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The 5P Funnel Framework: An AI-Integrated Instructional Design for Enhancing Teacher Professional Development

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Abstract

Currently, the education sector is undergoing a transformation centered around artificial intelligence, continually optimizing resource allocation, promoting educational equity, and enhancing the personalization, interactivity, and intelligence of learning, making education simpler, more enjoyable, and sustainable. To ensure that teachers can use artificial intelligence responsibly and effectively, UNESCO has released the “AI Competency Framework for Teachers” aimed at promoting lifelong professional development for educators. In this context, research on instructional design that can achieve this goal becomes particularly important. This study proposes an expanded “5P Funnel” framework based on the

“3P Funnel”. The framework includes five key elements: Purpose (teaching objectives), Product (learning outcomes), Priority (teaching contents), Pare down (eliminate redundancies), and Provide (appropriate AI tools). The study employs a quasi-experimental research design to explore the potential impact of the “5P Funnel” framework on the professional development of pre-service teachers in Zhaoqing, Guangdong. In this study, 204 candidates in the “Modern Educational Technology Application” course were randomly divided into an intervention group (n=102) and a control group (n=102), with the experiment lasting one semester (15 weeks). By analyzing the differences and relationships in the dimensions of professional development abilities between the two groups, the study evaluates the experimental effects and draws conclusions. Although the study is not yet complete, the paper will focus on the research methodology and preliminary progress, laying the foundation for future contributions. Once the experimental results are obtained, they will provide new ideas and methods for teacher training and practice in the AI era.

Keywords: 5P funnel, ai-integrated, instructional design, teacher professional development, pre-service teacher, guangdong, quasi-experimental

1. Introduction

The fundamental purpose of education is to cultivate innovative talents who can adapt to the development needs of future society and drive social progress. Educators shoulder the important responsibility of engaging with the next generation, with varying educational goals and requirements across different periods. The concept of “21st-century skills” suggests that the skills of the industrial age are no longer sufficient to meet the demands of contemporary society. Looking ahead, education is closely integrating with artificial intelligence (AI), profoundly influencing and reshaping educational paradigms and formats worldwide. AI in education has become a core theme in technological transformation and educational development. AI has significant and far-reaching implications for teaching and learning, as well as for enhancing teachers' roles and abilities. AI can process information and texts beyond human capabilities, generate new content that surpasses human thinking, and facilitate decision-making through predictive data analysis. The application of AI in education clearly demonstrates its great potential in realizing new methods of teaching, learning, and management, enhancing the learning experience, and supporting teachers’ tasks. AI is continuously revolutionizing the modes of production, life, and learning, pushing human society towards a new era (Zhu & He, 2012).

However, this educational revolution also brings unprecedented challenges and places higher and newer demands on teachers’ professional development. We increasingly recognize the new significance of “learning how to learn”, and teachers’ continuous learning competency is particularly important in coping with the rapidly changing educational environment. This can lead to tremendous pressure on teachers, who need to constantly update their knowledge and skills, and master new tools and methods to cope with complex and rapid educational changes. Faced with heavy teaching tasks and administrative work, many teachers, especially young educators, often feel overwhelmed and confused (Yang, 2023). This forces educators to deeply reflect on how to improve teaching methods, increase teaching efficiency, and promote

professional development, which has become an important topic in current educational research.

To help education keep pace with the times, the United Nations Educational, Scientific and Cultural Organization (UNESCO) released the "AI Competency Framework for Teachers" (Miao, 2024) proposing five key competencies: human-centered thinking, AI ethics, AI fundamentals and applications, AI pedagogy, and AI and professional development. These competency frameworks emphasize the need to adhere to human-centered values in AI design and use, maintaining teachers' leading roles in teaching, and providing guidance for teachers' lifelong professional development. Nonetheless, the application of AI in education also entails risks, such as threatening human agency, infringing on data privacy, exacerbating educational inequities, and potentially creating new forms of discrimination. It could devalue the role of teachers, weaken teacher-student relationships, and possibly reduce investment in human capital development, thereby worsening the shortage of qualified teachers globally. Therefore, the application of AI in education requires careful consideration to ensure that teachers have the necessary competencies and roles to use AI ethically and effectively.

As the primary users of AI in education, teachers are expected to become designers and guides of AI-assisted student learning, act as guardians of safe and ethical practices in AI-rich environments, and serve as exemplars of lifelong learning with AI. To undertake these responsibilities, they need support in developing the corresponding capabilities, making full use of AI's potential benefits while reducing the risks of AI to the educational environment and society.

The Minimalist In Education serves a philosophy to optimize teaching processes and enhance teaching efficiency, demonstrating a positive role in achieving this goal. It improves teaching effectiveness through strategies of simplifying complexity, addressing the burdens and challenges teachers face when encountering changes in course content or technology. This philosophy provides teachers with a clear framework to simplify the teaching process and focus on core goals in complex environments. Based on this philosophy, this study expands the "3P Funnel" framework—which includes Purpose, Priority, and Pare Down—by adding two key elements: Product and Provide, thus extending it to a "5P Funnel" framework. This framework also incorporates Outcomes Based Education philosophy and the Backward Design model, focusing on the end learning outcomes to enhance students' expectations of learning, designing the teaching process from the learning outcomes backward. The framework establishes an inclusive, universally applicable instructional design, using a progressive approach to plan learning, helping all teachers, including those previously unfamiliar with AI, to gradually develop from foundational knowledge to higher-level understanding and skill mastery, thereby promoting professional development.

This study utilizes a quasi-experimental research method to assess the impact of the "5P Funnel" instructional design on teacher professional development. It aims to provide new pathways for teacher professional development in the context of AI education, helping teachers better adapt to the educational demands of the AI era. These efforts not only promote the comprehensive enhancement of teachers' abilities but also lay a solid foundation for the

responsible use of AI within the educational system.

1. Theoretical Foundations

1.1 Minimalist in Education

Minimalism is an art movement that emerged in the 1960s, aiming to present the fundamental essence of things through artistic style while minimizing the artist's influence and encouraging active audience participation in the construction of the art's meaning. As a lifestyle, minimalism advocates reducing dependence on material wealth and emotional desires. The currently popular notion of "more is better" has trapped many educators, leading them to believe that the more activities, choices, and data students have, the faster they consume these materials and learning processes, resulting in a richer learning experience. However, the relentless pursuit of "more is better" exacerbates the education crisis, with many teachers reporting a significant disconnect between their efforts and outcomes. The heavy workload and complex teaching activities leave teachers exhausted, leading to the unsustainable depletion of their energy reserves. Therefore, the education industry urgently needs to "lighten the burden" and break free from the current inefficient and minimalist mindset.

Minimalism In Education (MID) emphasizes clear goals, learner-centered approaches, and the use of existing resources to establish more flexible systems and structures in the classroom. It allows for timely feedback and evaluation, aiding student growth. In the AI era, educational technology becomes increasingly important. MID does not imply the simplification of technology but rather the elimination of redundancy, focusing on the core, and avoiding meaningless internal friction (Zhang, 2023). It advocates for teachers and students to use convenient, practical, and easy-to-learn technologies, utilizing existing resources to reduce the burden of lesson planning and data processing on teachers, spark students' interest in learning, and provide personalized guidance (Li, 2019). MID is tailored to the characteristics of AI education environments and adult learners, catering to learners' pursuits of autonomy and practicality, thereby establishing a simple, efficient, and sustainable learning ecosystem. It makes educational methods more scientific, professional, visualized, and dynamic, providing strong support for advancing AI education reform (Ma & Yang, 2024).

From the moment we choose to become teachers, we are taught various educational philosophies to make learning and assessment more valuable, engaging, and exciting for students. But how do we select an approach from these philosophies that aligns with the development of teachers and the needs of students? How can we make the most of our time with students instead of frantically trying various methods and ending up overwhelmed? The legendary Nuremberg Funnel suggested that the right knowledge injected into the brain would make people smarter, so educators hope for a funnel over students' heads to quickly receive and instill knowledge in their minds. However, MID is different; it emphasizes leveraging learners' spontaneous behaviors to find meaning in learning activities.

2.2 Outcome Based Education

Outcome Based Education (OBE) focuses explicitly on organizing educational systems to ensure students gain the experiences needed for substantial success in future life. Unlike traditional education, which is primarily guided by teachers imparting knowledge, OBE emphasizes an orientation towards students achieving expected outcomes. It employs a "backward design" and "forward implementation" teaching process, with the core idea being "learning to learn", centering teaching priorities and evaluations on "outcomes" and focusing on cultivating students' innovative and practical competencies. OBE provides the following insights for curriculum teaching reform:

(1) Clarify course learning objectives: OBE focuses on what students can actually do. Therefore, the teaching process is divided into several stages, each with clear learning objectives. These objectives progress step by step, from basic to advanced, ultimately forming the overall learning outcome goals of the course. (2) Determine the requirements for course learning outcomes: OBE profoundly embodies the concept of determining curriculum teaching goals based on needs. It advocates a "backward design, forward implementation" process, where needs are both the starting and ending points, maximizing consistency between educational goals and outcomes. Its "forward implementation" process starts from needs—cultivation objectives—curriculum requirements—curriculum system—course segments, fully aligning with the human-concentric cognitive laws and characteristics in modern educational thought. (3) Design the process for achieving course learning outcomes: Practical teaching should be closely integrated with theoretical teaching, using appropriate teaching media to encourage students to engage in autonomous learning, cooperative learning, and inquiry-based learning to enhance learning effectiveness. (4) Construct an evaluation system for course learning outcomes: OBE emphasizes the evaluation principle of "teaching based on learning", where the effectiveness of teaching is assessed through students' learning outcomes. Therefore, teaching evaluation mainly focuses on learning outcomes rather than teaching content, learning time, or learning methods. Teachers need to use diversified evaluation methods, such as assignments, tests, presentations, project designs, research reports, etc., to dynamically grasp students' knowledge, skills, and quality development levels. (5) Establish a comprehensive continuous improvement mechanism: Continuous improvement in curriculum teaching should not be viewed as a single segment but as a mechanism running throughout the entire teaching process. Through incessant feedback and adjustments, it ensures the sustained enhancement of teaching quality.

3. Framework Foundations

3.1 "3P Funnel" Framework

Today's media, and it seems like the whole society, is bombarding us with the idea that "the more the better". We need to recognize that this is not the case. We also need to understand that in the process of finding our goals, prioritizing, and cutting back on expenses, we need to eliminate the habits we had before of wanting more or thinking we need more. As mentioned in the book "The Minimalist Teacher", if our educational work is made up of too many ideas, tasks, initiatives, unnecessary resources, and concepts, we will also feel lost and

overwhelmed. As educators, taking the time to streamline and focus on our priorities will support our larger goals (Millburn & Nicodemus, 2011).

The author brings minimalist thinking into the classroom and proposes a set of steps to organize ideas from the aspects of creating minimalist culture, organizing physical space, organizing plans, organizing courses, organizing teaching and evaluation strategies, etc., called "3P Funnel", that is, Determine the purpose of things, prioritize matters, and streamline them to the most basic content (Musiowsky & Arnold, 2021). The "3P Funnel" framework builds a minimalist instruction design, encourages members of a group to recognize and strive to utilize existing classroom resources, and creates a lifelong practice and lifestyle, educating learners to learn to appreciate and pursue efficiency and sustainability, rather than trying to meet student needs by adding more stuff (adding more tasks, or creating more paperwork). Support educators to become minimalist teachers, challenge the sense of loss of control and overwhelm that comes after letting go of things, make room for increased efficiency, productivity, new satisfaction, and happiness, and promote teacher professional development. This approach emphasizes structure and self-reflection to help us find educational priorities and goals to determine what is necessary, meaningful, and useful, helping us find motivation and satisfaction in our role as educators. As shown in Figure 1.

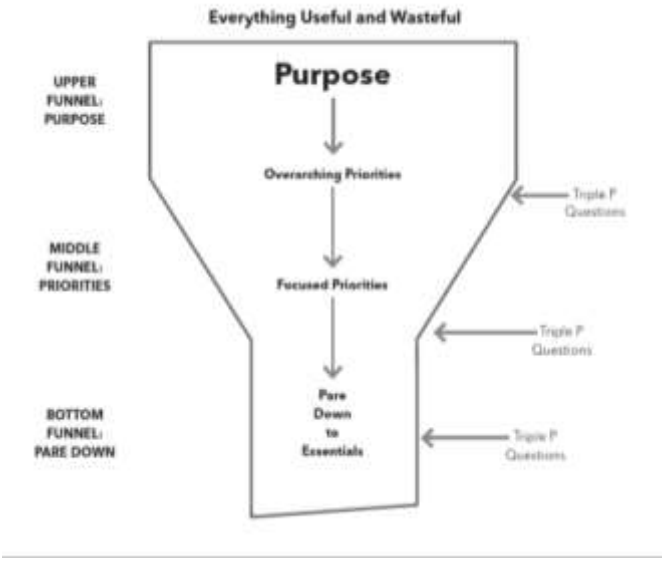

Figure 1. "3P Funnel" framework, adapted from Musiowsky & Arnold (2021)

3.2 Backward Design

"Teaching-Learning-Evaluation" is an important indicator of the quality of a teaching model and a key measure of effective learning (Wen, 2024). The core idea of backward design emphasizes "starting with the end in mind", highlighting the leading role of goals to ensure close coordination among teaching, learning, and assessment. Specifically, it includes four aspects: leadership by teaching objectives, consistency between teaching and learning, consistency between teaching and assessment, and consistency between assessment and learning. This method helps avoid the accumulation of teaching content, makes instruction

more targeted, enhances student motivation and autonomy, and improves teaching quality and learning outcomes.

Paul (2023) proposed using backward design (Wiggins & McTighe, 2005) for long-term teaching planning to support the longevity and sustainability of learning. Backward design is divided into three stages: (1) Clarify course objectives: Learning goals should be specific, measurable, and deconstruction (integrated with standards from other fields), related to students' learning needs and interests. (2) Create an assessment framework: Continuously record and collect evidence of student learning. These "evidence of learning" can be considered sustainable energy in the classroom, providing information for both teaching and learners' self-reflection. (3) Design teaching activities: Design activities such as project-based learning and cooperative learning based on learning goals and assessment criteria. Paul emphasizes developing unit plans and shifting towards the minimalist concept. From a minimalist perspective, backward design is more sustainable, requiring educators to have forward-thinking to design teaching plans that meet students' needs and stimulate their potential (Mi, 2024). It cultivates a lifelong planning and preparation mindset for teachers. By clarifying desired outcomes and determining acceptable evidence, teachers can create flexible learning plans. When faced with complex situations, teachers can integrate foundational resources provided by the school, shared materials, and teaching visions into their instructional design and make adjustments based on new data from formative evaluation. It is not only a strategy for teaching design but also an educational philosophy that guides us toward a more efficient and personalized educational future.

4. "5P Funnel" Framework

Instructional design is a systematic process based on educational objectives, student characteristics, and practical circumstances, utilizing educational theories and methods to develop appropriate teaching activity plans. This process is not only the premise and basis for effective teaching by educators but also a crucial part of ensuring teaching quality. Instructional design involves researching teaching strategies and discussing the theories and processes for formulating and implementing these strategies. By creating teaching environments and materials, the aim is to transform learners from a state of inability to perform certain tasks to a state where they can proficiently complete them. Research and practice in this field are deeply rooted in the theoretical foundations of cognitive science, educational psychology, and problem-solving domains. The core elements of instructional design usually include: setting instructional objectives, selecting teaching content, employing teaching methods, organizing teaching activities, and implementing assessment. These elements are interconnected and together form a complete system of instructional design.

The professional development of teachers is a continuous, lifelong journey of growth that spans their entire career and life experiences. In the field of education, the effectiveness of curriculum, assessment, and instructional design ultimately depends on the outcomes students achieve after learning. Therefore, it is evident that students are the primary customers of education(Wiggins et al., 2003). This necessitates a shift in traditional teaching design, focusing on the needs and developmental capabilities of students.

MID, OBE, BD, and the "3P Funnel" share a common principle of supporting sustainable learning. Given the rapid development of AI technology and the challenges of integrating AI into pedagogy, this study innovatively proposes the "5P Funnel" framework. As shown in Figure 2. This framework builds upon and optimizes existing research foundations to provide a more comprehensive and practical framework for instructional design. It aims to help educators improve their ability to transfer skills in a rapidly changing educational environment, particularly under the influence of AI, and to help teachers become familiar with emerging technologies and their impact on pedagogy, ethics, and society. This aligns with the recommendations of the "AI Competency Framework for Teachers", which encourages teachers to iterate through cycles of curriculum design, implementation, reflection, and redesign. The "5P Funnel" framework offers a systematic approach to planning and implementing teaching strategies, specifically explained as follows:

4.1 Purpose

This is the starting point of the "5P Funnel", emphasizing the need to clearly define the core objectives and intentions of teaching. When designing courses or instructional activities, teachers must clearly outline the learning objectives to ensure that all teaching activities are centered around these core goals. This approach helps learners focus their attention and achieve the desired learning outcomes.

4.2 Product

This focuses on the outcomes or skills that students are able to achieve through learning. At the same time, teachers should design assessment methods based on these outcomes to ensure that the learning results align with the expected objectives. This includes formative and assumptive assessments, which allow teachers to gauge students' understanding and skill development. These assessments then guide subsequent instructional adjustments.

4.3 Priority

After clarifying the teaching objectives and outcome requirements, it is necessary to prioritize the teaching content and activities based on their importance and necessity. This step requires teachers to determine which knowledge points and skills are essential and to prioritize and emphasize them. This approach helps avoid distractions from secondary content within the limited teaching time.

4.4 Pare Down

This is the process of streamlining the content and format of instruction. Teachers need to eliminate redundant and outdated material so that students can grasp the core concepts within a limited time frame. By simplifying the content, the teaching process becomes more efficient, reducing the burden on both teachers and students.

4.5 Provide

This emphasizes supplementing students with supportive learning resources. Teachers need to ensure that students have access to the necessary support and tools to achieve their learning

outcomes. This may involve providing knowledge, skills, values, and tools related to AI, among other resources.

In summary, the "5P Funnel" is not just an instructional design framework but also an educational philosophy that helps teachers maintain simplicity and focus in an increasingly complex and technology-intensive educational environment. It not only makes teaching more targeted and efficient but also provides a feasible path for teacher professional development in the context of AI education. The instructional design template as shown in Figure 3.

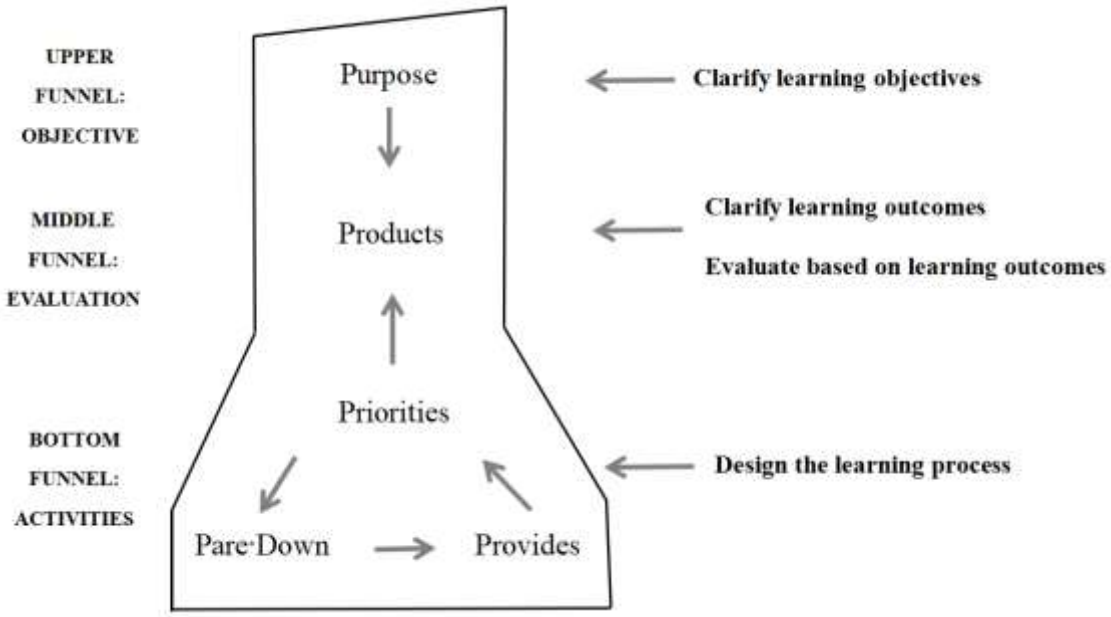

Figure 2. "5P Funnel" framework

"5P" Instructional Design Template	
Stage1: Learning Objectives	
Purpose (1P): What objectives to achieve（long-term goals）	
Stage 2: Outcomes and Evaluation	
Products (2P): Performance of participation and outcomes	
Performance tasks (T): 1.What performance tasks demonstrate that students achieve the expected goals? 2.What criteria are used to judge the effectiveness of understanding?	Other evidence(OE): 1.What other evidence does the student demonstrate achieving the expected outcomes? (exams, observations, assignments, journals) 2.How do students give feedback and self-assess their learning?
Stage 3: Learning Process	
Priorities (3P): Make choices and determine learning priorities	
Understand (U)： 1.What understanding is expected to be gained? 2.What are the foreseeable misunderstandings?	Questions (Q)： 1.What kinds of questions promote inquiry, understanding, and learning transfer?
Knowledge (K) & skill (S)： 1.What key knowledge will students gain from studying? 2.What key skills will students gain from studying?	
Pare down(4P) & Provide(5P): Reduce arrangements and add new content	
Activities: What learning activities will enable students to achieve the expected results?（WHERETO）	

Figure 3. "5P Funnel" Instructional Design Template

5. Teacher Professional Development

Professional development is an intrinsic element of building the teaching workforce, serving as a growth point and driving force for teachers' professional abilities. Teachers Professional Development (TPD) continuously updates and evolves with the times (Wu, 2024). The specific connotations of TPD may differ from various perspectives, yet they all point towards a long-term, professionally teaching-related comprehensive quality and competence for teachers. From a practical standpoint, TPD is rooted in educational practice and research work. Although descriptions of TPD content vary across countries and scholars, generally, these contents can be categorized into five major areas: subject content knowledge, pedagogical content knowledge, knowledge about students, classroom teaching skills, classroom management skills, and counseling and mentoring skills (Yan & Qi, 2017). TPD is a process of continuously acquiring new knowledge and enhancing professional capacity (Li & Liang, 2022). With the transformation of teaching and learning approaches in the era of AI, TPD has also taken a new direction. In the AI era, it is the process by which individuals advance towards maturity in professional theory, knowledge, thinking, and capabilities under the influence of AI (Dong & Li, 2018). While technology empowers teachers' professions, it also forces a reshaping of the teacher's role in professional development (Wei & He, 2020). Teachers are expected to take on more roles in the future (Yu, 2018), and without proactively changing their roles, they may face existential anxiety (Zhao et al., 2022) and a crisis of professional identity (Zhang, 2024). AI technology can free teachers from repetitive, tedious, mechanical work (Li, 2019), and teachers need to explore roles that are beyond technology and irreplaceable. In the AI era, teachers need to learn AI knowledge and understand how to continue their professional development in an educational environment characterized by human-technology interaction. This includes leveraging AI to assess professional learning needs and cultivate lifelong learning and collaboration skills.

The "AI Competency Framework for Teachers" mentions five key competencies that teachers need to possess. (1) human-centered mindset: Teachers should be able to assess the appropriateness of AI tools and maintain human dominance in the design and use of AI. (2) Ethics of AI: Teachers should understand and grasp fundamental issues of AI ethics, including data privacy, algorithm transparency, fairness, and interpretability, and be able to guide students. (3) AI foundations and applications: This includes definitions, principles, algorithms, and categories of AI. (4) AI pedagogy: Incorporating AI as a core part of teaching and learning to support students' innovation and autonomous learning. (5) AI for professional development: Teachers should be able to use AI tools to support their own professional development. These five aspects are interwoven and complementary, rather than isolated. Moreover, they are divided into three progressive levels: acquire, deepen, and create. As shown in Figure 4.

Aspects	Progression		
	Acquire	Deepen	Create
1. Human-centred mindset	Human agency	Human accountability	Social responsibility
2. Ethics of AI	Ethical principles	Safe and responsible use	Co-creating ethical rules
3. AI foundations and applications	Basic AI techniques and applications	Application skills	Creating with AI
4. AI pedagogy	AI-assisted teaching	AI–pedagogy integration	AI-enhanced pedagogical transformation
5. AI for professional development	AI enabling lifelong professional learning	AI to enhance organizational learning	AI to support professional transformation

Figure 4: The AI competency framework high-level structure: aspects and progression levels

Overall, effective teaching (whether using AI or not) requires a holistic approach that integrates various competencies. For example, a teacher's competency to apply AI pedagogy is influenced by their understanding of AI fundamentals, AI policy, and professional development. Similarly, their ability to navigate AI ethics is affected by their experience in applying AI. That is to say, proficiency in one area can enhance proficiency in another. Therefore, continuous professional development can strengthen teachers' understanding across all these aspects.

Existing research on teacher information technology teaching capability evaluation models and related applications holds significant value and provides a solid foundation for further study. Combining the "AI Competency Framework for Teachers", IBSTPI model (Spector et al., 2001), AITSL model (Lloyd, 2014), TPACK model (Schmidt et al., 2009), the "Standards for Information Technology Application Competencies for Primary and Secondary School Teachers" requirements in China (Zhang et al., 2014). This study identifies the Teacher Professional Development Contents include five first-level dimensions: Instructional Design Ability, Teaching Implementation Ability, Teaching Management Ability, Student Guidance Ability and Sustainable Development Ability. And eleven secondary-level dimensions, used to measure the level of teachers' professional development。As shown in Figure 5.

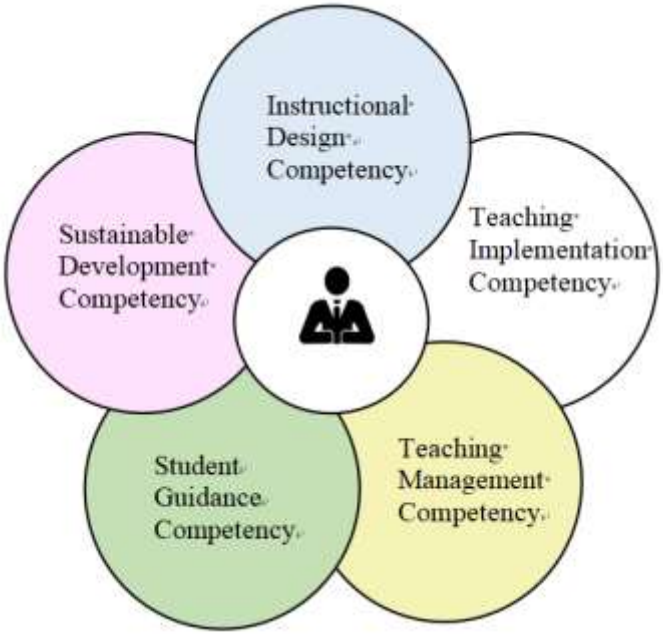

Figure 5. Teacher Professional Development Contents

6. Methodology

6.1 Research Design

The research design is a quasi-experiment. This study takes the course "Modern Educational Technology Application" as an example. The experimental class is taught using "5P Funnel" instructional design, and the control class is taught using traditional design. After one semester (15-weeks), the students in the two classes comparison of TPD. The development of instructional design and learning content follows the following research model and procedures.

6.2 Research Sampling

This research plans to select two "Modern Educational Technology Application" classes (experimental group and control group) at a normal university in Zhaoqing, Guangdong, with 102 students in each class, a total of 204 students. Classes are randomly composed by students' independent course selection system. Two classes with similar conditions are selected according to the class situation. The gender, age, and major of all students will be recorded to understand the demographic characteristics of the sample.

6.3 Research Variables

This study aims to explore the impact of the "5P Funnel" framework for instructional design on the professional development of pre-service teachers, while considering the moderating effects of personal factors (gender and subject). The study primarily adopts a quantitative research approach, adhering to the principles of comprehensiveness, objectivity, and operability in the selection of variables. Ultimately, different instructional designs were chosen as the independent variable, teacher professional competence as the dependent variable, and personal factors as the moderating variables. Each variable consists of several dimensions.

6.4 Research Instruments

6.4.1 Teacher Professional Ability Scale

The questionnaire survey is a convenient measurement tool that is easy to implement and facilitates data collection. Based on the "Teacher Professional Contents", the "Teacher Professional Ability Scale" is designed to measure pre-service teachers' performance in five dimensions (instructional design competency, teaching implementation competency, classroom management competency, student guidance competency, and sustainable learning competency) before and after the experiment. Additionally, it collects data on personal factors (such as gender and major) to control for the influence of moderating variables. The data is comparable and suitable for statistical analysis.

6.4.2 Interview Form

Pre-interviews: Through interviews, we gather the needs and suggestions of pre-service teachers and instructors regarding educational technology, improving the precision and practicality of teaching content.

Post-interviews: We delve into pre-service teachers' experiences and evaluations of the course, collecting feedback to enhance the interpretive power and application value of the research.

6.5 Data Collection Methods

To ensure that the collected data can address the relevant research questions, the study employed the following methods:

A questionnaire survey was conducted with students who had taken the course, and interviews were held with teachers to gather their feedback and needs regarding the "Application of Modern Educational Technology" course. Based on this feedback, instructional design was developed, and teaching activities were carried out. Data on teacher professional development (TPD) were collected twice—at the beginning and end of the course: using the standardized "Teacher Professional Competence Scale". Learning evidence was recorded and collected throughout the process via observation, interviews, and learning tasks to obtain more comprehensive information.

By comparing the data before and after the experiment, the study evaluated the implementation effects of the "5P Funnel" framework on the professional development of pre-service teachers in Zhaoqing, Guangdong. The research process was divided into three stages: preparation, teaching implementation, and evaluation and summary.

Stage 1: Preparation

Survey research is an important method for obtaining accurate data. From an objective perspective, demand-driven training should not be understood solely as meeting learners' self-identified needs but should also consider the gap between learners' current abilities and the required standards to design appropriate training (Zhu & Yan, 2015). Through questionnaires and interviews, the study collected and analyzed the problems and needs of the current educational technology course to make the instructional design more targeted, practical, and

operational. Based on the survey data and the book "Modern Educational Technology and Applications", and aligned with the goals of TPD, the course content, duration, and sequence were adjusted to complete the instructional design.

Stage 2: Teaching Implementation

First, participants were tested using the Teacher Professional Competence Scale (pre-test) to assess their baseline levels. Then, a 15-week educational technology course was conducted. The experimental group adopted the "5P Funnel" instructional design, while the control group continued with traditional teaching methods. At the end of the semester, both groups took the same test (post-test) to evaluate their progress and skill improvement.

Stage 3: Evaluation and Summary

Students' experiences and feedback on the course were collected. Data from before and after the experiment were analyzed using descriptive statistics, structural equation modeling (Liu & Liu, 2020), and other statistical methods to explore the relationships among multiple variables and compare the performance of the two groups before and after the experiment. Additionally, the study examined whether moderating variables (personal factors such as subject and gender) had a significant impact on the teaching outcomes.

6.6 Data Analysis

Data analysis will use statistical methods such as descriptive statistics, t-test and SEM, to ensure the scientific nature of data analysis. These methods will be used to evaluate whether there is a statistically significant difference in the professional development abilities of teachers in the two classes before and after the experiment? what is the significant relationship between "5P Funnel" instructional design and TPD? Does the moderating variable have a moderating effect on the experimental results?

7. Expected Results and Discussion

7.1 Expected Outcomes

Existing research has demonstrated that professional development is crucial for the growth of teachers, and curriculum teaching plays a significant role in promoting teachers' professional development. Many studies have confirmed that curriculum reform has a positive impact on teaching. For example: using blended learning models that combine traditional classroom teaching with online learning (Zhang, 2021); applying flipped classroom models (Li, 2015), enhancing classroom interaction and participation, and promoting deep learning; developing apps or platforms to assist subject teaching (Guo, 2019). Curriculum teaching should fully reflect cutting-edge, forward-looking, practical, and targeted aspects, guiding students to engage with the forefront of the field and the latest technologies early on, rather than repeating outdated theories and technologies (Wang & Song, 2024). However, current teaching reforms mainly focus on exploring the use of certain AI technologies, and AI technology in university education is still in the preliminary experimentation stage, with its developmental potential far from fully developed and demonstrated (Bie, 2024).

Based on existing theories and preliminary observations, we anticipate that the application of the "5P Funnel" framework will effectively improve learning outcomes. Specifically, we hypothesize that this framework can help teachers learn and use AI tools more effectively and promote their professional development. Additionally, individual differences, such as gender and major, are expected to moderate the teaching effectiveness of the "5P Funnel" framework.

7.2 Discussion

If the above hypotheses are validated, this will support the theoretical view that the "5P Funnel" enhances adaptability in complex educational environments. Achieving the expected outcomes will provide an effective operational path for teachers to use AI technology and for AI technology to promote professional development. However, we must also acknowledge that due to the study's limitations in time and sample size, the results may have limitations. Therefore, it is necessary to conduct further experimental research to verify these initial hypotheses.

8. Future Work and Recommendations

8.1 Future Work

Although the impact of the "5P Funnel" framework on the professional development of pre-service teachers in Zhaoqing, Guangdong, has not yet been fully confirmed, related research is actively progressing. However, this study is an exploratory experiment, and related research is actively underway. We plan to complete the preliminary data collection and analysis within the next three months and will conduct regular evaluations of the experiment's progress as scheduled, making adjustments if necessary. Future work will focus on the following aspects:

8.1.1 Verification of Applicability

Further expanding the sample size to validate the applicability of the "5P Funnel" framework in different educational contexts, such as exploring its impact on the professional development of pre-service teachers in various disciplines. Through testing in diverse educational environments, we aim to investigate its role in promoting interdisciplinary teaching and learning, and to evaluate the framework's broad applicability and flexibility.

8.1.2 Impact on Personalized Education

Investigate the potential of the "5P Funnel" framework for achieving large-scale personalized education by analyzing how it supports the individual needs of different learners to promote more efficient and personalized learning experiences.

8.1.3 Technological Updates and Iteration

Establish an "educational community" to gather more resources for the technological updates and iteration of this framework. Through collaborative development, strengthen the framework's flexibility and user-friendliness while exploring a wider range of application tools.

8.2 Recommendations

Based on the preliminary research results, we recommend the following measures to advance the application of the "5P Funnel" framework:

8.2.1 Establish Promotion Projects

Set up dedicated projects to promote the application of the "5P Funnel" framework in teacher training and learning. Through workshops, training courses, and online resources, assist teachers in better understanding and utilizing this framework.

8.2.2 Develop AI Application Standards

Establish clear standards for data privacy and the responsible use of AI technology in education to protect the rights of students and teachers. This will help ensure the safe and responsible use of AI technology.

8.2.3 Promote Educational Equity and Sustainability

We aim to find a simpler, more effective, fairer, and more sustainable learning road map for everyone in the AI education era, enabling all to benefit from technological advancements and improving education.

As Newton said, by making simple things complex, one can discover new fields; by seeing complex phenomena as simple, one can discover new laws. We hope that the application of this framework will drive educational innovation and provide new momentum and direction for the development of future education.

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