Enhancing Pre-Service Teachers' Learning of Instructional Strategies in Early Childhood Education through the Integration of Mind Maps and Bloom's Taxonomy

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Abstract

This study aimed to enhance the learning of instructional strategies in early childhood education for pre-service teachers through the integration of mind maps and Bloom's Taxonomy. It involved an experimental group (N=50) and a control group (N=50). The results showed that before the intervention, there was no statistically significant difference in mean scores (Sig.> 0.05). However, after the intervention, the mean score of the experimental group was significantly higher than the control group (Sig. < 0.05) in terms of measured learning achievement, indicating the positive impact of the integration. Furthermore, the analysis highlights the significant impact of students' pre-test scores, the type of group, and the mode of attendance on their post-test performance. Additionally, the integration of mind maps and Bloom's Taxonomy was perceived to enhance pre-service teachers' understanding and selection of instructional strategies, problem-solving skills, and instructional design capabilities, potentially leading to increased confidence and efficiency in their teaching abilities, as indicated by the survey responses.

Keywords Mind Maps · Bloom's Taxonomy · Instructional Strategies · Pre-service Teachers

Introduction

Instructional strategies are vital for students of all ages, especially young children (Pianta, La Paro, & Hamre , 2019).They profoundly impact immediate learning outcomes, as well as long-term perceptions of education, future learning, and personality development (Moore,2015). Effective methods create engaging environments, foster critical and creative thinking, and lay a solid foundation for success. Therefore, it is essential for teachers to consistently choose, refine, and apply suitable strategies to enhance their practices and achieve the best possible outcomes for their students.

Teaching is an art requiring specialized knowledge and skills. For pre-service teachers to develop effective instructional strategies, it is crucial that they possess a thorough understanding of students' psychology and behavior, along with a mastery of various instructional techniques and traditional instructional theories (Bråten & Ferguson,2015). This foundational knowledge and skill set are vital for teachers to innovate and enhance their instructional practices. However, the vast and complex nature of these theories can be overwhelming for students. Limited class time and resources further hinder students from gaining hands-on experience and effectively applying these theories in practice. Moreover, the content can sometimes be dull and uninspiring,

making it challenging for learner to maintain their interest and retain important information (Garret,2014). These challenges can lead to confusion and missed opportunities for Pre-teachers to design effective instructional plans and methods.

A Mind Map is a powerful visual tool that organizes information in a structured and interconnected way. It starts with a central idea and branches out to related concepts, subtopics, and ideas (Buzan,2018). Using images, colors, and keywords, Mind Maps help students remember and connect information effectively (Buzan & Buzan,2000). They promote better understanding, retention, and application of knowledge by facilitating comprehension, critical thinking, and active learning(Knight, 2016). Mind Maps encourage students to analyze, evaluate, and connect various pieces of information, leading to a deeper understanding of complex topics (Buzan,2018). By incorporating Mind Maps into their study, students can organize thoughts, improve recall, and achieve higher levels of learning achievement. Numerous studies have demonstrated the positive impact of mind maps on learning achievement. For example, during the COVID-19 pandemic in Saudi Arabia, Alsuraihi (2022) conducted a study assessing the effectiveness of mind maps as a teaching and assessment method in online education, involving students from medical physics courses at King Abdulaziz University, with the results indicating students' satisfaction with mind maps and their development of skills in organization, planning, decision making, and critical thinking.. Similarly, Mohammed and Mahdi (2021) conducted a study where a survey was distributed to 247 participants utilizing conceptual mapping tools for learning, revealing that conceptual mapping can enhance students' understanding, motivation, and academic achievements. Furthermore, several studies have indicated that combining mind mapping with other learning models or tools can be a valuable approach for optimizing learning outcomes (Anggy,Tukiran, &Sunu,2022; Chen&Kuan,2019; Yağbasan, 2019).

Bloom's Taxonomy Bloom's Taxonomy is a widely used cognitive framework in education aimed at promoting higher-order thinking skills among students(Krathwohl, 2002). It proposed by Benjamin Bloom, classifies into six cognitive levels, they are :Remember, Understand, Apply, Analyze, Evaluate, and Create. While Bloom's Taxonomy is originally defined based on learning objectives, its application can assist educators in evaluating learning outcomes. By integrating assessment and measurement methods, educators can determine students' proficiency and level of achievement across different levels. In the revised edition of Bloom's Taxonomy, Anderson and Krathwohl (2001) offer both theoretical and practical guidance, emphasizing the connection between learning objectives and assessment. When used as a measure of learning outcomes, each level of Bloom's Taxonomy can be described as follows:

1.*Remembe:* Students are able to recall and reproduce factual knowledge, concepts, and information they have learned.

2.*Understand:* Students are able to interpret and comprehend the meaning of the acquired knowledge, transforming it into their own language or concepts.

3.*Apply:* Students are able to apply the acquired knowledge to practical contexts, solving problems or applying it to new situations.

4.*Analyze:* Students are able to break down complex concepts, problems, or situations into their constituent parts and analyze the relationships between them.

5.*Evaluate:* Students are able to assess and judge, engaging in critical thinking based on specific criteria and making well-reasoned decisions.

6.Create: Students are able to generate novel ideas, designs, solutions, or works, demonstrating creativity and originality.

Each level builds upon the previous one, demanding increased complexity and higher-order thinking skills. While the levels generally follow a sequential order, there is room for flexibility to align with specific learning objectives, instructional design, and individual learners' abilities and needs (Anderson & Krathwohl, 2001).

When combined, Bloom's Taxonomy and Mind Maps form a powerful instructional approach. Mind Maps assist students in organizing their thoughts and ideas, leading to enhanced understanding of knowledge. By employing Bloom's Cognitive Domain Theory as a guiding framework, learners can develop higher-order thinking skills such as critical thinking and problem-solving (McGrath& Willcutt,2022; Krathwohl, 2002).Numerous studies have validates the effectiveness of combining Bloom's Taxonomy with mind maps. For example, Ma and Xu (2020) found that integrating mind mapping with Bloom's Taxonomy had a significant positive impact on students' reading comprehension abilities and vocabulary skills, leading to notable improvements.. Similarly, Tian (2018) explored the integration of mind mapping with Bloom's Taxonomy in college-level English writing instruction, revealing its effectiveness in improving students' understanding of writing tasks, enhancing their writing proficiency, and positively impacting their overall academic performance.

Given the limited research available on Pre-Service Teachers' Learning of Teaching Strategies in Early Childhood Education and the absence of studies investigating the utilization of mind maps to enhance such learning, the author conducted a study titled 'Enhancing Pre-Service Teachers' Learning of Teaching Strategies in Early Childhood Education through the Integration of Mind Maps and Bloom's Taxonomy.' The study aspires to provide valuable insights to this field and endeavors to offer practical references and theoretical guidance for enhancing the teaching quality of early childhood education teachers and improving the learning outcomes of young children

Research Objectives

1. To develop and implement an instructional design that using mind maps combined with Bloom's Taxonomy to enhance pre-service teachers' learning of instructional strategies in early childhood education.
2. To explore the effectiveness of the integration of Mind Maps and Bloom's Taxonomy to enhance pre-service teachers' learning of instructional strategies in early childhood education.

Methodology
Research Design
This study employed a pretest-posttest design with control and experimental groups. This Research and Development (R&D) study focused on developing instructional design and plan to that using mind maps combined with Bloom's Taxonomy to enhance pre-service teachers' learning of instructional strategies in Early Childhood Education.

Table 1 Research process

Step	Process	Description
1	Analysis	Identify research problem and review literature to establish theoretical framework and study objectives.
2	Design	Divide participants into two groups after determining the sample size.
3	Development	Prepare lesson plans and materials, evaluate them with experts, conduct a pilot test, and make revisions.
4	Experiment	Recruit participants, obtain informed consent, and assess learning achievement before and after intervention.
5	Evaluation	Analyze data using statistical techniques, analyze survey responses, summarize findings, and recommend further research.

Participants

The study included participants from two fourth-year classes majoring in Early Childhood Education at a University in Bangkok, Thailand. The participants were randomly selected from two classes with the same grade levels, similar average grades from the previous academic year, and approximately equal class sizes. All participants were enrolled in the course 'Innovation in Education' and had limited prior work experience.

One classroom was designated as the control group (N=50) and the other classroom was designated as the experimental group (N=50). The experimental group received 6 lessons on innovative classroom games, using Mind Maps Combined with Bloom's Taxonomy. The control group received 6 lessons using a traditional instructional approach.

Lesson Plans

Additional details can be found in Table 2.

Experimental group: The lesson plans (**Table 2**) of the experimental group were purposefully designed to enhance pre-service teachers' learning of instructional strategies through the integration of mind maps and Bloom's Taxonomy. These six comprehensive lesson plans encompassed a wide variety of activities, ensuring a diverse and engaging learning experience.

Control group: Meanwhile, the control group will receive the same learning content as the experimental group. However, the primary instructional methods employed will be presentations and explanations, and appropriate discussions and problem-solving case analyses. Additionally, similar to the experimental group, the control group will also have a course design competition during the final class session.
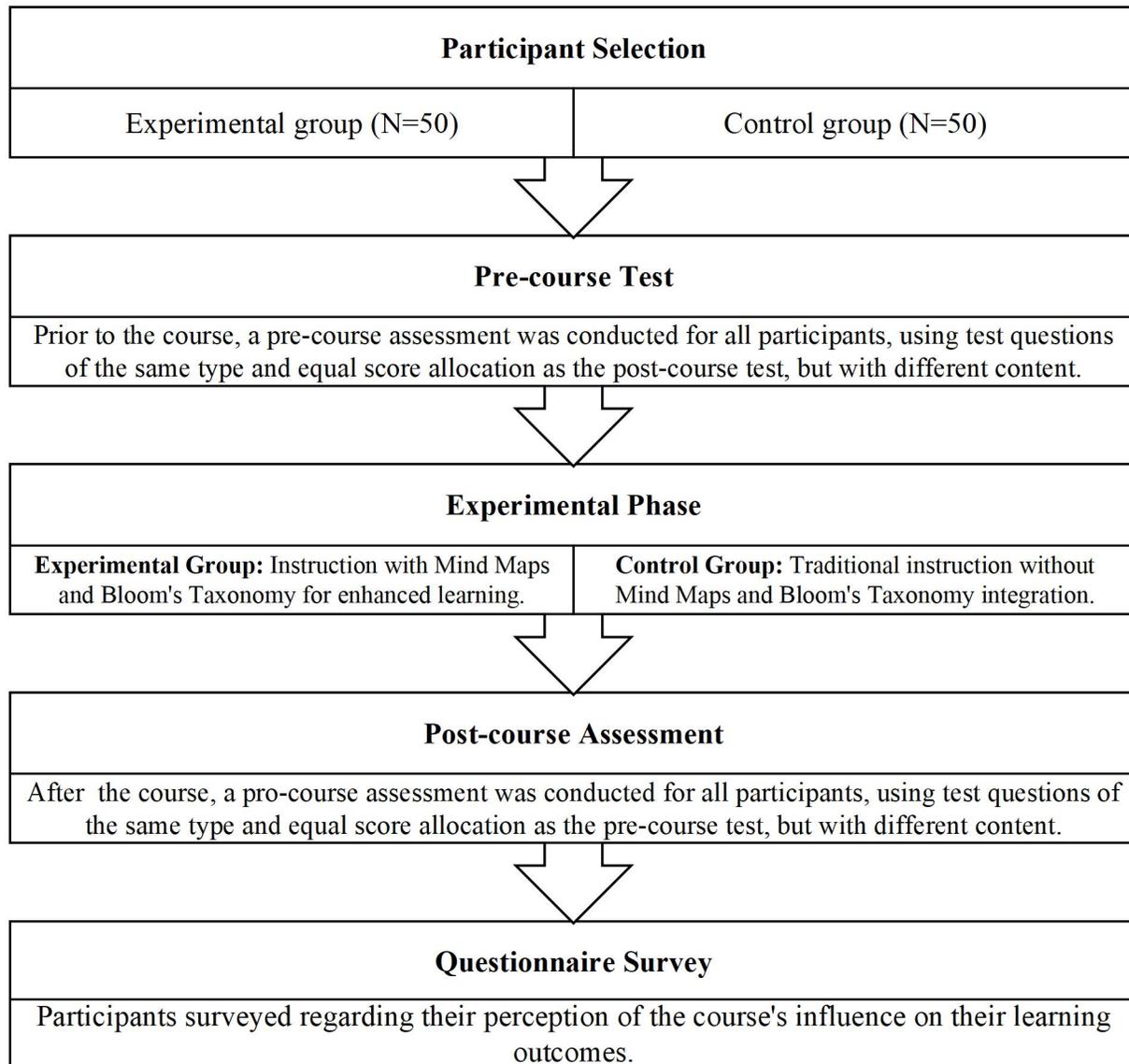
Experimental Design

Participant Selection	
Experimental group (N=50)	Control group (N=50)

⬇

Pre-course Test
Prior to the course, a pre-course assessment was conducted for all participants, using test questions of the same type and equal score allocation as the post-course test, but with different content.

⬇

Experimental Phase	
Experimental Group: Instruction with Mind Maps and Bloom's Taxonomy for enhanced learning.	**Control Group:** Traditional instruction without Mind Maps and Bloom's Taxonomy integration.

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Post-course Assessment
After the course, a pro-course assessment was conducted for all participants, using test questions of the same type and equal score allocation as the pre-course test, but with different content.

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Questionnaire Survey
Participants surveyed regarding their perception of the course's influence on their learning outcomes.

Table 2 6 Lesson Plans using the Integration of Mind Maps and Bloom's Taxonomy

Lessons	Objectives	Content	Method
Lesson 0 (60 minutes)	Introduction	The objectives, process, and significance of this course, as well as the fundamental principles and usage methods of mind maps.	**Demonstration, explanation**
Lesson 1 (90 minutes)	Remember	The basic concepts, history, principles, and characteristics of various instructional strategies	**Vocabulary Mind Map**: The class collaboratively create chain-game-style mind map for instructional method. **Mind Map Exercises**: Practice completing blank or incomplete mind maps on instructional methods.
Lesson 2 (90 minutes)	Understand	Instructional method information and theories involved in different instructional strategies.	**Puzzle Mind Maps:** Use mixed instructional method information and theories to engage students in solving puzzles and reconstructing mind maps. **Competition:** Present completed mind maps to class, and recognize outstanding student work.
Lesson 3 (90 minutes)	Analyze	The advantages and disadvantages of instructional strategies used in various situations.	**Exploring Mind Map:** Encourage participants to collaborate in small groups and develop mind maps for the chosen instructional method, then analyze and summarize the advantages, disadvantages. Participants search and gather information on the mind map from online sources, textbooks, and personal experiences. They will then present different viewpoints and conclusions.
Lesson 4 (90 minutes)	Apply	Applying instructional strategies to solve practical instructional problems.	**Teaching Challenges Mind Map**: Guide participants to identify challenges in teaching, such as learner motivation or interest issues.. Groups choose a problem and create a mind map with instructional strategies suitable for diverse age groups and subjects.
Lesson 5 (90 minutes)	Evaluate	Evaluating the effectiveness of different instructional strategies and providing suggestions for improvement.	**Presentation and Feedback:** The groups present their mind maps of problem solutions developed in Lesson 4, inviting the entire class to engage in sharing, comparing, and evaluating their strategies and perspectives. With the guidance of the teacher's feedback, the student groups improve their mind maps and solutions.
Lesson 6 (90 minutes)	Create	Creatively apply instructional strategies to design lesson plans.	**Mind map for course design:** Organize an instructional method competition using mind maps to design, analyze, and present a course in class. The class will then vote on the winning one.

Assessment for Evaluating Learning of Instructional Strategies in Early Childhood Education

The assessment will be conducted one week after the completion of the course. Prior to the experiment, five experts in related fields evaluated the test questions for appropriateness and accuracy before the experiment, using the *Index of item objective congruence (IOC)* evaluation method. The experts judged the questions to be suitable for the measurement experiment and provided valuable feedback. The researchers made revisions to the questions based on the experts' opinions, ensuring their quality and effectiveness.

The assessment consists of a comprehensive exam paper covering six sections: Remember, Understand, Apply, Analyze, Evaluate, and Create.The exam utilizes diverse question formats, including multiple choice, short answer, true/false, case analysis, and design questions, to assess students' learning outcomes. The allocation of scores for each section is determined by considering the progressive nature of Bloom's Taxonomy levels and the varying difficulty of the questions. Below is a score allocation table for reference.

Table 3 Question Types and Score Allocation

Sections	Question Types	Number of questions	Points per question	Total Points	Difficulty level
Remember	Choice Questions	5 questions	2 points each	10 points	Relatively easier
Understand	Short Answer Questions	5 questions	3 points each	15 points	Relatively easier
Analyze	True/False Questions	3 questions	5 points each	15 points	Moderate difficulty
Apply	Short Answer Questions	4 questions	5 points each	20 points	Moderate difficulty
Evaluate	Case Analysis	2 questions	10 points each	20 points	Moderate difficulty
Create	Design Questions	1 questions	20 points each	10 points	Relatively difficulty

The Remember, Understand, and Analyze sections consist of questions with simpler formats and lower difficulty levels, resulting in a relatively smaller weightage in scoring. On the other hand, the Apply, Evaluate, and Create sections involve complex and advanced cognitive abilities, and their scoring allocations are adjusted equally to reflect their significance.

Additional explanations based on the assessment of the six sections are provided below.
Section 1: *Remember:* Students are assessed on their ability to recall and reproduce factual knowledge and concepts of instructional content.
The Remember section include multiple-choice questions that primarily rely on memorization, making them relatively easier and allocated a lower score.

Sections 2: *Understand:* Students are assessed on their ability to interpret and comprehend key instructional theories and characteristics, transforming them into personal understanding.

The Understand section include short answer assess students' level of understanding of concepts and knowledge, allocated a moderate score.

Sections 3: *Analyze:* Students are assessed on their ability to break down complex concepts, problems, or situations and analyze the appropriateness of instructional strategies in different contexts.
The Analyze section include true/false assess students' ability to analyze complex concepts, allocated a moderate score.

Sections 4: *Apply:* Students are assessed on their ability to apply knowledge of instructional strategies to practical contexts, solving problems, and adapting to new situations, with accuracy and flexibility.
The Apply section include short answers assess students' ability to apply theoretical knowledge to practical situations, allocated a higher score.

Sections 5: *Evaluate:* Students are assessed on their ability to assess and critically analyze the effectiveness of instructional strategies, making well-reasoned judgments and suggesting improvements, reasonably and comprehensively.
The Evaluate section include case analysis questions assess students' ability to evaluate and make judgments, allocated a higher score.

Sections 6: Create: Students are assessed on their ability to generate creative, original, and practical ideas, designs, solutions, or works, demonstrating innovation, originality, and practicality in designing lesson plans using instructional strategies.
The Create section include lesson plan design questions require students to engage in creative thinking and planning, allocated a higher score.

Scoring Guidelines
For the first three Sections -Remember, Understand, Analyze, there are standard answers, and students will receive corresponding scores as long as they provide correct responses.

However, for the questions at the last three Sections -Apply, Evaluate, Create, although there are no specific correct answers, researchers have developed the following scoring guidelines based on discussions with experts.

Apply:
1.*Knowledge Application:* Assess if students can accurately apply learned knowledge and theories to practical situations.
2.*Problem-Solving:* Assess if students can effectively and flexibly apply knowledge to solve problems.
3.*Integration of Theory and Practice:* Assess if students can effectively combine theory with real-world contexts to provide logical and practical solutions.

Evaluate:
1.*Analytical Abilities*: Assess if students can identify and evaluate key factors when analyzing complex situations or cases.
2.*Logical Reasoning:* Assess if students can engage in logical reasoning and provide reasoned and persuasive evaluation outcomes.
3.*Accuracy of Judgment*: Assess if students can demonstrate accuracy and rationality in their judgments and provide wise evaluations and decisions.

Create:
1.*Instructional Objectives:* Assess if students' instructional designs align with the educational objectives and effectively achieve the learning goals in practice.
2.*Instructional Methods and Resources*: Assess if students' instructional designs include suitable teaching methods and resources to support learning and development.
3.*Innovation*: Assess if students' instructional designs demonstrate uniqueness and originality.

Learning achievement criteria
The criteria for rate of learning achievement based on GPA are presented in the table below.

Table 4 the criteria for rate of learning achievement based on GPA

Interval	*Criteria*
90-100	Excellent
80-89	Good
70-79	Average
60-69	Pass
0-59	Fail

Survey questionnaire for pe-service teachers who participated in the study
Prior to conducting the survey, five experts in related fields evaluated the survey questionnaire for appropriateness and accuracy before the experiment, using the *Index of item objective congruence (IOC)* evaluation method. The experts judged the questionnaire to be suitable for conducting the survey and provided valuable feedback. The researchers incorporated the experts' opinions and made necessary revisions to ensure that the questionnaire effectively collects useful data from pre-service teachers who participated in the study. The survey questionnaire included open-ended questions
Question 1. Has this course enhanced your comprehension and selection of instructional strategies? And why?
Question 2. Has this course enhanced your problem-solving skills in teaching? And why ?
Question 3. Has this course enhanced your ability to design teaching activities that meet students' learning needs? And why ?
Question 4. Do you have an intention to apply this approach in your future instructional design work? And why ?

Results

Learning Achievement

Pre-test results for the control and experimental classes can be seen in tables below.

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
PreTest	Experimental Group	50	61.62	11.073	1.566
	Control Group	50	62.00	10.932	1.546

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference		Lower	Upper
PreTest	Equal variances assumed	.056	.814	-.173	98	.863	-.380	2.201		-4.747	3.987
	Equal variances not assumed			-.173	97.984	.863	-.380	2.201		-4.747	3.987

Based on the provided table, before the intervention, there was no significant difference in the average learning achievement scores between the experimental and control groups, as indicated by the independent samples test results (Sig.> 0.05). This implies that the two groups had similar performance levels before the intervention and both groups demonstrated a similar level of performance, classified as "Pass" in terms of learning achievement.

Post-test results for the control and experimental classes can be seen in tables below.

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
PostTest	Experimental Group	50	85.34	8.334	1.179
	Control Group	50	76.90	8.821	1.247

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PostTest	Equal variances assumed	.859	.006	4.918	98	.000	8.440	1.716	5.034	11.846
	Equal variances not assumed			4.918	97.686	.000	8.440	1.716	5.034	11.846

Based on the provided table, after the intervention, the experimental group demonstrated a significantly higher mean learning achievement score compared to the control group ((Sig. < 0.05). The control group showed an improvement, reaching a "Average" level of performance. In contrast, the experimental group's performance soared to an "Good" level.

Following that, the researchers proceeded with an analysis of the Normality tests, and the corresponding chart is provided below:

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual for PostTest	.035	100	.200[*]	.996	100	.988

[*]. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Histogram

Mean = 4.09E-16
Std. Dev. = .99
N = 100
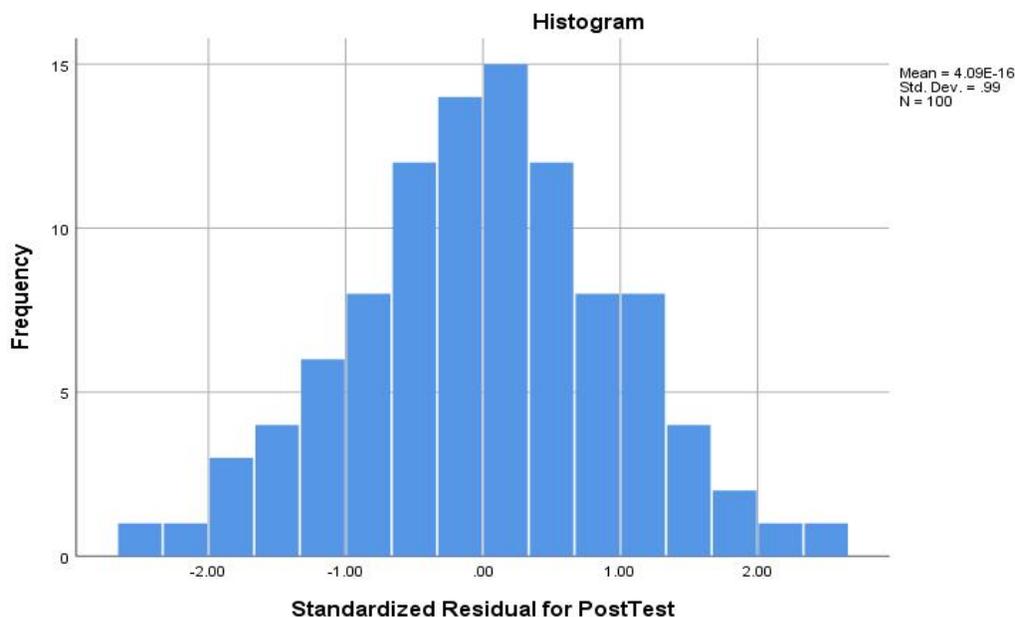
The analysis of Normality tests revealed a Sig. value of 0.200, indicating that the students' performances showed a general trend towards a normal distribution. Although the histogram displays a bell curve shape, it slightly skews to the right. This suggests that while the majority of performances conform to the expected distribution, there are some exceptional high values exceeding expectations. These higher values likely represent students who have achieved remarkably higher scores, surpassing the anticipated average performance.

To gain deeper insights into the differences in performance between the experimental and control groups explore potential influences from external factors and variables, the study employed ***"Tests of between-subjects effects"*** analysis. Additionally, in the current educational landscape, the ongoing COVID-19 pandemic continues to impact students, leading to challenges in attending in-person classes due to illness, quarantine protocols, or safety considerations. As a result, some students are unable to attend classes in person due to illness, quarantine requirements, or safety concerns. Consequently, they have been compelled to engage in synchronous learning with their classmates through online platforms. To gain a better understanding of the factors influencing students' academic performance, this study employs the method of covariate comparative analysis to explore the relationship between ***students' mode of attendance (online or in-person)*** and their post-course score. The results are presented below.

Descriptive Statistics

Dependent Variable: PostTest

Group	Model	Mean	Std. Deviation	N
Experimental Group	On-site learning	90.52	6.761	23
	Online learning	80.93	6.944	27
	Total	85.34	8.334	50
Control Group	On-site learning	82.28	5.054	25
	Online learning	71.52	8.545	25
	Total	76.90	8.821	50
Total	On-site learning	86.23	7.194	48
	Online learning	76.40	9.026	52
	Total	81.12	9.533	100

Tests of Between-Subjects Effects

Dependent Variable: PostTest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7254.730[a]	4	1813.683	98.919	.000
Intercept	6541.309	1	6541.309	356.765	.000
PreTest	2883.041	1	2883.041	157.242	.000
Group	2049.338	1	2049.338	111.772	.000
Model	1652.427	1	1652.427	90.124	.000
Group * Model	149.694	1	149.694	8.164	.005
Error	1741.830	95	18.335		
Total	667042.000	100			
Corrected Total	8996.560	99			

a. R Squared = .806 (Adjusted R Squared = .798)

The analysis of between-subjects effects for the dependent variable (post-test) uncovered intriguing findings, demonstrating a significant result (Sig. < .05). These findings shed light on the factors that influence students' academic performance.

Firstly, students' pre-test scores emerged as a significant predictor of their post-test performance(Sig.< .05). It means students' pre-test scores significantly impact their post-test performance, with higher pre-test scores correlating with better post-test results.

Secondly, the type of group, whether experimental or control,emerged as a significant predictor of their post-test performance (Sig.< .05). It means the group type (experimental or control) significantly affects students' post-test scores, with the experimental group outperforming the control group.

Furthermore, the mode of attendance, whether online or on-site, emerged as a significant predictor of their post-test performance (Sig.<.05). It means the mode of attendance (online or on-site) significantly influences students' post-test scores, with on-site attendance associated with better performance compared to online attendance.

The analysis of between-subjects effects for the posttest variable reveals the significant factors influencing students' post-test performance. Specifically, it highlights the profound impact of students' pre-test scores (indicative of their prior knowledge), the type of group (experimental or control), and the mode of attendance (online or in-person).

In conclusion, the research findings suggest that before the intervention, the experimental and control groups had similar performance levels. However, after the intervention, the experimental group demonstrated significantly higher learning achievement scores compared to the control

group. The analysis also indicates that students' performance showed a general trend towards a normal distribution, with some exceptional high values exceeding expectations. Overall, the results underscore the significant influence of students' pre-test scores, group type, and mode of attendance on their post-test performance.

Survey questionnaire results

Based on the research findings, the researcher conducted a comparative analysis of survey questionnaire results from two groups of participants regarding their perceived learning outcomes in instructional strategies. The following report presents the findings.

Question 1. Has this course enhanced your comprehension and selection of instructional strategies? And why?

Experimental Group

Participant 1: " The visual approach employed in the course was instrumental in enhancing my understanding of different instructional strategies. It allowed me to visualize the connections between strategies and their significance in the teaching process. This visual clarity enabled me to expand my repertoire of teaching methods and make more informed choices when selecting the most appropriate strategies for my specific teaching context. "

Participant 2: "This enhanced comprehension has empowered me to make more informed and deliberate choices when selecting strategies, considering factors such as the learning objectives, student preferences, and the learning environment. It has expanded my understanding of various strategies and their potential effectiveness in different teaching situations "

Participant 3: *"*The approach employed in the course made the concepts easy to understand and apply. By breaking down complex strategies into manageable components and providing practical examples, the course helped me gain a deeper understanding of their purpose and effectiveness.
This visual clarity has equipped me with the knowledge and confidence to seamlessly integrate various strategies into my teaching practice, ensuring optimal learning outcomes for my students."

88% of the participants reported an improvement in their understanding and ability to select instructional strategies after taking course.
Participants found that the instructional approach provided a clear and visually appealing way to understand the connections and importance of instructional strategies, offering greater choice and methods to help them select the most effective strategies.

Control Group

Participant 1: " Although the course provided valuable insights into different instructional strategies, I felt that there was a lack of practical guidance on how to effectively apply them in

real-world teaching situations. This left me uncertain about which strategies to select and how to implement them to best meet the unique needs of my students. I would have appreciated more clarity and guidance in bridging the gap between theory and practice."

Participant 2: " While I gained knowledge about various strategies, I felt that there was a missed opportunity to explore more interactive and student-centered approaches. This left me wanting more in terms of engaging and effective instructional strategies that promote active student participation and deeper understanding."

Participant 3: "I must say that I encountered challenges when it came to translating the learned strategies into practical applications within real-world teaching scenarios. There was a need for additional guidance and support to bridge the gap between theory and practice. It would have been helpful to receive more explicit instructions and examples showcasing how to effectively implement the strategies in a range of teaching contexts."

64% of the participants reported an improvement in their understanding and ability to select instructional strategies after taking course. Participants found that the traditional instructional approach prioritizes knowledge transmission lack meaningful interaction between teachers and students, causing some confusion and uncertainty in selecting instructional strategies.

Question 2.Has this course enhanced your problem-solving skills in teaching? And why ?

Experimental Group

Participant 1: "This has given me a deeper understanding of their effectiveness and how they can be applied in different teaching situations. Armed with this knowledge, I now feel more confident in making well-informed decisions when confronted with teaching challenges. I can assess the pros and cons of various approaches and choose the most suitable one to achieve optimal learning outcomes."

Participant 2: "Throughout this course, I have learned to carefully examine the strengths and weaknesses of different approaches, considering their relevance to specific teaching scenarios. This systematic analysis has empowered me to generate innovative solutions to teaching problems and overcome challenges more effectively."

Participant 3: "Thanks to this course, I have established a solid foundation for effective problem-solving in my teaching practice. It has taught me to consider multiple perspectives and approaches when faced with instructional challenges. I no longer rely on a one-size-fits-all solution but have gained greater flexibility in my problem-solving process. By being open-minded and adaptable, I can successfully navigate diverse teaching situations and find creative solutions tailored to the needs of my students."

82% of the participants reported an improvement in their problem-solving skills in teaching with this instructional approach.

Participants found that the instructional approach aided in conducting a more in-depth analysis and evaluation of the effectiveness and objectives of instructional strategies, thereby enhancing their thinking abilities and enabling them to effectively address instructional challenges with flexibility.

Control Group

Participant 1: "I must admit that while this course provided valuable knowledge about instructional strategies, I felt that the focus was more on transmitting information rather than actively developing my problem-solving abilities. I did notice some improvement in my problem-solving skills, but I wished there were more opportunities to apply those strategies in real teaching challenges."

Participant 2: "Throughout the course, I gained knowledge about various teaching strategies, but I felt there was a missed opportunity to actively apply those strategies to solve complex teaching challenges. As a result, when faced with real teaching situations, I found myself somewhat limited in my problem-solving capabilities."

Participant 3: "I can say that this course enhanced my problem-solving skills in teaching. The knowledge and strategies I gained provided me with a solid foundation for addressing teaching challenges. Through analyzing and evaluating different instructional strategies, I became more adept at identifying the most effective approaches to solving problems in the classroom."

42 % of the participants reported an improvement in their problem-solving skills in teaching with this instructional approach.
Participants found that the traditional instructional approach focus more on mechanical learning, neglecting the development of students' thinking and problem-solving skills, resulting in relatively low problem-solving abilities.

Question 3.Has this course enhanced your ability to design teaching activities that meet students' learning needs? And why ?

Experimental Group

Participant 1: "The instructional approach gave me a systematic framework to understand factors like their prior knowledge, learning styles, and interests. With this knowledge, I've been able to design activities that truly resonate with them, making learning more engaging and relevant."

Participant 2: "I feel so empowered by the organized framework provided by the instructional approach. It's like having a secret weapon in my teaching arsenal! By considering my students' individual strengths, weaknesses, and preferences, I've been able to create activities that ignite their curiosity, challenge their thinking, and keep them actively engaged throughout the learning process."

Participant 3: "The course provided me with a comprehensive understanding of instructional design principles and strategies. Armed with this knowledge, I've been able to create activities that perfectly align with my students' learning goals, tap into their interests, and cater to their unique abilities."

84% of the participants reported an improvement in their ability to design instructional activities that meet students' learning needs.
Participants found that the instructional approach provided a systematic and organized framework for considering students' diverse learning needs and abilities. deepening their understanding and enabling efficient design and adaptation of instructional activities.

Control Group

Participant 1: "Honestly, the course didn't have a significant impact on my ability to design activities that meet students' learning needs. The instructional approach didn't provide enough tools and strategies to address the diverse range of needs, which made it challenging to design effective activities for individual students."

Participant 2: "I did see a small improvement in my ability to design activities that cater to students' learning needs. However, the traditional approach didn't provide sufficient guidance, limiting my ability to meet the diverse needs of students effectively."

Participant 3: " While the course offered some guidance in instructional design, it fell short in enhancing my ability to create activities that meet students' learning needs. The traditional approach's focus on standardized methods hindered my flexibility in customizing activities for students with different preferences and abilities."

42 % of the participants reported an improvement in their ability to design instructional activities that meet students' learning needs.
Participants found that the traditional instructional approach lack innovation, personalization, and flexibility, which limited their ability to meet diverse student learning needs. This restricted their choices and creativity when designing instructional activities.

Question 4.Do you have an intention to apply this approach in your future instructional design work? And why ?

Experimental Group

Participant 1: "I'm definitely planning to use the methods I learned in my future instructional design work. It seems like a great way to make learning more engaging and effective for my students. Of course, I'll adapt it based on the specific situations and needs of my students."

Participant 2: "I'll apply this approach in my future instructional design work. It has shown its effectiveness in improving comprehension, problem-solving, and adaptability."

Participant 3: " I'm really excited about applying this approach in my future instructional design work. It offers a student-centered approach that encourages engagement and deeper understanding. I believe it will greatly enhance my teaching and lead to better learning outcomes."

90 % of the participants reported a tendency to apply the learned methods in future decision-making and instructional design work. Participants recognized this instructional method effective in promoting understanding, application, problem-solving, and creative thinking skills. However, some participants indicated they would not frequently utilize this method in their work based on personal teaching styles and preferences.

Control Group

Participant 1: "I have a moderate intention to apply the learned methods in my future instructional design work. While traditional approaches have their merits, but I recognize they may not always align with the changing needs of students. I'll carefully consider the context and requirements before deciding which methods to use. "

Participant 2: "I'm hesitant about using the methods I learned in this course for my future instructional design work. Traditional approaches have their advantages, but I believe there's a need for more innovative and flexible methods to address the evolving learning needs of students."

Participant 3: "I'll explore other approaches that align better with my vision. The methods presented in the course seemed too complex and time-consuming for my teaching context. I'm eager to find simpler and more practical approaches that can still create engaging learning experiences for my students."

50 % of the participants reported a tendency to apply the learned methods in future decision-making and instructional design work.
Participants recognized the effectiveness of traditional instructional methods in some situations due to their personal familiarity and ease of implementation and assessment, while others indicated limitations in meeting the learning needs of modern children and a lack of innovation.

Discussion

1.The Integration of Mind Maps and Bloom's Taxonomy Improve Pre-Service Teachers' Learning of Instructional Strategies in Early Childhood Education

The learning achievement results clearly showed significant improvements in the experimental group compared to the control group following the intervention, highlighting the positive impact of the integration. Possible explanations for this result may include:
Difference in teaching methods: The observed improvement in the experimental group's academic performance can be attributed to the adoption of different teaching methods. The experimental group may have benefited from more interactive and personalized teaching

approaches, which stimulated students' motivation and interest, thereby enhancing their academic performance.

2.The mode of attending classes plays an important role in students' academic performance, with on-site learning demonstrating clear advantages.

Additionally, the results highlighted the significant relationship between mode of attending classes and students' academic performance. Specifically, students in both the experimental and control groups, who opted for on-site learning, exhibited significantly superior academic achievements compared to the online learning group. Possible explanations for this result may include:

Advantages of in-person classroom learning: On-site learning facilitates face-to-face interaction and instant feedback, allowing students to directly engage with teachers and classmates, participate in discussions, and receive timely answers to their inquiries. This interactive learning environment fosters a deeper understanding and mastery of the subject matter.

Challenges of online learning: Online learning can be affected by issues such as unstable internet connectivity, limitations of technology devices, and the learning environment. The lack of face-to-face interaction and real-time feedback may present greater learning difficulties and self-management challenges for students, potentially resulting in relatively lower academic performance in online learning groups.

3.Participants in the Experimental group reported a perceived excellence in understanding, problem-solving, and designing learner-centered activities.

Based on the analysis of survey responses, participants in the experimental group perceived significant improvements in their understanding of instructional strategies, problem-solving abilities in teaching, and the design of learner-centric activities. The experimental group found the approach to be clear, intuitive, and diverse, leading to enhanced thinking abilities and the ability to address instructional challenges flexibly while considering diverse student needs. In contrast, the control group exhibited a stronger focus on knowledge acquisition, which limited their problem-solving and critical thinking skills. Although participants acknowledged the benefits of traditional methods, they also recognized their limitations in meeting the modern learning needs.

Conclusion

In conclusion, integrating mind maps and Bloom's Taxonomy in early childhood education enhances participants' understanding, problem-solving skills, and instructional design. Participants show increased confidence and efficiency, indicating the importance of adopting this approach for improved learning outcomes. Additionally, these findings underscore the importance of Mode of Attendance on students' academic performance. To enhance academic outcomes, educational institutions and teachers should adopt more interactive teaching methods, encourage active participation, emphasize regular attendance, implement effective incentives and communication strategies, create a conducive learning environment, and provide support and resources. Promoting learner-centered approaches is recommended to foster better understanding, problem-solving abilities, and instructional design, leading to improved learning outcomes.

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