Evaluating the Use of Artificial Intelligence in Designing Lesson Plans for Teaching Ideological and Political Education Among Chinese Pre-Service Teachers

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Abstract. This qualitative research explores the potential of using an AI tool (i.e., ERNIE Bot) to facilitate Chinese pre-service teachers in developing lesson plans in ideological and political education. A total of seven participants created the initial draft of their own lesson plans and then sought assistance from ERNIE Bot to revise and further develop their lesson plans. A one-on-one semi-structure interview based on AI-TPACK framework was conducted to explore these participants' perceptions of using this AI tool for lesson plan development. Findings showed that ERNIE Bot provides convenience and operability, enhances the structure of lesson plans, adapts to diverse student needs, and supports multiple assessment designs. Yet, this study also revealed several issues in producing precise, contextually relevant content and expressing emotional subtleties. This study provides insights into the opportunities and challenges presented by integrating AI into lesson plan development, aiming to offer implications for the professional development of future educators.

Keywords: Artificial intelligence (AI), lesson plan development, pre-serve teachers, ideological and political education, ERNIE Bot.

1. Introduction

A lesson plan is a structured outline that organizes instructional methods, forming the foundation for effective teaching and supporting student achievement [1, 2]. Effective lesson plans could facilitate student learning, serving as a crucial factor [3, 4]. A well-structured lesson plan could also promote student engagement, making learners more active and self-motivated [5]. With the widely used of artificial intelligence (AI) in education, these tools have a significant promise for effective lesson plan development.

AI tools can streamline challenging tasks in teaching, such as creating assessments, grading, and recommending resources [6]. AI could also support teachers by facilitating material collection, saving time, and enhancing teaching efficiency [7]. Specifically, these tools could significantly improve the efficiency and quality of lesson planning, reducing teachers' workload by generating dynamic, personalized plans based on curriculum and student data, which enhances the educational experience [8]. For example, Sundin (2024) used broad observations from five classes with 8th Grade students and sociocultural contexts, and the results concluded that the integration of AI in preparing English for second language lessons presents a significant possibility to alleviate the challenges faced by contemporary instructors [9]. Powell and Courchesne (2024) conducted an exploratory case study examining a science lesson design activity using a series of prompts and responses from ChatGPT—one widely used AI tool. They discovered that within just 30 minutes, a lesson plan could be created and significantly refined to precisely align with the intended curriculum framework and the 5E instructional model [10]. Moreover, using a case study from the spring semester of the 2022–2023 semester, Broutın (2024) investigated how mathematics teacher candidates utilized ChatGPT to create lesson plans, paying close attention to the usage schemes and purposes. The findings showed that ChatGPT was used as a tool by teacher candidates in these procedures and that they created various usage schemes for the lesson plan development [11].

While AI has demonstrated potential benefits in lesson planning for various subjects, there is a lack of research focusing on its application in the context of ideological and political education especially in China. The ideology and politics class, a core subject in school curricula, is integral to

conveying national will and cultural heritage [12]. Political and ideological education supports students in developing a solid ideological foundation and promotes holistic growth in moral, intellectual, physical, and aesthetic areas, aligning with the aims of communist modernization [13]. In an era where information technology advances rapidly, global competitiveness increasingly depends on talent cultivation. Students, representing the nation's future and social advancement, are essential in this regard. Political and ideological education, deeply rooted in the party's tradition in China, reinforces its importance to the national development [14].

However, traditional teaching methods in ideological and political education face growing challenges, prompting a reevaluation of instructional approaches [15]. Key issues include ineffective subject-object interaction and a lack of real-world connections in Civic and Political Education, with outdated curriculum materials further limiting relevance [16]. As students increasingly possess diverse interests, active thinking, and higher cultural awareness, the textbook-centered approach struggles to meet their needs, weakening the impact of political education [17, 18]. As a result, to effectively teaching ideological education was restricted, with practical teaching hindered by superficial, one-sided partnerships, and unoptimized content [19].

To solve this issue, this study aims to explore the effectiveness of incorporating AI in assisting Chinese pre-service teachers to revise and further develop lesson plans for ideological and political concepts. The research question guides the study is: How do Chinese pre-service teachers perceive the effectiveness of using AI in the lesson planning process for ideological and political education? It is expected that this study will enlighten educators, policymakers, stakeholders to understand the benefits and issues of integrating AI in the ideological and political education, thus promoting the use of AI in this field.

2. Literature Review

2.1. AI in Education

AI is broadly defined as technology enabling computer systems to perform human-like tasks, including learning, adaptation, and complex processing [20]. Originally described as the "science and engineering of creating intelligent machines" [21]. Today, AI has encompassed a blend of natural language processing, algorithm development, and machine learning [22] that could tranform the education. For example, AI could assist teachers to gather materials, save time, and improve training [7]. Tools such as ChatGPT can serve as a versatile assistant, helping as a content provider, teaching assistant, and evaluator [23], and aiding in organizing and managing learning environments [24]. Furthermore, AI could facilitate personalized learning through providing resources based on individual needs and fostering a dynamic and engaging educational experience that aligns with modern educational goals [25, 26].

With the growing presence of AI in classrooms, researchers emphasize human-AI collaboration, suggesting that combining human facilitation with AI's capabilities would enhance learning outcomes more effectively than either alone [27]. By integrating human educational expertise with AI's analytical strengths, a customized approach can be developed to better meet diverse student needs [28]. One particular practice is to integrate AI into the development of lesson plans.

2.2. Developing Effective Lesson Plans

A lesson plan is a methodical framework that arranges teaching strategies, serving as the cornerstone of successful instruction and promoting student success [1, 2]. It enables teachers to confidently manage classroom dynamics, organize learning activities, and avoid instructional challenges [9]. A well-designed and goal-oriented lesson plan is crucial for enhancing educational outcomes and fostering successful teaching practices [29, 30, 31, 32 ,33]. To develop effective lesson plans is fundamental to teachers' professional growth, bridging the gap between pre-service training and practical application in the classroom and supporting both novice and experienced educators in refining their teaching practices [34, 35]. Effective lesson preparation is also a critical component

associated with better student learning outcomes [3, 4]. Students would be more engaged and self-motivated if provided with a well-structured lesson plan [5], which would also aid in classroom management by optimizing time and clarifying student expectations [36], as well as providing meaningful learning opportunities for all students [37].

However, creating an effective lesson plan can be challenging, especially for new teachers, as they often lack experience with efficient teaching techniques [38, 39, 40]. New teachers may struggle to gather necessary resources for planned activities, often relying on textbooks, online materials, and previous established lesson plans [41]. According to a report in the US, lesson planning is also time-consuming that usually requires teachers to spend an average of seven hours per week for its development, contributing to an overall workweek of 53 hours when including planning, instruction and grading responsibilities [42, 43].

2.3. Using AI to Create Lesson Plans

To overcome the challenges of developing effective lesson plans, AI tools are considered to have the potential for improve the efficiency and quality of lesson planning, reducing teachers' workload by generating dynamic and personalized plans based on curriculum and student data, which would enhance their teaching experience [8]. For instance, Baytak (2024) used content analysis within the scope of a qualitative study and discovered that the expected learning objectives, activities, teachers' roles, and assessment created by AI tools are in accordance with that designed by human instructors which is used in the classroom [44]. Li et al. (2024) requested human educators and ChatGPT to devise five lesson plans with each to investigate the potential of ChatGPT in supplanting human teachers in lesson plan creation. The study revealed that ChatGPT can utilize its robust data collection and processing capabilities to enhance the relevance of educational content and improve its alignment [45].

Additionally, acting as a "guide on the side" and "co-designer," AI could support teachers in creating instructional materials and sequencing content, allowing more time for tailored lesson planning [46, 47, 48]. AI tools such as ChatGPT also brings new dimensions to instructional design with real-time feedback on materials, fostering active learning through interactive resources and multimedia [49, 50, 51, 52]. For instance, Sun (2024) used questionnaires and interviews to explore Chinese pre-service teachers' perceptions of lesson plans generated by human beings vs. those created by ChatGPT, and findings highlight that Chinese pre-service teachers view ChatGPT-generated lesson plans as both inspirational and valuable knowledge bases [23]. Evaluated through both quantitative (percentage of time savings) and qualitative (user satisfaction) criteria, Karpouzis et al. (2023) demonstrated that AI-generated lesson plans could address varied learning demands, hence improving the educational experience and promoting adaptation [25]. Additionally, Powell and Courchesne (2024) used an exploratory case study method to explore the potential impact of teachers' use of ChatGPT to develop lesson plans. They found that ChatGPT successfully applied the 5E model in lesson planning, showcasing its potential for flexible, innovative instruction [10]. Furthermore, Sun (2024) found that pre-service teachers perceived both ChatGPT- and human-generated lesson plans as valuable [23].

2.4. Challenges of Using AI to Develop Lesson Plans

However, AI's responses can sometimes seem robotic or formulaic, lacking the natural flow and uniqueness of human interaction [53]. For instance, ChatGPT's effectiveness in educational settings depends on addressing concerns and resolving issues around its use [54]. While ChatGPT excels at delivering accurate information, it lacks the emotional support and human connection fundamental to effective teaching [55]. There are also concerns regarding ChatGPT's potential of being "ultimate epistemic authority," despite instances of generating false information and limited evidence backing its outputs [50, 56, 57, 58].

Therefore, the use of AI in lesson plan design presents challenges, particularly in ensuring accuracy, quality, and ethical AI usage in education. Research has identified several drawbacks of

using ChatGPT for course design, including a lack of understanding of the course context, creation of impractical activities, and provision of inaccessible resources [59]. Other issues include unclear instructions, excessive discussion exercises, shallow evaluations, and inconsistent outcomes [60]. Concerns have also been raised about content veracity, harmfulness, bias, and unfairness on AI platforms [61, 62]. Therefore, fostering proper use of AI tools would help address ethical concerns and ensure quality control [63]. Lastly, overreliance on AI could reduce teachers' engagement in the creative aspects of lesson planning [64].

2.5. The Current Study

As mentioned above, ideological and political education plays a vital role in the all-round development of students and the modernization of China, however, traditional teaching methods in this subject usually faces growing challenges, prompting a reevaluation of instructional approaches [15]. Therefore, with the widely used of AI tools in education, teachers begin to integrate this tool in ideological and political education. For example, virtual simulation technology, incorporating AI tools like intelligent classrooms, tutoring, and assessment systems, is transforming ideological and political education by enhancing teaching quality and introducing a modernized approach to theoretical instruction. Li and Dong (2022) developed an AI-driven online platform that leverages mobile and AI technology to collect extensive ideological data, optimize platform functionality, and create a flexible virtual learning environment accessible from anywhere at any time. This platform enables resource sharing and facilitates online teaching for ideological subjects [13]. Similarly, Yan (2024) highlighted AI's potential to enhance personalization, interactivity, and decision-making, particularly through intelligent tutoring, virtual reality, and big data analysis, fostering effective assessment and feedback systems [65].

Yet, limited study has researched on AI's role in supporting lesson plan development for ideological and political education in China. Therefore, this study aims to explore the effectiveness of AI in assisting Chinese pre-service teachers to create lesson plans by integrating an AI tool in the development of lesson plans for ideological and political concepts. AI-TPACK was used as the theoretical framework.

2.6. AI-TPACK Framework

The Technological Pedagogical and Content Knowledge (TPACK) framework (see Figure 1) has become essential for understanding effective technology integration in education by combining Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK) along with their intersections [66]. Originating from Shulman's Pedagogical Content Knowledge (PCK) concept, TPACK provides a comprehensive model for evaluating teachers' effectiveness in using technology to enhance subject-specific learning [67]. CK refers to the information used by teachers to impart knowledge in particular subject areas, such as science or mathematics [68, 69]. PK refers to knowledge about the pedagogical process, methodologies, and practices including the creation of lesson plans, the choice of teaching techniques, classroom management techniques, and evaluations of student conduct and academic achievement [70, 71]. TK is defined as knowledge of how to use emerging technologies [72].

Since the early 2000s, TPACK has seen a rapid research growth, establishing itself as a critical tool for teacher professional development and education research [73]. TPACK's adaptable structure considers the subject matter, learner characteristics, and instructional goals, supporting both teacher-centered and student-centered methodologies and fostering pedagogical innovation. This model enables targeted training by identifying strengths and areas for improvement, setting a standardized language and framework for analyzing technology integration across educational contexts [73].

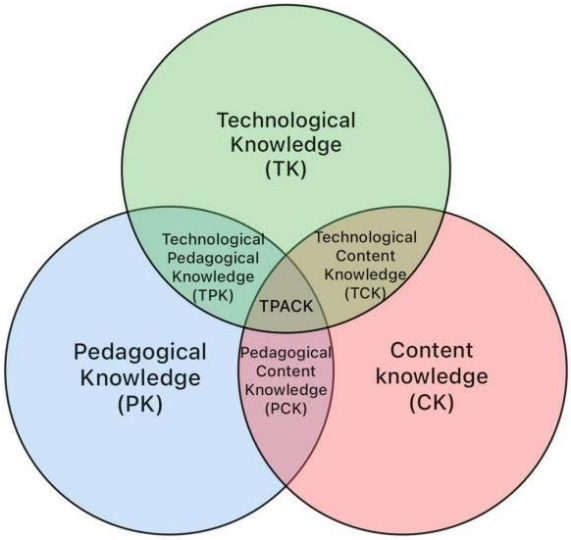

Figure 1. TPACK Framework, adopted from Koehler and Mishra (2009) [74]

Research in AI education has extended the TPACK model to include AI integration, termed AI-Technological Pedagogical Content Knowledge (AI-TPACK) (see Figure 2) [73]. Technology is more dynamic than pedagogical and subject-matter knowledge in this framework, which assumes knowledge elements would change. Technological Pedagogical Knowledge (TPK) became AI-TPK, Technological Content Knowledge (TCK) became AI-TCK, and TPACK became AI-TPACK, which included AI literacy. Today's pre-service teachers, often seen as digital natives, generally demonstrate a greater affinity for AI technology than in-service teachers, who are often considered digital immigrants [75, 76]. Therefore, the AI-TPACK model has been used for research specifically focusing on AI's utilization in education [77, 78].

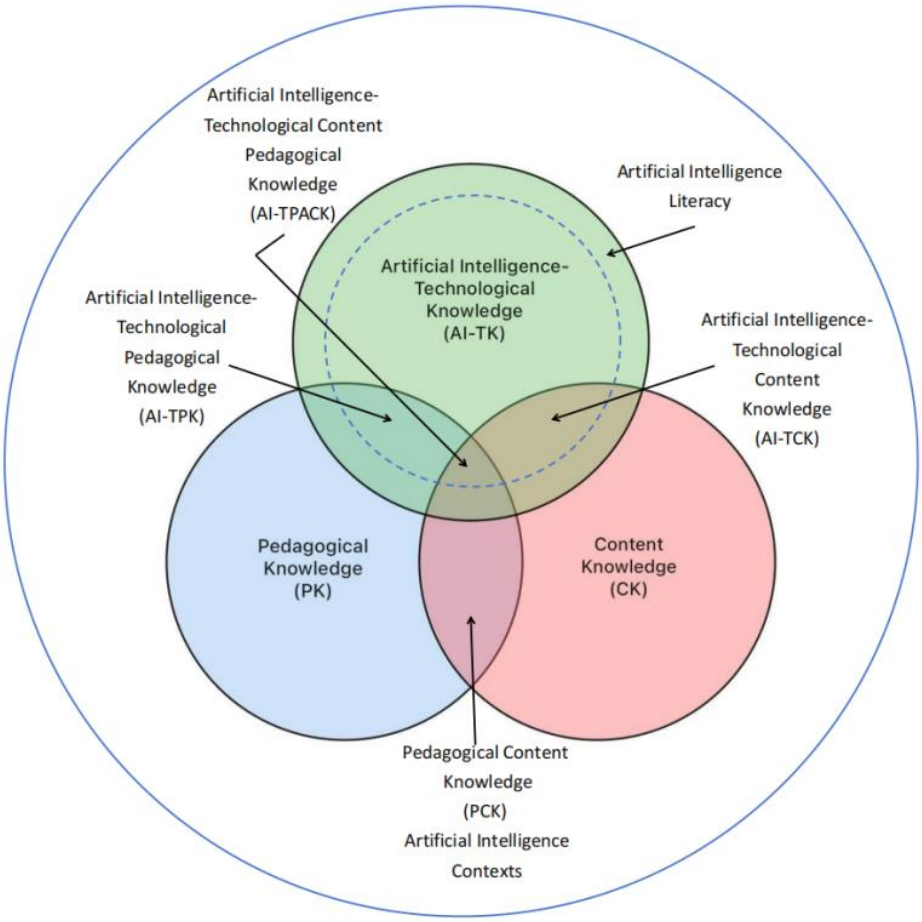

Figure 2. AI-TPACK Framework, adopted from Celik (2023) [73]

3. Methods

3.1. Activity design

Participants, who are pre-service teachers, were asked to create a 40-to-50-minute lesson plan for an ideological and political education course at their choice, encompassing fundamental elements such as teaching objectives and instructional exercises. The courses developed by the participants primarily focus on legal education and life skills education. During the process, the participants used an AI tool (i.e., ERINE Bot) to facilitate their development of the lesson plan. To be specific, participants were asked to draft their own lesson plan, and they were allowed to ask the AI for help if they were having challenges such as creating cases, examples, or activities during the process. The researcher also requested the lesson plan curriculum from interviewees. The teaching material offered detailed information on the course objectives, teaching schedule, lesson content, and assessment method, which would expand the researcher's understanding of these pre-service teachers' experiences of using ERINE Bot to design their lesson plans.

ERNIE Bot is a generation of Baidu's knowledge improvement big language model that can communicate and engage with people, respond to enquiries, help with creativity, and facilitate the quick and convenient acquisition of information, knowledge, and inspiration. It has the technological benefits of knowledge improvement, retrieval enhancement, and conversation enhancement as a result of adopting supervised fine-tuning, human feedback reinforcement learning, prompting, and other technologies. ERNIE Bot and ChatGPT are similar in their core functionality, both being advanced AI models capable of natural language processing and conversational tasks. However, ERNIE Bot is tailored to Chinese language and culture, making it a more suitable replacement in China, where ChatGPT is blocked, offering localized features and better integration with Chinese contexts and content.

3.2. Participants

A total of seven participants were recruited in this study. All of them are pre-service teachers specializing in ideological and political education, comprising one male and six females. Their average age ranges from 22 to 23 years old (M=22.5). All the participants have some experiences using ERNIE Bot before, and they have completed basic teacher training, qualifying them to serve as instructors of ideological and political education in secondary schools. The lesson plans they designed includes Protect life, All People Abide by the Law, System of Self-governance at the Community Level, and Impartial Administration of Justice. Most of the lesson plans were designed for 7-12 graders with one for 5-6 graders.

3.3. Instruments

A one-on-one semi-structure interview last for about 40 to 60 minutes was conducted for each participant. The interview consisted of 14 questions focusing on understanding participants' perspectives of using ERNIE Bot to develop their lesson plans based on the seven components of the AI-TPACK framework. All interviews were videotaped with the consent of the participants for further analysis. Table 1 includes sample questions for the interview.

Table 1. Interview Sample Questions

AI-TPACK Components	Sample questions
Technological Knowledge (TK)	Can you describe your experience using the ERNIE Bot during the lesson plan development? How convenient did you feel using it?
Pedagogical Knowledge (PK)	In what ways did the ERNIE Bot support (or hinder) your efforts to align lesson plans with diverse student needs?
Content Knowledge (CK)	How did the ERNIE Bot affect your approach to teaching ideological and political concept? Did it help you think differently about the content you were preparing to teach?
Technological Pedagogical Knowledge (TPK)	Did using the ERNIE Bot inspire any changes in your approach to designing assessments or measuring student learning outcomes?
Technological Content Knowledge (TCK)	To what extent did the ERNIE Bot help you generate new ideas for delivering complex concepts in your subject area?
Pedagogical Content Knowledge (PCK)	How did the ERNIE Bot assist you in connecting pedagogical strategies with the content you were teaching?
AI-Technological Pedagogical Content Knowledge (AI-TPACK)	How do you see AI technology enhancing your future teaching practice beyond lesson planning?

3.4. Data collection and analysis

The interview recordings were converted into text with WPS Office for thematic analysis, with the objective of assessing pre-service teachers' attitudes towards utilizing the AI tool for designing lesson plans and identifying benefits and potential problems. The interview transcripts were qualitatively examined using a multiple-case study methodology. The case study approach, which focused on current events and gave the researcher little control over the data, was especially helpful in addressing the "how" and "why" components of the participants' perspectives of using the AI tool [79]. In this study, each participant was handled as an individual case. In accordance with Braun and Clarke's (2006) recommendations, thematic analysis was used to look at the participants' comments from the interviews [80]. The presenting of the participants' genuine voices was made easier by this method. A codebook was created as a result of the first coding phase, which depended on each participant's replies. The authors used an inductive open-coding technique in the second phase of analysis, comparing notes to find key themes. In order to provide strong and convincing study findings, the themes were finally finalized in the last round [79, 81]. The logic and development of the case design and data analysis procedure were shown in Figure 3.

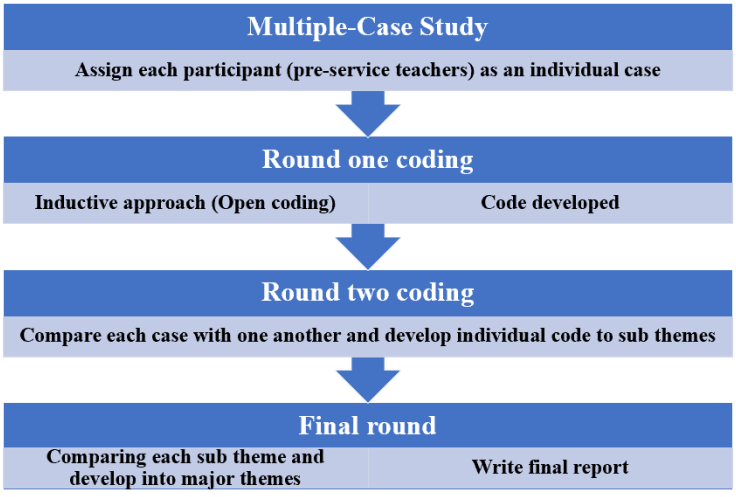

Figure 3. Multiple-case Study Coding Steps

4. Findings

To answer the research question "How do Chinese pre-service teachers perceive the effectiveness of using AI in the lesson planning process for ideological and political concepts?" thematic analysis shows five themes: 1) convenience and operability of ERNIE Bot, 2) enhancing the structure of lesson plans, 3) adapting to diverse student needs, 4) supporting multiple assessment design, and 5) challenges in using ERNIE Bot.

4.1. Theme 1: Convenience and Operability of ERNIE Bot

The participated pre-service teachers believed that ERNIE Bot were easy to use and function efficiently. First of all, these teachers noted that ERNIE Bot often provides a straightforward and friendly interface and interaction mode. For example, one pre-service teacher said, "…the interface of ERNIE Bot is relatively simple, there are few modules, and all of them are in Chinese, it is convenient for beginners to start using AI tools." Other participants believed ERNIE Bot's interface is user-friendly and enable them to "easily browse various functions and tools" without require extensive technical knowledge. Additionally, these pre-service teachers reported that the response speed of ERNIE Bot is fast, as one participant mentioned, "ERNIE Bot can generate Chinese content at a fast speed, almost without waiting. I can efficiently complete the preliminary design of the curriculum plan." Similarly, another comment highlights that "Whether facing complex problems or simple queries, ERNIE Bot can quickly capture key information, conduct rapid analysis and give satisfactory answers." Such immediate response leads to a "smooth experience of asking and answering." Lastly, the pre-service teachers expressed that ERNIE Bot is proficient in generating Chinese content, which makes it convenient for them to use it for creating materials in their native language. Specifically, one pre-service teacher noted, "When it comes to producing Chinese materials, ERNIE Bot excels. Depending on your teaching target student group, it may produce sample questions, offer brief explanations, and even suggest course ideas." Another participant mentioned, "Chinese language can be used in ERNIE Bot, which shortens the learning curve for new Chinese users of AI tools."

4.2. Theme 2: Enhancing the Structure of Lesson Plans

ERINE Bot's capacity to assist in lesson planning, particularly in structuring lesson plans' outlines, was emphasized by the pre-service teachers. Specifically, on one hand, ERNIE Bot can quickly generate the course structure and point out important points that are easily overlooked by those teachers. For example, one pre-service teacher highlighted that ERNIE Bot could assist her in "…sorting, classifying and integrating the content, ensuring smooth connection between various topics of the course, and improving the quality of the course." Because of its natural language processing feature, ERNIE Bot can additionally help these pre-service teachers to "express their needs clearly, analyze the learning needs of the target student population and teaching content", and gradually guides these teachers to improve the structures of their lesson plans all through the human-AI conversation. On the other hand, ERNIE Bot can help improve the logic of the lesson plan structure, especially in sorting out and classifying teaching content. For instance, one pre-service teacher mentioned that "ERNIE Bot supports optimizing the logical structure of the curriculum, such as ensuring that the sequence and content of teaching links meets the teaching objectives and actual classroom needs." Moreover, other participants emphasized that ERNIE Bot could "make the connection between various topics of the curriculum smoother."

4.3. Theme 3: Adapting to Diverse Student Needs

ERNIE Bot can cater to different student needs by providing diverse resources and suggestions. For instance, one participated reported that "ERNIE Bot can combine text, pictures, videos and other multimedia resources to make my course more inclusive and meet the needs of students with different learning styles." Specifically, some highlighted that "For visual learners, ERNIE Bot recommends

the use of pictures, charts, flow charts, videos and other visual aids." Others praised that ERNIE Bot also offered strategies such as "…role-playing and simulated debate, to help students with different learning styles maintain their learning enthusiasm." Second, ERNIE Bot can quickly generate learning content across different levels of difficulty and types, thus "help teachers design rich teaching materials for students at different levels", as one participant said, "ERNIE Bot can adjust the content according to students' language ability and interests, which makes the curriculum design more diversified and targeted."

However, limitations in addressing deeper emotional or contextual diversity were also mentioned. Although "ERNIE Bot could provide suggestions based on the age of students and the subject of the course", as one pre-service teacher argued that "it [ERNIE Bot] takes less consideration of the social, historical and cultural background, and needs additional materials." Similarly, another participant echoed that "When creating targeted learning materials, ERNIE Bot can quickly generate diverse content, but occasionally shows prejudice or stereotypes."

4.4. Theme 4: Supporting Multiple Assessment Design

ERNIE Bot often suggests alternative assessment strategies to the pre-service teachers for fostering deeper engagement and understanding. Particularly, ERNIE Bot pays special attention to the comprehensive ability of the targeted students. For example, one pre-served teacher was impressed that "ERNIE Bot enlightens me to arrange after-school activities based on students' actual life to help them consolidate and understand knowledge and promote their all-round development." Others shared that ERNIE Bot would recommend course assignments based on practical problems, such as "…asking students to make suggestions for community governance, which enables them to apply knowledge to practice." Additionally, ERNIE Bot tends to design open-ended questions to evaluate students' learning performance and outcome by "suggesting the method of mind mapping, allowing students to draw their own mind mapping of this lesson to help them remember and understand." Finally, ERNIE Bot suggests designing "open-ended topics such as small papers and hand copied newspapers to stimulate students' thinking and cultivate their creativity."

4.5. Theme 5: Challenges in Using ERNIE Bot

Some challenges were noted related to generating accurate, context-specific content and conveying emotional nuances when using ERNIE Bot. To be specific, ERNIE Bot creates content based on a large number of corpora, yet the materials it generates are not always entirely accurate or educational. One pre-service teacher highlighted that, "The generated content or issues sometimes contain errors or do not meet the requirements of the ideological and political discipline, which requires additional manual inspection and adjustment." Also, the content ERNIE Bot generates are usually too general to use, as one participant said, "It [ERNIE Bot] often spreads out all knowledge points equally in assisting practical lesson plan design without achieving appropriate detail." Likewise, another participant reported that, "…it [ERNIE Bot] cannot always provide targeted recommendations based on the specific needs of the teaching audience, and requires teachers to frequently adjust and supplement materials." In addition, content generated by ERNIE Bot is usually follows a fixed template, and its language is relatively stiff, lacking emotion and humanistic care, as one discussed, "The generation of teaching content focuses on the transmission of logic and information, but there are often deficiencies in emotional communication, teacher-student relationship and other humanistic care." Another participant furthermore added,

Each teacher has a different language style, and the lesson preparation content generated by AI may not match the personalized style of the teacher. For example, some AI generated teaching content is too formulaic, lacking the unique thinking and language characteristics of teachers, and lacks infectivity to students.

5. Discussions

The findings provide insights into pre-service teachers' perceptions of using AI, specifically ERNIE Bot, for lesson planning in teaching ideological and political concepts. The findings demonstrate how ERNIE Bot contributes to the intersections, enhancing instructional practices, while highlighting both its potential and limitations.

First of all, the convenience of ERNIE Bot emerged as a primary advantage, reflecting the role of AI in advancing TK. The pre-service teachers consistently reported that ERNIE Bot's intuitive interface and rapid responses optimized the lesson preparation process by automating repetitive tasks. This automation aligns with AI-TK, as it allows pre-service teachers to redirect their focus to creative and strategic dimensions of pedagogy. Such efficiency not only mirrors the findings of prior studies [8] but also illustrates how AI-TPK enables a smoother integration of technology into educational practices, facilitating more effective lesson planning.

Another finding was ERNIE Bot's ability to improve the organization and structure of the lesson plans, which directly supports AI-TCK. Participants noted that the tool facilitated logical sequencing, ensured smooth transitions between course components, and addressed neglected aspects in initial drafts. These capabilities emphasis on effectively using AI technologies to refine and enhance content delivery. By aiding in curriculum organization and resource development, ERNIE Bot reflects how AI-TCK can amplify pre-service teachers' ability to present complex content coherently, supporting pedagogical innovation and instructional goals [47].

Additionally, ERNIE Bot's capacity to align teaching strategies with subject-specific content. The participated pre-service teachers highlighted how the tool helped them create their lesson plans that not only presented content effectively but also tailored pedagogical methods to the ideological and political themes they were teaching. For example, ERNIE Bot's ability to identify key concepts and provide targeted explanations. This would reflect the integration of PCK, where pedagogy and content work together to achieve instructional goals. This interplay of PCK also shows the importance of connecting the "what" (CK) with the "how" (PK) of teaching, enhanced by AI's analytical and generative capabilities.

Furthermore, ERNIE Bot's capacity to meet diverse student needs highlights its role in bridging AI-TK and CK. The tool provided customized recommendations tailored to various learning styles, such as visual and auditory, and suggested exercises for different skill levels. This personalization aligns with AI-TCK, as it illustrates how AI can integrate contextual knowledge into content design. Additionally, ERNIE Bot's support for innovative assessment methods, such as peer reviews, thought maps, and role-playing activities, reflects AI-TPK's focus on advancing pedagogical strategies. These features shift the emphasis from traditional evaluations to more interactive and reflective assessments, fostering critical thinking and engagement in line with modern pedagogical trends [6].

Despite these advantages, the study identified limitations that highlight gaps in the integration of AI-TK, PK, and CK within the AI-TPACK framework. For instance, ERNIE Bot occasionally produced inaccurate content and struggled to incorporate contextual nuances, such as cultural and geographical factors. These shortcomings reveal the limitations of AI-TCK, where the technology's lack of contextual sensitivity necessitates human intervention to refine and adapt its outputs. This finding also resonates with previous research regarding the risks of AI-generated content, emphasizing the need for educators to critically evaluate and modify AI-produced materials [56, 58].

Finally, ERNIE Bot-generated content was criticized for lacking emotional depth, reflecting an underdeveloped integration of AI-TK and the affective dimensions of pedagogy, aligning with prior studies showing that AI-generated language is frequently perceived as cold and detached, which can undermine its effectiveness in fostering meaningful teacher-student interactions [55]. Our participants noted that the rigid templates and impersonal tone of AI-generated language fell short of providing the empathy and humanistic care essential for effective teaching. This limitation indicates the importance of human elements within the AI-TPACK framework, suggesting that while AI can enhance instructional design, it cannot fully replicate the relational aspects of teaching.

6. Implications

Ideological and political education is crucial for students' holistic development and the nation's modernization. As a mandatory course, its concepts are often complex, making it challenging for pre-service teachers to design effective cases or activities that engage students. The findings suggest that incorporating AI as a facilitator in the lesson planning process can assist future educators in developing engaging activities, simplifying complex concepts, and providing valuable insights throughout the planning process. Therefore, this study proposed several strategies to better prepare pre-service teachers to use AI tools such as ERNIE Bot in designing lesson plans for ideological and political education.

First, given the rapid advancement of AI tools, pre-service teachers should cultivate a mindset of perpetual learning. They should consistently enhance their knowledge and skills to stay updated on technological innovations. Pre-service teachers should possess the ability to evaluate and comprehend AI-generated information to optimize instructional strategies and improve student learning outcomes. Moreover, critical thinking skills are essential for accurately assessing the pedagogical efficacy of AI systems and determining their genuine contribution to student learning and advancement.

Second, institutions should provide professional development programs to increase pre-service teachers' awareness of AI in education and familiarize them with the functions of specific AI tools. Institutions can also offer practical workshops that enable pre-service teachers to use AI tools for lesson planning. These workshops should include instruction on refining and adapting AI-generated outputs to meet specific educational goals and classroom needs.

Lastly, this study revealed notable issues, particularly concerning the precision and relevance of the information generated by ERNIE Bot. Therefore, pre-service teachers must validate ERNIE Bot's outputs to ensure they align with curricular requirements and correct factual inaccuracies, which are especially critical in domains like ideological and political education. In short, given the limitations of AI tools in creating lesson plans, active teacher involvement is necessary to enhance AI-generated material and tailor it to specific classroom environments. Sole reliance on AI is insufficient as high-quality teaching often requires the expertise and interaction of educators.

7. Conclusion

Several limitations exist. First, the sample size of this study was small with only seven participants focusing on ideological and political education. Therefore, future studies should recruit more teachers from different subjects and levels to examine pre-service teachers' perspectives of using AI tools for designing lesson plans. Furthermore, data was only collected through interviews. Thus, future studies should collect quantitative data such as via a survey to offer more comprehensive understanding of how AI affects pre-service teachers' lesson planning. Additionally, this study only explores pre-service teachers' perceptions of using AI to design lesson plans. Further study should be conducted to investigate students' experiences, such as learning engagement and course satisfaction, in classes where lesson plans designed with the facilitation of AI tools are implemented, thus providing insights into the effectiveness of AI-assisted lesson plans in real classroom settings.

In conclusion, AI tools such as ERNIE Bot have the potential to facilitate pre-service teachers to develop lesson plans. Yet, there is a need for careful integration, continual refinement, and human involvement. By addressing the limitations of these tools while applying their strengths, educators could enhance teaching effectiveness and motivate more meaningful learning experiences.

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