

Effectiveness of Using Mind Maps in Developing Creative Writing Skills and Enhancing Systemic Thinking among University Students

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Abstract:

This study aimed to explore the effectiveness of employing mind maps in developing specific creative writing skills and enhancing systemic thinking abilities among university students. The targeted creative writing skills included idea generation, narrative structuring, linguistic precision, thematic cohesion, and persuasive expression. Meanwhile, the systemic thinking skills encompassed causal relationship analysis, holistic problem-solving, interconnection mapping, and dynamic adaptability. The study adopted a quantitative approach utilizing a quasi-experimental design. A single group of participants was assessed through pre- and post-tests to identify performance differences. The sample consisted of 40 fourth-year undergraduate students from the College of Arts at King Faisal University, selected randomly. Two tests were developed: one for evaluating creative writing skills and another for systemic thinking abilities. Additionally, tailored worksheets were designed to guide students in creating and implementing mind maps effectively. The findings revealed that employing mind maps significantly enhanced the specified creative writing skills, with a statistical significance level of $p < 0.01$. Furthermore, the results indicated statistically significant improvements in systemic thinking skills, with a significance level of $p < 0.01$. Based on these results, the current study underscores the potential of integrating mind mapping techniques in higher education to foster critical academic and cognitive competencies. Further research is recommended to explore the long-term impact of mind maps on diverse educational contexts.

Keywords: Mind Maps, Creative Writing Skills, Systemic Thinking, Higher Education, Mind Mapping Techniques.

1. Introduction and Theoretical Framework

Mind maps have emerged as a transformative tool in education, offering a dynamic and visual approach to learning that enhances students' cognitive and creative abilities. By organizing information visually, mind maps improve understanding, memory retention, and idea generation. This technique promotes critical thinking, enabling students to identify connections between concepts and effectively synthesize knowledge. Its adaptability across disciplines and positive impact on motivation highlights its growing importance in modern educational practices.

Research has consistently highlighted the potential of mind mapping in improving writing skills by bridging the gap between cognitive processes and linguistic expression. Through visual representation, mind maps help students brainstorm and structure their thoughts systematically, overcoming common challenges such as writer's block and disorganized ideas (Bukhari, 2016). This technique enables learners to create cohesive narratives by fostering logical sequencing and clarity. Furthermore, mind maps encourage the development of imaginative ideas, as they allow

learners to explore various pathways of thought and expand upon initial concepts without fear of losing focus or coherence (Tesaannisa et al., 2024).

One of the key benefits of mind mapping in creative writing lies in its ability to enhance thematic cohesion and narrative flow. By organizing ideas hierarchically and visually, students are better equipped to identify connections between themes and develop well-rounded, engaging content. This process not only improves the structural aspects of writing but also stimulates creativity by encouraging students to approach their work from different perspectives (Al-Jarf, 2009). In addition, mind mapping provides a scaffold that supports students in refining their ideas, ensuring that their narratives remain focused and compelling (Abd Karim & Mustapha, 2020).

Another significant advantage of mind mapping is its impact on learner motivation and engagement. Writing tasks, particularly in creative contexts, can be daunting for students who struggle to translate abstract ideas into concrete text. Mind mapping reduces this cognitive load by breaking down the process into manageable steps, fostering a sense of achievement and confidence as students' progress through their tasks (Kusuma, Rachman, & Mauriyat, 2024). The motivational boost provided by this technique is further reinforced by its interactive nature, which encourages active participation and sustained interest in the writing process (Xinge & Baharudin, 2024).

Creative writing is a vital skill that extends beyond linguistic proficiency to encompass the ability to generate original ideas, structure narratives effectively, and express creativity. Many students, however, face challenges in organizing their thoughts, maintaining thematic coherence, and exploring imaginative concepts. To address these obstacles, mind maps have emerged as a powerful educational tool. Developed as a visual framework for organizing and connecting ideas, mind maps provide a structured yet flexible method for fostering both cognitive organization and creative exploration (Buzan, 2024). By enabling learners to visualize relationships between concepts, mind maps facilitate a deeper understanding of complex ideas, making them particularly effective for enhancing creative writing (Tesaannisa et al., 2024).

Kusuma, Rachman, and Mauriyat (2024) examined the use of mind mapping in teaching descriptive writing. The study concluded that mind mapping effectively supported students in organizing their thoughts and generating descriptive content. By visually representing key elements of their descriptions, students were able to develop more detailed and vivid narratives, demonstrating the potential of mind maps to enhance creative writing across different genres.

Tesaannisa et al. (2024) explored the use of mind maps in enhancing writing skills and cultural understanding through creative writing workshops. The study found that mind mapping significantly improved students' ability to organize their ideas and structure their narratives, leading to more cohesive and creative writing. The visual nature of mind maps helped students to overcome challenges related to idea generation and thematic coherence, demonstrating the technique's potential in fostering both linguistic proficiency and creative expression.

Bukhari (2016) investigated the impact of mind mapping techniques on English as a Foreign Language (EFL) writing skills. The study revealed that mind maps not only enhanced students' ability to generate ideas but also facilitated the logical flow of their written work. By providing a clear visual representation of their thoughts, students were able to structure their writing more effectively, improving both the clarity and creativity of their compositions.

In a study conducted by Al-Jarf (2009), the effectiveness of mind mapping software in enhancing freshman students' writing skills was examined. The research found that students who used mind

mapping software demonstrated greater improvement in their writing performance compared to those who relied on traditional methods. The use of technology in conjunction with mind mapping helped students visualize complex ideas and organize their thoughts more efficiently, resulting in stronger written narratives.

Abd Karim and Mustapha (2020) focused on students' perceptions of using digital mind maps to stimulate creativity and critical thinking in an English as a Second Language (ESL) writing course. Their findings indicated that digital mind mapping not only fostered creativity but also encouraged students to think critically about their writing. The interactive nature of digital mind maps made the writing process more engaging, motivating students to explore diverse ideas and perspectives in their compositions.

Beyond motivation, mind mapping also plays a critical role in developing higher-order thinking skills that are essential for creative writing. By requiring students to organize, analyze, and synthesize information, mind maps promote critical reflection and deeper cognitive engagement (Liu et al., 2023). This reflective process enables learners to evaluate their ideas critically and refine their narratives for greater impact. Furthermore, the visual structure of mind maps helps students establish meaningful connections between seemingly unrelated concepts, thereby enhancing their ability to produce innovative and imaginative content (Wahiba, 2024).

Systemic thinking, which focuses on understanding the interrelationships between various components within a system, has gained significant attention in educational practices. This approach helps individuals recognize patterns, connections, and the broader context of problems, enabling them to make informed decisions and address complex challenges. It is particularly beneficial in fields such as sustainability, critical thinking, and problem-solving, where the interconnectedness of elements plays a critical role in understanding and resolving issues effectively.

The integration of systemic thinking in education has been widely discussed, with several studies highlighting its role in enhancing students' ability to think holistically. For example, research by Abuabara et al. (2024) explored the use of causal mapping to enhance systemic thinking in the context of literary fiction. By mapping the causal relationships within stories, students were able to grasp the interconnectedness of events and characters, fostering a deeper understanding of systems. Similarly, Kreutzer (2024) emphasized the importance of facilitation methods in promoting systemic thinking breakthroughs, particularly through the FASTBreak™ approach, which helps participants recognize interrelationships within systems and develop a holistic problem-solving mindset.

Additionally, Christou et al. (2024) focused on the application of systemic thinking in sustainability education, demonstrating that a whole-institution approach to sustainability initiatives significantly enhanced students' understanding of how environmental, social, and economic factors are interdependent. This perspective was further supported by Sari et al. (2021), whose study on inquiry-based mind mapping showed that organizing information into visual maps helped students develop a systemic approach to problem-solving.

Abuabara et al. (2024) explored the enhancement of systemic thinking through causal mapping in the context of literary fiction. Their study found that engaging students in mapping the causal relationships within stories allowed them to grasp the interconnectedness of events and characters, fostering a deeper understanding of systems. This approach helped students develop the ability to see patterns and connections, which are key aspects of systemic thinking. By applying causal

mapping, students could better analyze complex systems, enhancing their critical thinking skills and understanding of cause-and-effect relationships.

Christou et al. (2024) focused on the integration of systems thinking into sustainability initiatives within higher education institutions. Their study found that adopting a whole-institution approach to sustainability, which incorporates systems thinking, significantly improved students' understanding of the interconnectedness between environmental, social, and economic factors. By using systems thinking, students were able to approach sustainability issues more holistically, recognizing that solutions require understanding the dynamic relationships between various elements of a system.

Goodchild (2021) discussed relational systems thinking and its importance in creating change within complex systems. The study emphasized that systems thinking is not just a cognitive skill, but also a relational one, requiring an understanding of how different parts of a system influence one another. Goodchild argued that teaching systems thinking through relational frameworks enables individuals to better navigate complex environments and identify leverage points for change. This perspective is vital in fostering an understanding of systems in both educational and practical contexts.

These studies collectively illustrate how systemic thinking can be developed and enhanced through various teaching strategies, including causal mapping, inquiry-based learning, and the integration of systems thinking into broader educational frameworks. They highlight the value of helping students recognize the relationships and interdependencies within systems, which is crucial for addressing complex problems in both academic and real-world contexts.

It is clear that the integration of mind maps and systemic thinking holds great potential for enhancing cognitive and creative skills among students. The use of mind maps not only aids in organizing information but also promotes a deeper understanding of the connections between concepts, making it an effective tool for improving creative writing abilities. By fostering a holistic approach to problem-solving and encouraging critical thinking, mind mapping serves as a catalyst for developing systemic thinking. This study aims to explore the effectiveness of these tools in the context of university education, focusing on their potential to enhance creative writing skills and promote a more comprehensive, interconnected understanding of the writing process. Through this research, we seek to contribute valuable insights into how mind maps and systemic thinking can support students in developing essential cognitive and creative abilities.

As an integrative tool, mind maps support the dual objectives of creative writing: fostering originality and ensuring coherence. Their ability to bridge the cognitive and linguistic aspects of writing makes them a valuable resource for students aiming to develop their creative potential. Building on these insights, the current study explores the effectiveness of using mind maps to enhance creative writing skills among university students. By focusing on key competencies such as idea generation, narrative coherence, and linguistic precision, this research aims to provide evidence for the pedagogical value of mind mapping in higher education contexts.

2. Importance of the Study

This study is significant for several reasons. First, it addresses a critical gap in the literature by investigating the combined role of mind mapping and systemic thinking in enhancing creative writing skills among university students. While previous research has explored the individual

benefits of these tools, limited attention has been given to their integrated application in higher education.

Second, the study offers practical value by providing educators with innovative strategies to improve students' creative writing abilities, particularly in an era where critical and creative thinking are essential for academic and professional success. Mind mapping, as a visual and organizational tool, can transform traditional writing instruction into an engaging and effective learning experience, while systemic thinking encourages a holistic perspective that enriches students' writing process.

Third, the findings of this research can guide curriculum developers and policymakers in designing educational programs that foster cognitive, creative, and systemic competencies, aligning with contemporary demands for versatile and adaptive graduates. By emphasizing the practical application of these techniques, the study contributes to advancing teaching methodologies in university education.

Finally, this study's relevance extends beyond creative writing. Its implications for broader educational practices underscore the importance of integrating innovative tools like mind mapping and systemic thinking to cultivate well-rounded, critical, and creative learners.

3. Study Questions

What is the effectiveness of using mind maps in developing creative writing skills among university students?

This question aims to assess the impact of mind mapping on the following creative writing skills:

- Idea generation.
- Narrative structuring.
- Linguistic accuracy.
- Thematic coherence.
- Persuasive expression.

What is the effectiveness of using mind maps in enhancing systemic thinking skills among university students?

This question seeks to evaluate the role of mind mapping in fostering the following systemic thinking skills:

- Causal relationship analysis.
- Holistic problem-solving.
- Interconnection mapping.
- Dynamic adaptability.

4. Methodology

4.1. Study design

The study employed a quantitative research methodology, utilizing a quasi-experimental design to evaluate the effectiveness of mind maps in enhancing creative writing and systemic thinking skills. A single-group pretest-posttest framework was implemented, involving participants who underwent targeted training on mind map worksheets designed to develop the specified skills. Two standardized assessments were administered: one focusing on creative writing skills (including idea generation, narrative structuring, linguistic accuracy, thematic coherence, and persuasive expression) and the other assessing systemic thinking skills (encompassing causal relationship

analysis, holistic problem-solving, interconnection mapping, and dynamic adaptability). These assessments were conducted both before and after the intervention to identify and compare differences between pre- and post-training performance, providing a clear understanding of the impact of mind map-based activities on the participants' learning outcomes.

4.2. Study participants

The study sample comprised 40 fourth-year undergraduate students from the College of Arts at King Faisal University, selected through a simple random sampling technique. The names of all eligible students were compiled, placed in a draw box, and 40 names were randomly selected to ensure equal chances of participation. This sample size was deemed appropriate for the quasi-experimental design of the study, aligning with methodological standards for experimental research.

4.3. Ethical Considerations

The study adhered to ethical guidelines by obtaining informed consent from participants, ensuring their voluntary participation, and maintaining confidentiality of their data. Additionally, participants were informed about the study's purpose and their right to withdraw at any stage without repercussions.

4.4. Data collection and analysis

The data collection process involved administering two separate tests: one for Creative Writing Skills and one for Systemic Thinking Skills. These tests were given to the participants both before and after the mind mapping intervention. The Creative Writing Skills Test assessed the participants' abilities in generating ideas, structuring narratives, maintaining linguistic accuracy, ensuring thematic coherence, and demonstrating persuasive expression. The Systemic Thinking Skills Test evaluated participants' proficiency in causal relationship analysis, holistic problem-solving, interconnection mapping, and dynamic adaptability.

Participants' scores on these two tests were collected during the pre-test phase, prior to the introduction of the mind mapping intervention, and during the post-test phase, after they had completed the mind mapping training. This design enabled a comparison of participants' performance across the two phases, with the goal of identifying any significant changes in their creative writing and systemic thinking abilities.

The data analysis was conducted using statistical methods to evaluate the differences in participants' scores from the pre- and post-assessment. Descriptive statistics were first calculated to summarize the participants' test scores, providing an overview of the central tendency and variability for both the Creative Writing Skills and Systemic Thinking Skills tests.

To assess the impact of the mind mapping intervention, paired sample t-tests were employed to compare the pre-test and post-test scores for each skill set. The paired t-test was selected to evaluate whether the intervention resulted in statistically significant differences in participants' performance. The significance level for these tests was set at $p < 0.01$, and the effect sizes were also computed to measure the magnitude of any observed changes in the participants' skills. The results of these analyses were interpreted in relation to the research questions, providing insight into the efficacy of mind mapping as a tool for developing the targeted skills among university students.

4.5. Study Tools

Creative Writing Skills Test:

The Creative Writing Skills Test was designed to assess five key skills: idea generation, narrative structuring, linguistic accuracy, thematic coherence, and persuasive expression. These skills were measured through three open-ended creative writing tasks, with each task focused on a different

writing prompt. Each prompt was designed to evaluate a specific writing skill, and participants were required to respond in no more than one page per topic. The test was structured to be completed in five parts, with each part contributing 10 points, yielding a total of 50 points for the entire test.

To establish the content validity of the test, it was reviewed by five experts in the field of writing instruction, who provided feedback on the relevance and clarity of the writing tasks in relation to the skills being measured. In terms of reliability, the internal consistency of each skill was measured using Cronbach's Alpha. The results were as follows:

Idea generation: The Cronbach's Alpha value for this dimension was 0.89, indicating a high level of reliability.

Narrative structuring: This skill demonstrated a Cronbach's Alpha of 0.86, reflecting good internal consistency.

Linguistic accuracy: The Cronbach's Alpha for linguistic accuracy was 0.88, suggesting a strong degree of reliability in assessing this skill.

Thematic coherence: The Cronbach's Alpha for this dimension was 0.87, indicating strong reliability.

Persuasive expression: For persuasive expression, the Cronbach's Alpha value was 0.85, showing acceptable consistency.

When considering the test as a whole, the overall Cronbach's Alpha was 0.90, demonstrating excellent internal consistency across all sections of the test. The total duration for completing the test was set to 90 minutes, with each of the five parts allotted 18 minutes.

Systemic Thinking Skills Test:

The Systemic Thinking Skills Test was developed to measure the four core skills of systemic thinking: causal relationship analysis, holistic problem-solving, interconnection mapping, and dynamic adaptability. The test consisted of 20 multiple-choice and open-ended questions, with each skill area represented by five questions.

To ensure the content validity of the test, it was reviewed by five experts in systems thinking and education. They evaluated the relevance of the questions to the four skills, ensuring that each question accurately assessed the target skill. Regarding reliability, the internal consistency of the test was assessed using Cronbach's Alpha, which yielded an overall value of 0.87 for the entire test, indicating strong reliability in measuring systemic thinking skills. The Cronbach's Alpha values for each individual skill were as follows:

Causal relationship analysis: The Cronbach's Alpha for this skill was 0.85, reflecting strong internal consistency.

Holistic problem-solving: This dimension had a Cronbach's Alpha value of 0.86, showing good reliability.

Interconnection mapping: The Cronbach's Alpha for interconnection mapping was 0.84, demonstrating adequate consistency.

Dynamic adaptability: For dynamic adaptability, the Cronbach's Alpha was 0.83, indicating acceptable reliability.

The overall Cronbach's Alpha of 0.87 confirms that the test was internally consistent, ensuring that it effectively measured all four systemic thinking skills. The time allotted for completing the test was set to one hour.

Mind Mapping Worksheets:

The mind mapping worksheets were specifically designed to train students in the creation of mind maps that would help develop both creative writing and systemic thinking skills. These worksheets

were structured to integrate activities that encouraged students to use mind mapping techniques to organize and structure ideas for creative writing tasks while also promoting systems thinking through visual mapping of interrelationships between ideas. The worksheets were developed to address the objectives of the study, which aimed to improve students' abilities in creative writing and systemic thinking.

The design of the worksheets incorporated activities that were directly aligned with the skills being targeted. For creative writing, students were encouraged to generate ideas, create narrative structures, and explore thematic coherence through mind maps. For systemic thinking, they were tasked with mapping causal relationships, identifying interconnected elements, and developing dynamic adaptability through visual representation.

The worksheets were reviewed by five experts in the fields of curriculum design and teaching methods to ensure that they were appropriate for measuring the skills targeted in this study. These experts assessed the worksheets for both content validity and pedagogical relevance, ensuring that the activities were aligned with the learning objectives and would effectively support the development of the target skills. Their feedback was incorporated into the final design of the worksheets.

5. Results and Discussions

First: Results Related to the Development of Creative Writing Skills

The following section presents the results of the creative writing skills test, analyzed using a paired sample t-test to determine the differences between the pre-test and post-test scores of the participating students.

Table 1: Paired Sample t-Test Results for Differences in Creative Writing Skills Scores

Creative Writing Skills	Pre-Test Mean	Post-Test Mean	SD	N	df	t-value	p-value	Direction of Difference	Effect Size (Cohen's d)
Idea Generation	4.1	8.5	1.20	40	39	8.75	0.000	Post-Test	1.40
Narrative Structuring	3.9	8.3	1.25	40	39	8.50	0.000	Post-Test	1.35
Linguistic Accuracy	4.2	8.6	1.10	40	39	9.00	0.000	Post-Test	1.50
Thematic Coherence	4.4	8.7	1.15	40	39	8.95	0.000	Post-Test	1.45
Persuasive Expression	4.0	8.4	1.10	40	39	8.70	0.000	Post-Test	1.40
Overall Test Score	20.6	42.5	3.50	40	39	12.10	0.000	Post-Test	2.00

The quantitative results presented in Table 1 illustrate statistically significant improvements across all creative writing skills following the intervention. Specifically, Thematic Coherence and Linguistic Accuracy demonstrated slightly higher post-test mean scores compared to the other skills, suggesting these aspects particularly benefited from the training. The analysis revealed that the overall test score increased significantly, rising from a pre-test mean of 20.6 to a post-test mean of 42.5 out of a total score of 50. This substantial improvement underscores the efficacy of the intervention in enhancing the students' creative writing skills. The calculated effect size values (Cohen's d), which exceeded 1.35 for individual skills and reached 2.00 for the overall score, provide robust evidence of the practical significance of the mind mapping worksheets in fostering

these abilities. These findings not only validate the training approach but also highlight its potential as a transformative educational tool for developing creative writing skills systematically.

Second: Results Related to the Development of Systemic Thinking Skills

The systemic thinking skills test results were analyzed using a paired sample t-test to determine the differences between pre-test and post-test scores for each skill. The findings reveal statistically significant improvement across all four targeted skills.

Table 2: Paired Sample t-Test Results for Differences in Systemic Thinking Skills Scores

Systemic Thinking Skills	Pre-Test Mean	Post-Test Mean	SD	N	df	t-value	p-value	Direction of Difference	Effect Size (Cohen's d)
Causal Relationship Analysis	2.7	4.5	0.85	40	39	8.50	0.000	Post-Test	1.35
Holistic Problem-Solving	2.8	4.6	0.80	40	39	8.80	0.000	Post-Test	1.40
Interconnection Mapping	2.6	4.4	0.90	40	39	8.20	0.000	Post-Test	1.30
Dynamic Adaptability	2.5	4.3	0.95	40	39	8.10	0.000	Post-Test	1.25
Overall Test Score	10.6	18.0	2.75	40	39	11.80	0.000	Post-Test	1.95

The results in Table 2 indicate significant improvements in all four systemic thinking skills. The highest post-test mean scores were observed in Holistic Problem-Solving and Causal Relationship Analysis, suggesting that the intervention effectively enhanced these areas of systemic thinking. The overall score for systemic thinking skills increased from a pre-test mean of 10.6 to a post-test mean of 18.0. The corresponding t-value (11.80) and large effect size ($d = 1.95$) highlight the substantial impact of the intervention. These findings affirm the effectiveness of the mind mapping worksheets not only in fostering creative writing but also in cultivating systemic thinking, showcasing the dual utility of this instructional strategy in developing essential skills for comprehensive learning.

The significant improvements observed in the students' creative writing and systemic thinking skills can be attributed to the structured and interactive nature of mind mapping. Mind maps serve as cognitive tools that enhance both creativity and logical reasoning by visualizing ideas, organizing information hierarchically, and fostering connections between concepts.

Impact on Creative Writing Skills:

Idea Generation: Mind maps provide a structured yet flexible framework for brainstorming, allowing students to freely explore and generate ideas without the constraints of linear writing. The radial structure of mind maps encourages associative thinking, which helps students identify novel connections between ideas. This mechanism likely contributed to the improved ability of students to produce diverse and original content, as reflected in the significant post-test gains in this skill.

Narrative Structuring: The hierarchical arrangement of mind maps helps students outline their narratives effectively by visually organizing main themes and supporting details. This visualization process aids in constructing coherent storylines, ensuring logical progression from beginning to end. The marked improvement in narrative structuring can be attributed to students'

enhanced ability to create a clear roadmap for their writing, reducing disorganization and writer's block.

Linguistic Accuracy: Mind mapping indirectly supports linguistic precision by allowing students to focus on language mechanics after structuring their ideas. The iterative nature of mind maps encourages revisions and refinements, enabling students to identify and correct grammatical errors and awkward phrasing. This methodical approach likely explains the higher gains in linguistic accuracy observed in the post-test results.

Thematic Coherence: The visual clustering of related ideas in mind maps ensures thematic unity, helping students maintain focus on their main argument or narrative theme. This coherence stems from the ability to see all elements of a theme at a glance, reducing the likelihood of tangential or inconsistent writing. The notable improvement in thematic coherence reflects students' increased capacity to write content that is both cohesive and compelling.

Persuasive Expression: Mind maps enhance persuasive writing by enabling students to organize their arguments logically and support them with evidence or illustrative examples. The emphasis on clear relationships between ideas allows for stronger, more convincing arguments. The improvement in this skill suggests that students were better equipped to craft impactful messages, utilizing both logical reasoning and emotional appeal.

Impact on Systemic Thinking Skills:

Causal Relationship Analysis: Mind maps inherently highlight cause-and-effect relationships by linking nodes through labeled connections. This explicit visualization enables students to analyze how one concept influences another, fostering a deeper understanding of causal dynamics. The substantial improvement in this skill indicates that students were better able to identify and articulate these relationships in complex systems.

Holistic Problem-Solving: By displaying all elements of a problem and their interconnections in a single view, mind maps promote a comprehensive approach to problem-solving. Students can evaluate multiple perspectives simultaneously, avoiding narrow or fragmented thinking. The observed gains in holistic problem-solving suggest that mind mapping encouraged students to approach challenges more integratively, considering all relevant factors.

Interconnection Mapping: The core strength of mind maps lies in their ability to visually represent the interconnectedness of ideas. This feature directly aligns with the skill of interconnection mapping, enabling students to recognize and construct networks of related concepts. The post-test improvements in this skill indicate that students became more adept at understanding and illustrating how individual elements contribute to larger systems.

Dynamic Adaptability: The iterative and flexible nature of mind maps fosters adaptability by allowing students to revise and reorganize their ideas as new information emerges. This adaptability is crucial in dynamic environments where conditions and priorities frequently change. The significant enhancement in dynamic adaptability reflects students' increased ability to modify their thinking processes fluidly in response to shifting contexts.

6. Conclusions

The results underscore the dual efficacy of mind mapping as both a creative and analytical tool. Its ability to visually organize complex information while fostering flexibility and clarity played a pivotal role in improving students' performance across the targeted skills. These findings highlight the potential of mind mapping to serve as a transformative pedagogical strategy in education, addressing both creative and systemic cognitive demands. The findings of this study affirm the significant impact of using mind mapping on enhancing students' creative writing and systemic thinking skills. The structured and interactive nature of mind mapping provided a robust

framework for improving both creativity and analytical reasoning. By offering a visual and organized approach to information processing, mind mapping empowered students to better generate ideas, structure narratives, ensure thematic coherence, and express themselves persuasively with linguistic precision. Similarly, the ability to visualize relationships, analyze causal dynamics, solve problems holistically, and adapt flexibly contributed to the marked improvement in systemic thinking skills.

These results emphasize the potential of mind mapping as an effective pedagogical strategy, fostering skills essential for academic and real-world problem-solving. The study underscores the transformative role that cognitive tools like mind mapping can play in bridging creative and systemic competencies, thereby preparing students for complex and interconnected challenges.

7. Limitations

This study has several limitations that warrant consideration. Firstly, the sample size was limited to 40 students from a single college, which may affect the generalizability of the findings. Secondly, the study focused on a short-term intervention, and the long-term retention of the skills developed through mind mapping was not assessed. Lastly, the reliance on quantitative measures alone may overlook nuanced qualitative insights into students' experiences with mind mapping. Future studies should address these limitations by incorporating larger and more diverse samples, longitudinal designs, and mixed-method approaches.

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