). The strategies of multiple intelligences and the six thinking hats are among the most important approaches for enhancing thinking skills in general and critical thinking in particular. These strategies are increasingly embraced by teachers, educators, and students due to their clear impact on teaching and learning. They have been effectively employed in various subjects to develop thinking skills (Wu & Lu, 2022). Believing in the importance of fostering thinking skills among students, most Saudi universities have made it a priority to include a critical thinking unit within the curricula for first-year university programs.

Problem Statement:

The researchers observed that traditional teaching methods, particularly lecturing, do not fulfill their purpose of developing their thinking skills and fail to assist students in enhancing. While these methods may help students acquire some theoretical knowledge about thinking, they do not provide opportunities for practicing higher-order thinking skills such as problem-solving, analysis, and innovation. Most students tend to engage in the lowest levels of thinking, primarily memorization, and occasionally understanding. A pilot study including conducting interviews with instructors of various courses who mentioned that they often rely on lectures and discussions, sometimes supplemented by presentations during instruction. They indicated that developing students' thinking skills is typically not included in their teaching objectives. Consequently, the researchers became motivated to explore the potential use of modern

teaching methods such as the strategies of multiple intelligences and the six thinking hats and to assess their impact on students' acquisition of critical thinking skills.

This study aims to answer the following questions:

1. What is the effectiveness of the strategies of multiple intelligences and the six thinking hats in enhancing students' academic achievement?
2. What is the effectiveness of the strategies of multiple intelligences and the six thinking hats in developing students' critical thinking skills?

Objectives of the Study:

The study aims to investigate:

1. the impact of teaching first-year university students using the strategies of multiple intelligences and the six thinking hats on their academic achievement?
2. the impact of teaching first-year university students using the strategies of multiple intelligences and the six thinking hats on the development of their critical thinking skills?

Hypotheses of the Study:

The current study is based on the following hypotheses:

1. There are statistically significant differences at the 0.05 level in post-test achievement in the critical thinking unit, depending on the teaching strategy used (multiple intelligences vs. six thinking hats).
2. There are statistically significant differences at the 0.05 level in the retention of thinking skills related to the "thinking" unit among first-year university students, based on the teaching strategy (multiple intelligences vs. six thinking hats).
3. There are statistically significant differences at the 0.05 level in the development of critical thinking skills post-test, depending on the teaching strategy used (multiple intelligences vs. six thinking hats). **Delimitations of the Study:**

This study is confined to the following boundaries:

- First-year university students at Imam Abdulrahman bin Faisal University.
- The critical thinking unit, which is one of the units within the communication and learning skills program for first-year students at Imam Abdulrahman bin Faisal University.

Literature Review

Theoretical Framework

Critical Thinking has emerged as a pivotal objective within the educational landscape. Defined as "a purposeful, organized judgment and cognitive drive that leads to problem-solving and decision-making" (Xu & Wang, 2023), critical thinking involves

evaluating information objectively, free from bias (Al-Saleh, 2020). Rudd emphasizes the importance of identifying central problems and verifying relevant information, while Gooding highlights the need to assess the reliability of sources and predict possible outcomes (Supriyatno, Susilawati, & Hassan, 2020). Critical thinking empowers students to differentiate between hypotheses and facts (Al-Suroor, 2003) and to evaluate various perspectives (Warsah et al., 2021).

Core skills of critical thinking include:

- **Interpretation:** Extracting main ideas and clarifying meanings.
- **Analysis:** Identifying relationships and examining arguments.
- **Evaluation:** Scrutinizing claims and verifying credibility.
- **Inference:** Drawing conclusions based on available information.
- **Explanation:** Justifying actions and presenting arguments.
- **Self-Regulation:** Understanding one's capabilities to manage thoughts effectively.

Multiple Intelligences Theory, introduced by Howard Gardner in 1983, challenged the traditional view of intelligence as a single cognitive ability. Gardner (2004) posited that individuals possess diverse intelligences, including linguistic, logical-mathematical, musical, and interpersonal, among others. This theory promotes tailored educational strategies that align with individual strengths, addressing the limitations of conventional intelligence assessments (Malapad & Quimbo, 2021; Richardson, 2022). Gardner later added naturalistic intelligence in 2005, emphasizing the potential for these intelligences to be nurtured through appropriate training and encouragement (Berk, 2024).

Teaching Thinking Skills using the Multiple Intelligences strategy involves facilitating active learning and fostering an environment for collaborative engagement. Educators encourage students to explore thinking styles through various activities, enhancing their critical thinking abilities by posing challenging questions and encouraging hypothesis testing (Bruscia, 2021).

The Six Thinking Hats Strategy, proposed by Edward de Bono, provides a framework for thinking about issues through different perspectives, represented by colored hats. Each hat symbolizes a unique mode of thinking: the White Hat focuses on data, the Red Hat emphasizes emotions, the Black Hat adopts a critical stance, the Yellow Hat encourages positivity, the Green Hat promotes creativity, and the Blue Hat oversees the process (Debono, 2002; Yefang et al., 2024). This strategy not only motivates students but also enhances their ability to navigate complex discussions and arrive at independent conclusions.

Previous Studies

Studies Related to the Strategy of Multiple Intelligences

Saada and Al-Rashidi (2023) examined the impact of multiple intelligences on ninth-grade mathematics students in Kuwait, finding that logical-mathematical intelligence significantly enhanced achievement compared to conventional methods. Similarly, Al-Kharbash and Al-Masa'id (2022) demonstrated that multiple intelligences strategies,

when applied in geography education, significantly improved reflective thinking among student teachers. Al-Blawna and Hamza (2022) confirmed the positive effect of a multiple intelligences program on fifth graders' math performance and attitudes. Al-Deb (2021) noted improvements in spatial geometry achievement through a multiple intelligences approach, while Al-Dulaimi (2020) highlighted the effectiveness of a program aimed at developing multiple intelligences among university students.

Studies Related to the Six Thinking Hats Strategy

Research by Al-Saleeti and Mufdi (2022) found that the Six Thinking Hats strategy significantly improved scientific thinking skills among eighth-grade students in Jordan. Al-Samak and Azeddin (2021) investigated its impact on faculty performance at Mosul University, concluding that the strategy enhances performance quality. Al-Shaya and Al-Aqeel (2019) reported improvements in verbal classroom interaction when using the Six Thinking Hats in science teaching, although they found no significant changes in creative thinking skills.

Studies Related to Developing Critical Thinking

Al-Khasawneh (2024) explored a program designed to enhance critical and innovative thinking in history education, finding statistically significant improvements for students engaged in the program. Al-Zayadat (2023) assessed the impact of metacognitive teaching strategies on critical thinking in geography, revealing significant differences favoring the metacognitive approach. Al-Hosani (2022) demonstrated that teaching history through storytelling effectively developed students' critical thinking and academic achievement.

Summary of Previous Studies

Overall, previous research underscores the superiority of the Multiple Intelligences strategy over traditional teaching methods in fostering academic achievement and motivation. The Six Thinking Hats strategy has proven effective in enhancing classroom interaction and thinking skills. While modern strategies have been linked to the development of critical thinking, no existing study specifically investigates thinking skills within a course on communication and learning utilizing both the Multiple Intelligences and Six Thinking Hats strategies. This study aims to fill this gap in the literature.

Research Methodology

1. **Preparation of Study Materials:** The researchers prepared two teacher guides, each restructured to align the Thinking Skills unit from the Communication and Learning curriculum with the principles of each strategy. One guide was created for teaching using the multiple intelligences strategy, and the other for teaching using the six thinking hats strategy. The instructional material in each guide was divided into six lessons, spanning six weeks. The restructured Thinking Skills unit, based on the principles of the multiple intelligences and six thinking hats strategies, was presented to experts and specialists (members of the jury committee). They were asked to provide feedback on the appropriateness of the proposed teaching materials for the level of preparatory year students and their

alignment with the two strategies. They offered several suggestions, and the instructional material was modified in light of their feedback.

2. Preparation of Measurement Tools

First: Academic Achievement Test

The researchers prepared an academic achievement test consisting of 46 multiple-choice items. To verify the test's validity, it was reviewed by a group of 13 specialists in teaching thinking skills, educational psychology, and measurement and evaluation. Based on the judges' feedback, which suggested modifications to items 4, 13, 18, 29, and 36, as well as the removal of three items, the wording of these items was adjusted accordingly. To calculate the reliability of the test, the researchers administered it twice to a pilot sample outside the main study sample, using Cronbach's alpha to assess internal consistency. The reliability coefficient was found to be 0.87, which is suitable for the study's purposes. Difficulty and discrimination indices for the test items were calculated, resulting in the exclusion of three items that had a discrimination index below 0.30. Thus, the final version of the test consisted of 40 items.

Second: Critical Thinking Test

A test was developed to measure critical thinking skills among preparatory year students. This was based on a review of related studies, including those by Al-Hosani (2022), Al-Zayadat (2023), Al-Khasawneh (2024), and Al-Khudair (2015). After consulting 11 referees specialized in educational psychology, measurement and evaluation, and curricula, the researchers identified six activities to measure the following skills: interpretation, analysis, evaluation, inference, explanation, and self-regulation. To verify the reliability of the test, the test-retest method was employed. It was administered to a pilot sample of 35 students, and then re-administered to the same group two weeks later. The correlation coefficients between the results of the two administrations for the critical thinking skills ranged from 0.88 to 0.82, which are suitable values for the study's purposes.

Study Population and Sample

The study population consists of preparatory year students (first-year university students) at Imam Abdulrahman bin Faisal University. The sample was selected from these students during the first semester of the academic year 2022-2023. The study sample comprised two classes: one representing the first experimental group that studied using the Multiple Intelligences strategy, consisting of 36 students, and the other representing the second experimental group that studied using the Six Thinking Hats strategy, consisting of 37 students. Participants in the experimental and control groups were randomly selected after their pre-test achievements were standardized.

Statistical Treatment

To answer the study questions, the researchers used the following statistical treatments:

1. **Descriptive Statistics:** The researchers calculated the means and standard deviations of the preparatory year students' scores on the achievement test and the critical thinking skills test.

2. **Independent Samples T-Test:** The T-test was used to determine the statistical significance of differences between the mean scores of the students in the study groups on both the achievement test and the critical thinking skills test.

Equivalence of Study Groups

To ensure the equivalence of the study groups before the experiment began, the researchers examined whether there were statistically significant differences at the significance level ($\alpha \geq 0.05$) between the mean scores of students in the study groups on the pre-test achievement test administered before the experiment. The means and standard deviations for both groups were calculated, as shown in Table 1.

Table 1

Means and Standard Deviations of Students' Scores on the Pre-Test Achievement Test

Group	Number of Participants	Mean	Standard Deviation
Multiple Intelligences	36	8.94	2.75
Six Thinking Hats	37	8.86	2.69

Maximum score for the test: 40

To examine the statistical significance of the differences between the mean scores of the study groups on the pre-test achievement test, an independent samples T-test was employed. The results are displayed in Table 2.

Table 2

Results of the T-Test for the Study Groups on the Pre-Test Achievement Test

Group	Number of Participants	Degrees of Freedom	T-Value	Statistical Significance
Multiple Intelligences	36	71	2.47	0.85
Six Thinking Hats	37			

From Table 2, it is observed that there are no statistically significant differences at the significance level ($\alpha \geq 0.05$) between the study groups on the pre-test achievement test, with a T-value of 2.47 and a statistical significance of 0.85. This result indicates the equivalence of the study groups on the pre-test achievement test.

Table 3

Means and Standard Deviations of Students' Scores on the Pre-Test of Critical Thinking Skills

Group	Number of Participants	Mean	Standard Deviation
Multiple Intelligences	36	7.35	2.51
Six Thinking Hats	37	7.42	2.33

Maximum score for the test: 30

To assess the statistical significance of the differences between the mean scores of the study groups on the pre-test of critical thinking skills, an independent samples T-test was conducted. The results are presented in Table 4.

Table 4

Results of the T-Test for the Study Groups on the Pre-Test of Critical Thinking Skills

Group	Number of Participants	Degrees of Freedom	T-Value	Statistical Significance
Multiple Intelligences	36	71	2.58	0.78
Six Thinking Hats	37			

From Table 4, it is noted that there are no statistically significant differences at the significance level ($\alpha \geq 0.05$) between the study groups on the pre-test of critical thinking skills, with a T-value of 2.58 and a statistical significance of 0.78. This result indicates the equivalence of the study groups on the pre-test of critical thinking skills.

Research Results

First - Answering the First Question:

Are there statistically significant differences at the significance level ($0.05 \geq \alpha$) in the post-test achievement in the Thinking Skills unit, according to the teaching strategies (Multiple Intelligences, Six Thinking Hats)?

The post-test was administered immediately after completing the unit. The means and standard deviations of the performance of the study groups were calculated. To determine the effectiveness of the treatment using (Multiple Intelligences and Six Thinking Hats strategies), the independent samples t-test was used to compare the mean scores of the individuals in the two experimental groups on the post-test.

Table 7

Results of the t-test for differences between the mean scores of individuals in the two experimental groups in the post-test

Experimental Group	Sample Size (N)	Mean Scores (M)	Standard Deviations (SD)	t-value	Significance Level
Multiple Intelligences	36	25.41	7.25	4.03	0.02*
Six Thinking Hats	37	23.67	7.58		

Significant at the level of $(0.05 \geq \alpha)$.

Table 7 shows statistically significant differences between the mean scores of the individuals in the two experimental groups in the post-test. The mean score for the performance of the first experimental group (Multiple Intelligences) was 25.41, while the mean score for the second experimental group (Six Thinking Hats) was 23.67.

The t-value of 4.03 is statistically significant at the significance level $(0.05 \geq \alpha)$, indicating that there are statistically significant differences between the mean scores of students who studied using the Multiple Intelligences strategy and those who studied using the Six Thinking Hats strategy.

One-Way ANOVA Analysis

To ensure control over other variables that may affect the procedures of the study and the results of the post-test, one-way ANOVA was used while controlling for the pre-test effect in the post-test results.

Table 8

Results of the One-Way ANOVA for students' scores in the post-test while controlling for the pre-test effect

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-value	Significance Level
Teaching Strategy	403.281	2	401.143	11.021	0.03*
Error	4798.549	69	37.417		
Total	119426.152	67			

Significant at the level of $(0.05 \geq \alpha)$.

Table 8 shows that the F-value is 0.03, which is statistically significant at the significance level $(0.05 \geq \alpha)$, indicating that there are statistically significant differences

between the study groups in their post-test achievement, favoring the group that studied using the (Multiple Intelligences) strategy.

Comparing Table 8 with Table 7 reveals statistically significant differences in the academic achievement of the study groups in the post-test, favoring the experimental group that studied using the Multiple Intelligences strategy in both cases.

Research Findings

Second - Answering the Second Question:

Are there statistically significant differences at the significance level ($0.05 \geq \alpha$) in the retention of concepts related to the "Thinking Skills" unit among preparatory year students, based on the teaching strategies (Multiple Intelligences, Six Thinking Hats)?

The delayed post-test was administered one month after the post-test, and the means and standard deviations of the performance of the study groups were calculated. To determine the effectiveness of the treatment using (Multiple Intelligences and Six Thinking Hats strategies), an independent samples t-test was used to compare the mean scores of the individuals in the two experimental groups in the delayed post-test.

Table 9

Results of the t-test for differences between the mean scores of individuals in the two experimental groups in the delayed post-test

Experimental Group	Sample Size	Mean Scores	Standard Deviations	t-value	Significance Level
Multiple Intelligences	36	23.95	7.61	3.84	0.04*
Six Thinking Hats	35	22.03	7.95		

Significant at the level of ($0.05 \geq \alpha$).

Table 9 shows that one individual from the Six Thinking Hats experimental group was lost due to transferring to another university. The table indicates statistically significant differences between the mean scores of the individuals in the experimental groups in the delayed post-test. The mean score for the Multiple Intelligences group was 23.95 with a standard deviation of 7.61, while the mean score for the Six Thinking Hats group was 22.03 with a standard deviation of 7.95.

The t-value of 3.84 is statistically significant at the significance level ($0.05 \geq \alpha$), indicating that there are statistically significant differences between the mean scores of students who studied using the Multiple Intelligences strategy and those who studied using the Six Thinking Hats strategy in their retention of concepts in the delayed post-test.

Results of Analysis of Variance

To ensure the control of other variables that may affect the study procedures and the results of the delayed test, a one-way ANOVA was conducted while controlling for the effect of the pre-test on the results of the delayed test, as shown in Table 10.

Table 10

Results of One-Way ANOVA for Students' Scores in the Delayed Test while Controlling for the Effect of the Pre-Test

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F-value	Significance Level
Teaching Strategy	298.497	1	297.895	7.978	0.04*
Error	5210.327	132	36.789		
Total	123764.132	135			

Significant at the level of $(0.05 \geq \alpha)$.

Table 10 shows that the F-value is 0.04, which is statistically significant at the level of $(0.05 \geq \alpha)$. This indicates that there are statistically significant differences between the study groups in students' scores on the delayed test, favoring the experimental group that studied the Thinking Skills unit using the Multiple Intelligences strategy.

Comparing Table 10 with Table 9, we observe consistent statistically significant differences between the study groups in their performance on the delayed test, again favoring the group that studied the Thinking Skills unit using the Multiple Intelligences strategy.

This can be attributed to the fact that learning through the Multiple Intelligences strategy helps connect students' personal experiences and feelings with the experiences included in the curriculum, allowing learning to extend over a longer duration due to its association with their ongoing lived experiences.

Results on the Development of Critical Thinking Skills

Third Question:

Are there statistically significant differences at the significance level $(0.05 \geq \alpha)$ in the development of post-test critical thinking skills, according to the teaching strategy (Multiple Intelligences, Six Thinking Hats) after controlling for pre-test scores?

The researchers calculated the means and standard deviations of the students' scores on the critical thinking skills test applied after the experiment. The results are summarized in Table 11.

Table 11

Means and Standard Deviations of Students' Scores on the Post-Test Critical Thinking Skills Scale

Group	Number of Participants	Mean Score	Standard Deviation
Multiple Intelligences	36	15.64	3.61
Six Thinking Hats	37	13.98	3.47
Maximum Score on Test	30		

Table 11 indicates that the mean score of students who were taught using the Multiple Intelligences strategy (15.64) is higher than that of students who were taught using the Six Thinking Hats strategy (13.98). To determine the statistical significance of the differences between the means of the study groups on the post-test critical thinking skills scale, a T-test for independent samples was used, as shown in Table 12.

Table 12

Results of T-test for the Study Groups on the Post-Test Critical Thinking Skills Scale

Group	Number of Participants	Degrees of Freedom	T-value	Significance Level
Multiple Intelligences	36	71	15.29	0.03
Six Thinking Hats	37			

From Table 12, the T-value is 15.29, which is statistically significant at the level of $(0.05 \geq \alpha)$. This means there are statistically significant differences between the mean scores of the study groups on the post-test critical thinking skills scale, favoring the experimental group (Multiple Intelligences), which had a mean score of 15.64, compared to the mean score of the second experimental group (Six Thinking Hats), which was 13.98.

This result indicates the effectiveness of the Multiple Intelligences strategy in helping preparatory year students acquire and develop critical thinking skills compared to the Six Thinking Hats strategy.

Results on Critical Thinking Skills

This is attributed to the alignment of critical thinking activities (interpretation, analysis, evaluation, inference, explanation, self-regulation) with the principles of the Multiple Intelligences strategies, which are based on problem-solving, decision-making, reasoning about causes and effects, and providing objective, accurate judgments free from bias and favoritism. The means and standard errors for critical thinking skills for both strategies are distributed as shown in the following table.

Table 13

Means and Standard Errors for Critical Thinking Skills for Both Strategies

Skill	Experimental Group	Mean Score	Standard Error
Interpretation	Multiple Intelligences Strategy	15.41	3.49
	Six Thinking Hats Strategy	14.73	4.13
Analysis	Multiple Intelligences Strategy	16.07	3.72
	Six Thinking Hats Strategy	13.95	3.87
Evaluation	Multiple Intelligences Strategy	16.62	4.58
	Six Thinking Hats Strategy	13.83	2.78
Inference	Multiple Intelligences Strategy	13.57	2.47
	Six Thinking Hats Strategy	13.72	4.26
Explanation	Multiple Intelligences Strategy	19.63	3.28
	Six Thinking Hats Strategy	16.35	2.85
Self-Regulation	Multiple Intelligences Strategy	12.57	4.15
	Six Thinking Hats Strategy	11.35	2.95
Overall Average	Multiple Intelligences Strategy	15.64	3.61
	Six Thinking Hats Strategy	13.98	3.47

Discussion of Results

The findings of this study highlight significant differences in the effectiveness of teaching strategies—specifically, the Multiple Intelligences strategy compared to the Six Thinking Hats strategy—in enhancing students' achievement in the Thinking Skills unit. The post-test results indicate that students taught using the Multiple Intelligences strategy (mean score = 25.41) outperformed those taught with the Six Thinking Hats strategy (mean score = 23.67), with a t-value of 4.03 ($p < 0.05$). This result aligns with previous research emphasizing the advantages of tailoring instruction to diverse learning styles, as noted in the studies of Joudat Saada and Nawaf Al-Rashidi (2023) and Ghazi Al-Kharbash and Saud Al-Masa'id (2022), which demonstrate that employing varied pedagogical approaches can lead to improved academic outcomes and motivation.

Moreover, the one-way ANOVA results further corroborate the findings, showing statistically significant differences (F-value = 11.021, $p < 0.05$) favoring the Multiple Intelligences strategy. This supports Gardner's (2004) theory, which posits that recognizing and utilizing various intelligences in the classroom fosters a deeper understanding and retention of knowledge. The prolonged retention of concepts in the delayed post-test also underscores the lasting impact of the Multiple Intelligences approach, reflecting insights from Al-Deb (2021) and Mahfouz Al-Dulaimi (2020) regarding the efficacy of such strategies in promoting long-term learning.

In terms of critical thinking skills, the results reveal a similar trend. The Multiple Intelligences group achieved a higher mean score (15.64) than the Six Thinking Hats

group (13.98) with a significant t-value of 15.29 ($p < 0.05$). This aligns with the findings of Al-Hosani (2022) and Al-Zayadat (2023), suggesting that methods fostering creativity and engagement—characteristic of the Multiple Intelligences strategy—are more effective in developing critical thinking. The observed development in specific critical thinking skills such as evaluation and explanation among the Multiple Intelligences group further demonstrates the alignment of critical thinking activities with Gardner's framework, where learners engage with content more meaningfully and contextually (Warsah et al., 2021).

Conclusion

In conclusion, this study establishes that the Multiple Intelligences strategy is superior to the Six Thinking Hats strategy in enhancing both academic achievement and critical thinking skills among preparatory year students. The statistically significant differences observed in both post-test and delayed post-test results affirm the importance of adopting diverse instructional methods that cater to various learning styles. By engaging students through a framework that connects their personal experiences and intelligences with the curriculum, educators can foster a more profound understanding of content and improve retention.

These findings contribute to the growing body of literature advocating for the integration of innovative teaching strategies in educational practices. Future research should continue to explore the application of these strategies across different subjects and educational contexts to further validate their effectiveness. As educators strive to prepare students for complex problem-solving and decision-making in an ever-changing world, embracing varied instructional approaches, such as those highlighted in this study, will be crucial for promoting holistic student development and critical engagement with learning materials.

Recommendations

In light of the study's findings, the researchers propose the following recommendations:

1. **Development of Critical Thinking Units:** It is imperative to integrate critical thinking units into the Communication and Learning Skills curriculum, structured around the principles of the Multiple Intelligences strategy. This approach will facilitate a more personalized learning experience that caters to diverse student needs.
2. **Emphasis on Critical Thinking Skills:** Academic programs should prioritize the enhancement of critical thinking skills among preparatory year students across all disciplines. This focus will equip students with essential cognitive abilities necessary for academic success and lifelong learning.
3. **Instructor Training Workshops:** The implementation of training workshops for educators is essential. These workshops should provide comprehensive guidance on effectively employing Multiple Intelligences strategies and the Six Thinking Hats approach, ensuring that instructors are well-prepared to foster critical thinking in their students.

References

Al-Blawna, F. Y., & Hamza, A. W. (2022). The effect of a program based on multiple intelligences in teaching mathematics on the achievement and attitudes of fifth grade students towards mathematics. *Open Jerusalem University Journal for Research and Studies: A Refereed Scientific Journal*, 2(28).

Al-Dulaimi, Y. M. H. (2020). The effect of using an educational program in developing multiple intelligences among students at the University of Mosul. *Journal of Basic Education Research: A Refereed Scientific Journal*, 9(2).

Al-Deeb, M. M. (2021). The effectiveness of a proposed program in multiple intelligences on the development of achievement and mathematical thinking and retention of learning effects among basic stage students in Gaza Governorate. *Al-Aqsa University Journal: Humanities Series: A Semi-Annual Refereed Scientific Journal*, 15(1).

Al-Hosani, Z. B. A. (2022). The effectiveness of using stories in teaching history at the intermediate stage to develop critical thinking and achievement (Unpublished master's thesis). Sultan Qaboos University, Sultanate of Oman.

Al-Kharbash, G., & Al-Masa'id, S. (2022). The effect of using two strategies: Multiple intelligences and concept maps, in developing reflective thinking in geography of the Arab world among student teachers at Isra University in Jordan. *Islamic University Journal for Educational and Psychological Studies*, 20(1).

Al-Khassawneh, R. (2024). Developing the tenth grade history curriculum in light of basic education principles and testing the effectiveness of an advanced educational unit in student achievement and development of critical thinking (Unpublished doctoral dissertation). Yarmouk University, Irbid, Jordan.

Al-Khudra, F. A. (2015). Developing innovative and critical thinking: An experimental study. Dar Dabor: Amman, Jordan.

Al-Saliti, F., & Maqda, K. (2022). The effect of problem-solving strategies and six thinking hats on the development of scientific thinking skills among eighth grade students in Jordan. *Journal of Educational and Psychological Studies: A Specialized Refereed Periodical*, 6(1).

Al-Samak, M. A. J., & Azeddin, B. (2021). The effectiveness of six thinking hats strategies in improving the quality of performance of faculty members in higher education: An exploratory study of the views of a sample from the teaching staff at the University of Mosul. *Journal of Basic Education Research: A Refereed Scientific Journal*, 11(1).

Al-Shayyab, F., & Al-Aqeel, M. B. A. (2019). The effect of using six thinking hats in teaching science on the development of creative thinking and verbal interaction in the classroom among sixth grade students in Riyadh. *Journal of Curriculum and Supervision Studies, King Saud University*, 1(1), 16-56.

Al-Zayadat, M. (2023). The effect of using metacognitive teaching strategies and the inquiry model on achievement and development of critical thinking among ninth grade students in geography (Unpublished doctoral dissertation). Yarmouk University, Irbid, Jordan.

Alharbi, S. M., Elfeky, A. I., & Ahmed, E. S. (2022). The effect of e-collaborative learning environment on development of critical thinking and higher order thinking skills. *Journal of Positive School Psychology*, 6, 6848-6854.

Berk, R. A. (2024). Using music with demonstrations to trigger laughter and facilitate learning in multiple intelligences.

Bruscia, K. E. (2021). *Teaching with Multiple Intelligences: Strategies for Enhancing Student Learning*. New York, NY: Educational Publishing.

Ma, L., Wu, D., Li, H., Ni, B., Ouyang, L., Zhang, Z., & Deng, F. (2024). "Six thinking hats": Improving thinking in traditional problem-based learning pathophysiology curriculum for medical students.

Malapad, L. P., & Quimbo, M. A. T. (2021). Designing an instructional module for classroom teaching based on the multiple intelligences theory. *Philippine Social Science Journal*, 4(3), 9-18.

Oktaviani, L., Aulia, U. Y., Murdiono, M., & Suharno, S. (2024). Strengthening the critical thinking skill through the six-hat thinking model in Pancasila education. *Journal of Education and Learning (EduLearn)*, 18(4), 1272-1278.

Orhan, A., & Çeviker Ay, Ş. (2023). How to teach critical thinking: An experimental study with three different approaches. *Learning Environments Research*, 26(1), 199-217.

Richardson, K. (2022). *Understanding intelligence*. Cambridge University Press.

Supriyatno, T., Susilawati, S., & Hassan, A. (2020). E-learning development in improving students' critical thinking ability. *Cypriot Journal of Educational Sciences*, 15(5), 1099-1106.

Uçar, M. N., & Cetin, A. (2024). Effects of coordinated techniques on science education learning: Six hats and jigsaw techniques. *Journal of STEM Teacher Institutes*, 4(1), 29-37.

Warsah, I., Morganna, R., Uyun, M., Afandi, M., & Hamengkubuwono, H. (2021). The impact of collaborative learning on learners' critical thinking skills. *International Journal of Instruction*, 14(2), 443-460.

Wu, Y., & Lu, P. (2022). Comparative analysis and evaluation of bridge construction risk with multiple intelligent algorithms. *Mathematical Problems in Engineering*, 2022(1), 2638273.

Xu, E., Wang, W., & Wang, Q. (2023). The effectiveness of collaborative problem solving in promoting students' critical thinking: A meta-analysis based on empirical literature. *Humanities and Social Sciences Communications*, 10(1), 1-11.

Yefang, W., Sereerat, B. O., Songsiengchai, S., & Thongkumsuk, P. (2024). The development of an instructional model based on experiential learning theory and six thinking hats to improve the critical thinking ability of undergraduate students. *World Journal of Education*, 14(1), 66-78.