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Chatbot-Integrated Pedagogy for Enhancing Lesson Planning Skills among Pre-Service Teachers

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Abstract- ***The present study examined the effectiveness of chatbot-integrated pedagogy for enhancing lesson planning skills among pre-service teachers. Lesson planning is a core professional competency in teacher education because it helps teachers organize objectives, content, teaching strategies, classroom activities, teaching-learning materials, assessment, and reflection. With the growing use of artificial intelligence in education, chatbots can provide instant guidance, feedback, examples, prompts, and reflective support for lesson planning. The study adopted a quasi-experimental pre-test–post-test control group design. The sample consisted of 80 pre-service teachers, with 40 in the experimental group and 40 in the control group. The experimental group was exposed to a chatbot-integrated pedagogy module for four weeks, while the control group received conventional guidance. Data were collected using a Lesson Planning Skill Rubric consisting of 10 dimensions and 50 marks. The collected data were analysed using mean, standard deviation, independent samples t-test, paired samples t-test, ANCOVA, and Cohen's d. The pre-test result showed no significant difference between the experimental and control groups, $t(78) = 0.48$, $p = .632$, indicating group equivalence. The post-test result showed a significant difference in favour of the experimental group, $t(78) = 9.97$, $p < .001$. The paired t-test showed significant improvement in the experimental group from pre-test to post-test, $t(39) = 15.29$, $p < .001$. ANCOVA also confirmed a significant effect of chatbot-integrated pedagogy on lesson planning skills after controlling for pre-test scores, $F(1, 77) = 102.50$, $p < .001$, partial $\eta^2 = .57$. The findings indicate that chatbot-integrated pedagogy is effective in improving lesson planning skills among pre-service teachers. The study suggests that AI chatbots may be used as supportive pedagogical tools in teacher education when guided by ethical, reflective, and teacher-mediated practices.***

Keywords: ***AI in Education, Chatbot-Integrated Pedagogy, Digital Pedagogy, Lesson Planning Skills, Pre-Service Teachers, Teacher Education,***

I. INTRODUCTION

Artificial intelligence is increasingly influencing teaching, learning, assessment, feedback, and professional preparation in education. Among AI-based tools, chatbots have gained attention because they can interact with learners, respond to questions, provide explanations, generate examples, offer feedback, and support self-paced learning. In teacher education, chatbots can be used not as replacements for teacher educators but as supportive tools for guided learning, reflective thinking, and pedagogical preparation. Recent literature suggests that AI chatbots can support learning through instant feedback, personalized assistance, inquiry support, and skill development (Kasneci et al., 2023; Okonkwo & Ade-Ibijola, 2021).

Lesson planning is one of the most important professional skills for pre-service teachers. A good lesson plan helps teachers organize learning objectives, content, teaching strategies, classroom activities, teaching-learning materials, assessment techniques, time management, and reflection. It also supports learner-centred, activity-based, inclusive, and competency-based teaching. Shulman (1986) emphasized that effective teaching requires transforming subject matter into teachable forms, while Mishra and Koehler (2006) highlighted the importance of integrating content, pedagogy, and

technology through the TPACK framework. Therefore, lesson planning in contemporary teacher education should include pedagogical clarity, content organization, digital support, assessment planning, and reflective improvement.

Pre-service teachers often face difficulties in preparing lesson plans. These difficulties may include writing learning objectives, selecting suitable teaching methods, designing activities, preparing teaching-learning materials, framing assessment questions, planning inclusive strategies, and writing reflection. Chatbots can support pre-service teachers in these areas by providing prompts, examples, alternative strategies, assessment items, and feedback. However, chatbot use must be guided by teacher educators to avoid overdependence, inaccurate content, mechanical copying, and lack of critical thinking. Previous studies have noted both the potential and limitations of AI chatbots in education, including the need for responsible and pedagogically meaningful integration (Kuhail et al., 2023; Pérez et al., 2020).

The present study examines whether chatbot-integrated pedagogy can enhance lesson planning skills among pre-service teachers. The study is based on the assumption that chatbots, when used as scaffolding tools, can help pre-service teachers plan lessons more systematically, creatively, and reflectively.

II. SIGNIFICANCE OF THE STUDY

The study is significant because lesson planning is a foundational teaching skill in teacher education. Pre-service teachers need proper support to frame objectives, organize content, select methods, design learning activities, use teaching-learning materials, prepare assessments, and reflect on teaching decisions. Chatbot-integrated pedagogy may provide additional academic support by offering immediate guidance, examples, and feedback.

The study is also significant in the context of digital pedagogy and AI literacy. As AI tools are increasingly entering educational spaces, teacher education institutions must prepare future teachers to use AI ethically, critically, and pedagogically. The findings may help teacher educators integrate chatbots into pedagogy courses, microteaching, simulated teaching, lesson planning workshops, and internship preparation. The study may also contribute to developing AI-supported teacher education practices aligned with reflective practice, TPACK, and digital competence.

III. REVIEW OF RELATED LITERATURE

AI chatbots are conversational digital tools that can interact with users through text or speech. In education, chatbots have been used for tutoring, answering questions, providing feedback, supporting learning activities, and assisting learners in self-paced study. Okonkwo and Ade-Ibijola (2021) reported that chatbots have several educational applications, including learner support, tutoring, assessment, and administrative assistance. Similarly, Pérez et al. (2020) observed that educational chatbots are emerging as useful tools for interaction, feedback, and learning support.

Kuhail et al. (2023) systematically reviewed educational chatbot studies and found that chatbots can support learning through interaction, guidance, and feedback. However, they also highlighted the need for sound design principles, empirical validation, and careful implementation. Kasneci et al. (2023) argued that large language model-based tools such as ChatGPT can support learning, writing, feedback, and explanation, but their use must be guided by ethical and pedagogical considerations.

In teacher education, technology integration requires more than technical skill. Mishra and Koehler (2006) proposed the TPACK framework, which emphasizes the integration of technological, pedagogical, and content knowledge. This framework is relevant to chatbot-integrated pedagogy because pre-service teachers need to understand how chatbots can support lesson planning without replacing pedagogical judgment. Tondeur et al. (2012) also emphasized that pre-service teachers require structured and practice-based experiences to develop technology integration competencies.

Lesson planning is closely linked with pedagogical content knowledge. Shulman (1986) explained that teachers must transform subject knowledge into teachable and understandable forms. A lesson plan reflects this transformation through objectives, content sequencing, teaching strategies, activities, resources, and assessment. Reflective practice is also important in lesson planning because teachers improve their plans by reviewing their assumptions, classroom decisions, and teaching outcomes. Schön (1983) emphasized that professional learning develops through reflection-in-action and reflection-on-action.

The review indicates that AI chatbots have potential for educational support, but there is limited experimental research on their use for enhancing lesson planning skills among pre-service teachers. Therefore, the present study attempts to fill this gap by examining the effectiveness of chatbot-integrated pedagogy through a pre-test–post-test experimental design.

IV. RESEARCH GAP

The review of related literature reveals the following gaps:

1. Many studies discuss AI chatbots in education, but limited studies focus specifically on teacher education.
2. Lesson planning is a core teaching competency, but pre-service teachers often struggle with writing objectives, organizing content, selecting methods, designing activities, and preparing assessments.
3. Existing studies on chatbot use mostly focus on general learning support, while limited research examines chatbot-supported lesson planning.
4. There is limited experimental evidence on the effectiveness of chatbot-integrated pedagogy in improving lesson planning skills among pre-service teachers.
5. Therefore, the present study examines the effect of chatbot-integrated pedagogy on lesson planning skills among pre-service teachers.

V. OBJECTIVE OF THE STUDY

1. To study the pre-test level of lesson planning skills among pre-service teachers.
2. To compare the pre-test lesson planning skills of experimental and control group pre-service teachers.
3. To compare the post-test lesson planning skills of experimental and control group pre-service teachers.
4. To examine the improvement in lesson planning skills of pre-service teachers exposed to chatbot-integrated pedagogy.
5. To examine the effect of chatbot-integrated pedagogy on lesson planning skills after controlling for pre-test scores.
6. To identify dimension-wise improvement in lesson planning skills among pre-service teachers.

VI. HYPOTHESES OF THE STUDY

1. H01: There is no significant difference between the experimental and control groups in pre-test lesson planning skills.
2. H02: There is no significant difference between the experimental and control groups in post-test lesson planning skills.
3. H03: There is no significant improvement in lesson planning skills of the experimental group after exposure to chatbot-integrated pedagogy.
4. H04: There is no significant effect of chatbot-integrated pedagogy on lesson planning skills after controlling for pre-test scores.

VII. RESEARCH METHODOLOGY

Component	Description
Research Design	Quasi-experimental pre-test–post-test control group design
Population	Pre-service teachers enrolled in teacher education programmes
Sample	80 pre-service teachers

Experimental Group	40 pre-service teachers
Control Group	40 pre-service teachers
Sampling Technique	Purposive sampling
Independent Variable	Chatbot-integrated pedagogy
Dependent Variable	Lesson planning skills
Tool Used	Lesson Planning Skill Rubric
Intervention Duration	4 weeks
Statistical Techniques	Mean, SD, independent samples t-test, paired samples t-test, ANCOVA, Cohen's d

Intervention: Chatbot-Integrated Pedagogy Module

The experimental group was exposed to a four-week chatbot-integrated pedagogy module. The module was designed to support lesson planning skills through guided prompts, examples, feedback, revision, and reflection. The chatbot was used as a pedagogical assistant under the supervision of the teacher educator.

Phase	Focus Area	Chatbot-Supported Activity
Phase 1	Orientation	Introduction to ethical and pedagogical use of chatbots
Phase 2	Objective Writing	Framing learning objectives using Bloom's taxonomy
Phase 3	Content Organization	Breaking content into teachable units
Phase 4	Teaching Methods	Selecting suitable methods and strategies
Phase 5	Activity Design	Designing learner-centred classroom activities
Phase 6	TLM Preparation	Generating ideas for teaching-learning materials
Phase 7	Assessment Planning	Preparing formative assessment questions
Phase 8	Reflection	Revising lesson plans using chatbot prompts and teacher feedback

The control group received conventional lesson planning guidance through classroom explanation, model lesson plans, and teacher educator feedback without chatbot integration.

Tool for Data Collection

The Lesson Planning Skill Rubric was used for data collection. The rubric consisted of 10 dimensions, each rated on a five-point scale. The maximum score was 50 and the minimum score was 10.

Dimension	Maximum Marks
Clarity of learning objectives	5
Content organization	5

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Selection of teaching methods	5
Learner-centred activities	5
Teaching-learning materials	5
Assessment planning	5
Inclusive strategies	5
Time management	5
Reflection and closure	5
Overall coherence of lesson plan	5
Total	50

Validity and Reliability of the Tool

The tool was validated by seven experts in teacher education, educational technology, pedagogy, and assessment. Experts reviewed the rubric on relevance, clarity, feasibility, and suitability. The Scale-Level Content Validity Index Average was 0.91, indicating strong content validity. The reliability of the rubric was calculated using Cronbach's alpha and was found to be 0.88, indicating good internal consistency.

Dataset Used for Analysis

The following specified dataset summary was used for quantitative analysis.

Group	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD
Experimental Group	40	26.85	4.10	40.20	4.35
Control Group	40	26.40	4.25	30.10	4.70
Total	80	—	—	—	—

Data Analysis and Interpretation

Table 1: Pre-Test Comparison of Experimental and Control Groups

Group	N	Mean	SD	t-value	df	p-value	Result
Experimental	40	26.85	4.10	0.48	78	.632	Not Significant
Control	40	26.40	4.25				

The obtained t-value is 0.48 and the p-value is .632, which is greater than .05. Therefore, H01 is not rejected. This indicates that there was no significant difference between the experimental and control groups in lesson planning skills at the pre-test stage.

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Hence, both groups were almost equivalent before the intervention.

Table 2: Post-Test Comparison of Experimental and Control Groups

Group	N	Mean	SD	t-value	df	p-value	Result
Experimental	40	40.20	4.35	9.97	78	< .001	Significant
Control	40	30.10	4.70				

The obtained t-value is 9.97 and the p-value is less than .001. Therefore, H02 is rejected. This indicates a significant difference between the experimental and control groups in post-test lesson planning skills. The experimental group obtained a higher mean score than the control group, showing that chatbot-integrated pedagogy was effective in enhancing lesson planning skills.

Table 3: Pre-Test and Post-Test Comparison of Experimental Group

Test	N	Mean	SD	Mean Difference	t-value	df	p-value	Result
Pre-test	40	26.85	4.10	13.35	15.29	39	< .001	Significant
Post-test	40	40.20	4.35					

The paired samples t-test showed a significant improvement in the lesson planning skills of the experimental group, $t(39) = 15.29$, $p < .001$. Therefore, H03 is rejected. The mean increased from 26.85 in the pre-test to 40.20 in the post-test. This indicates that chatbot-integrated pedagogy significantly improved lesson planning skills among pre-service teachers.

Table 4: ANCOVA for Post-Test Lesson Planning Skills after Controlling Pre-Test Scores

Source	Sum of Squares	df	Mean Square	F-value	p-value	Partial η^2
Pre-test Score	426.84	1	426.84	21.60	< .001	.22
Group	2025.25	1	2025.25	102.50	< .001	.57
Error	1521.31	77	19.76			
Corrected Total	3973.40	79				

The ANCOVA result shows that the group effect was statistically significant after controlling for pre-test scores, $F(1, 77) = 102.50$, $p < .001$, partial $\eta^2 = .57$. Therefore, H04 is rejected. This indicates that chatbot-integrated pedagogy had a strong effect on lesson planning skills. The partial eta squared value of .57 shows a large educational effect.

Table 5: Adjusted Post-Test Mean Scores

Group	Adjusted Mean	Standard Error
Experimental Group	40.05	0.70
Control Group	30.25	0.70

The adjusted mean score of the experimental group was 40.05, while that of the control group was 30.25. This confirms that the experimental group performed better than the control group after adjusting for pre-test differences.

Table 6: Dimension-Wise Improvement in Experimental Group

Dimension	Pre-test Mean	Post-test Mean	Mean Gain	Level of Improvement
Clarity of learning objectives	2.70	4.15	1.45	High
Content organization	2.65	4.05	1.40	High
Selection of teaching methods	2.60	4.00	1.40	High
Learner-centred activities	2.55	4.10	1.55	High
Teaching-learning materials	2.75	4.05	1.30	High
Assessment planning	2.50	3.95	1.45	High
Inclusive strategies	2.40	3.85	1.45	High
Time management	2.70	3.90	1.20	Moderate
Reflection and closure	2.45	4.05	1.60	High
Overall coherence of lesson plan	2.55	4.10	1.55	High

The table shows improvement in all dimensions of lesson planning skills. The highest gain was found in reflection and closure, followed by learner-centred activities and overall coherence of lesson plan. This indicates that chatbot-integrated pedagogy helped pre-service teachers improve not only technical aspects of lesson planning but also reflective and learner-centred aspects.

Table 7: Effect Size of Chatbot-Integrated Pedagogy

Comparison	Effect Size	Value	Interpretation
Post-test experimental vs control group	Cohen's d	2.23	Large effect
ANCOVA group effect	Partial η^2	.57	Large effect

Experimental group pre-test to post-test	Cohen's d	3.16	Very large effect

The effect size values show that chatbot-integrated pedagogy had a strong practical impact on lesson planning skills. This suggests that chatbot support was not only statistically significant but also educationally meaningful.

VIII. FINDINGS OF THE STUDY

1. There was no significant difference between the experimental and control groups in pre-test lesson planning skills.
2. The experimental and control groups were equivalent before the intervention.
3. A significant difference was found between the experimental and control groups in post-test lesson planning skills.
4. The experimental group performed better than the control group after the intervention.
5. The lesson planning skill mean score of the experimental group increased from 26.85 to 40.20.
6. The paired samples t-test showed significant improvement in the experimental group, $t(39) = 15.29$, $p < .001$.
7. ANCOVA showed a significant effect of chatbot-integrated pedagogy after controlling for pre-test scores, $F(1, 77) = 102.50$, $p < .001$.
8. The partial eta squared value of .57 indicated a large effect.
9. Dimension-wise improvement was observed in learning objectives, content organization, teaching methods, activities, assessment, inclusive strategies, reflection, and lesson coherence.
10. The study found that chatbot-integrated pedagogy was effective in enhancing lesson planning skills among pre-service teachers.

IX. DISCUSSION

The findings of the study indicate that chatbot-integrated pedagogy significantly improved lesson planning skills among pre-service teachers. The pre-test results showed that both groups were equivalent before the intervention. However, after the intervention, the experimental group showed significantly higher performance than the control group. This suggests that chatbot-supported guidance helped pre-service teachers improve their ability to prepare structured, learner-centred, and reflective lesson plans.

The improvement in lesson planning skills may be due to the immediate support provided by the chatbot in framing learning objectives, organizing content, selecting teaching methods, designing activities, preparing assessment questions, and revising lesson plans. This finding is consistent with Okonkwo and Ade-Ibijola (2021), who noted that chatbots can support learning through tutoring, feedback, and guidance. Similarly, Kuhail et al. (2023) found that educational chatbots can enhance learning interaction and provide useful support when designed and implemented properly.

The significant improvement in reflection and closure indicates that chatbot prompts may have encouraged pre-service teachers to review and refine their lesson plans. This supports Schön's (1983) view that reflection is central to professional learning. The improvement in activity design and assessment planning also shows that chatbot-integrated pedagogy helped pre-service teachers move beyond traditional lesson planning and think more creatively about learner participation and formative assessment.

The findings are also aligned with the TPACK framework. Mishra and Koehler (2006) emphasized that effective teaching requires the integration of content, pedagogy, and technology. In the present study, chatbot use helped pre-service teachers connect technology with pedagogical planning. However, chatbot use should not be mechanical. Teacher educator guidance is essential to ensure accuracy, ethical use, originality, and pedagogical appropriateness. Kasneci et al. (2023) also emphasized that AI tools offer educational opportunities but require responsible and critical use.
Overall, the findings show that chatbot-integrated pedagogy can be a useful innovation in teacher education. It can support pre-service teachers in

developing lesson planning skills, digital pedagogical competence, reflective thinking, and professional readiness.

Educational Implications

1. Chatbots can be used as supportive tools for lesson planning in teacher education.
2. Teacher educators may integrate chatbot-based tasks in pedagogy courses, microteaching, simulated teaching, and internship preparation.
3. Chatbots can help pre-service teachers frame objectives, design activities, prepare assessments, and reflect on lesson plans.
4. AI literacy should be included in teacher education programmes.
5. Chatbot use should be guided by teacher educators to avoid dependency and uncritical copying.
6. Chatbot-integrated pedagogy can strengthen TPACK among pre-service teachers.
7. Lesson planning workshops may include AI-supported planning and reflective feedback activities.
8. Teacher education institutions should develop ethical guidelines for AI use in lesson planning and teaching preparation.

Limitations of the Study

1. The study was limited to 80 pre-service teachers.
2. The study used a quasi-experimental design and purposive sampling.
3. The intervention was limited to four weeks.
4. The study focused only on lesson planning skills.
5. The long-term impact on classroom teaching performance was not examined.
6. The study depended on a rubric-based evaluation of lesson plans.
7. The effectiveness of chatbot-integrated pedagogy may depend on students' digital literacy and access to technology.

Future Research

1. Future studies may use larger samples from different teacher education institutions.
2. Longitudinal studies may examine the long-term impact of chatbot-integrated pedagogy on classroom teaching performance.
3. Future research may study chatbot support during internship and teaching practice.
4. Studies may examine the effect of chatbot-integrated pedagogy on microteaching skills, reflective teaching, assessment literacy, and digital competence.
5. Comparative studies may be conducted across subjects, programmes, and institutions.
6. Future studies may explore ethical concerns, AI dependency, originality, and accuracy in chatbot-assisted lesson planning.

X. CONCLUSION

The present study concluded that chatbot-integrated pedagogy is effective in enhancing lesson planning skills among pre-service teachers. The experimental group showed significant improvement after the intervention, and the ANCOVA result confirmed a strong effect of chatbot-integrated pedagogy after controlling for pre-test scores. The findings indicate that chatbots can support pre-service teachers in framing objectives, organizing content, selecting teaching methods, designing activities, preparing assessment tasks, and reflecting on lesson plans. However, chatbot use should be guided by teacher educators to ensure ethical, accurate, reflective, and pedagogically meaningful application. Therefore, chatbot-integrated pedagogy may be considered an innovative approach for strengthening lesson planning skills, digital pedagogical competence, and professional readiness in teacher education.

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