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Original Paper

Exploring Senior High School English Teachers' Professional Development:Challenges and Pathways within the TPACK Framework

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Abstract

The present study is an attempt to explore the professional development challenges faced by high school English teachers within the TPACK framework, particularly in the context of technology integration. By reviewing existing literature, this study identifies three primary challenges: the difficulty in incorporating technology into pedagogy and content knowledge, the lack of sufficient time and resources, and the psychological resistance to innovation. In response to these issues, the study proposes three strategies. First, focusing on tailored training programs and reflective activities to equip teachers with both the tools and mindset necessary for successful technology integration. Second, optimizing time and resources through personalization and collaboration, which emphasizes flexible, personalized learning pathways and encourages collaboration among teachers to make the best use of available resources. Third, advocating for gradual integration and supportive strategies, such as fostering a positive environment and establishing incentive mechanisms, to alleviate resistance. The study seeks to promote the successful implementation of the TPACK framework, enhancing the quality of high school English instruction and offering valuable support for teachers' professional development.The findings not only offer practical solutions for integrating technology into pedagogy and content knowledge but also lay a theoretical foundation for the future application of educational technology.

Keywords

Professional development, TPACK framework, Integration, Senior High School, English teachers

Outline

Introduction

With the advent of artificial intelligence (AI), technology has became an essential part in teachers' professional development. The 2024 World Digital Education Conference issued the "Artificial Intelligence Empowering Education Development" initiative, emphasized that teachers are supposed to leverage innovative AI technologies in education to promote the depth of educational content and diversify teaching methods, thereby enhancing high-quality educational development. "*The Professional Standards for Secondary School Teachers (Trial)*" (2012) proposed that teachers should possess information technology knowledge aligned with the modernization of educational content, teaching methods, and pedagogical approaches. What's more, they are expected to effectively combine modern educational technologies with their instructional practices. In addition, Amber Yayin Wang(2022) claimed that integrating technology into teachers' professional development is critical for fostering their ability to adapt the evolving demands of digital education.In this way, teachers are able to improve teaching efficiency and create a more dynamic and engaging teaching atmosphere, and also equip students with the necessary skills needed for the 21st century.

However, senior high school English teachers face considerable challenges in integrating technology into their teaching. On the one hand, they lack of relevant technological knowledge and experience, especially for pre-service teachers. Schmid et al. (2023) stressed that pre-service teachers are not likely to have well-structured and stable technological knowledge system due to scarce experience. At the same time, it is hard for teachers to deal with the ethical issues in AI. For example, Ismail Celik (2023) emphasized that AI-generated responses occasionally exhibit biases, including those related to religion or gender. Thus, it is essential for teachers to possess the knowledge required to comprehend, assess, and explain outcomes produced by AI-powered tools. Similarly, AI-based tools sometimes make decisions that result in consistent and repeatable mistakes (Shin, 2020). Such mistakes may lead to biased treatment of students from different races. (De Cremer & De Schutter, 2021). On the other hand, the predominant focus on enhancing students' performance in standardized tests, such as college entrance examinations, leads to an exam-oriented teaching method. Then the teachers have not the opportunities to explore innovative technologies.

Thanks to the emergency of TPACK framework, which integrates technology, pedagogy and content knowledge. Senior high school English teachers are able to cope with challenges caused by AI. As Pawat Chaipidech et al. (2021) argued that the Technological Pedagogical Content Knowledge (TPACK) framework plays a pivotal role in advancing teacher professional development (TPD) initiatives, particularly in the context of technology-integrated instruction. Apart from that, Joseline M. Santos et al. (2021) also stated that the TPACK framework is essential for pre-service teachers because they are the future educators that are responsible for the new generation. By advocating the integration and interaction between the three basic elements, with a special emphasize on technology, the TPACK framework gains its popularity around the world. It underscores that the technological knowledge (TK),

pedagogical knowledge (PK) and content knowledge (CK) can not exist separately, the teachers must combine them into their professional development.

Although TPACK offers a robust theoretical foundation for incorporating technology into education, its practical implementation still presents significant challenges. Teachers often struggle to dynamically balance technological, pedagogical, and content knowledge in practical teaching scenarios. Recognizing these difficulties is important for developing tailored strategies that can support senior high school English teachers in their professional growth. Thus, this study aims to explore the following key questions:

1. What are the main challenges that senior high school English teachers encounter in their professional development when applying the TPACK framework?
2. How can the TPACK framework be strategically utilized to develop solutions that address these challenges and promote the smooth integration of technology, pedagogy, and content knowledge in teaching practices?

2. Literature Review

2.1 Theoretical Framework

According to Koehler and Mishra (2009), the TPACK framework expands on Shulman's (1986, 1987) concept of pedagogical content knowledge (PCK) by illustrating how teachers' comprehension of educational technologies interacts with PCK to facilitate effective technology-integrated teaching. In 2006, Mishra and Koehler introduced Technological Knowledge (TK) and proposed the TPACK framework. They define TPACK as the comprehensive ability of teachers to combine technology, pedagogy, and content knowledge effectively in the teaching process[11]. In recent years, the advancement of educational technology has led to a crucial expansion of the TPACK framework's application in subject-specific research and practice, particularly within the domain of language teaching, which provides theoretical basis for English teachers' integration capability.

Although the TPACK framework has gained significant advancements at both theoretical and practical levels, its application in specific subjects and cultural background remains challenging (Rosenberg & Koehler, 2015). To address this issue, Mishra (2019) proposed to integrate Contextual Knowledge (XK) into this framework, highlighting the importance of teachers' adaptability in complex educational contexts. This thought further enriches the theoretical dimensions of TPACK, which forms the following integrated TPACK framework (Figure 1).

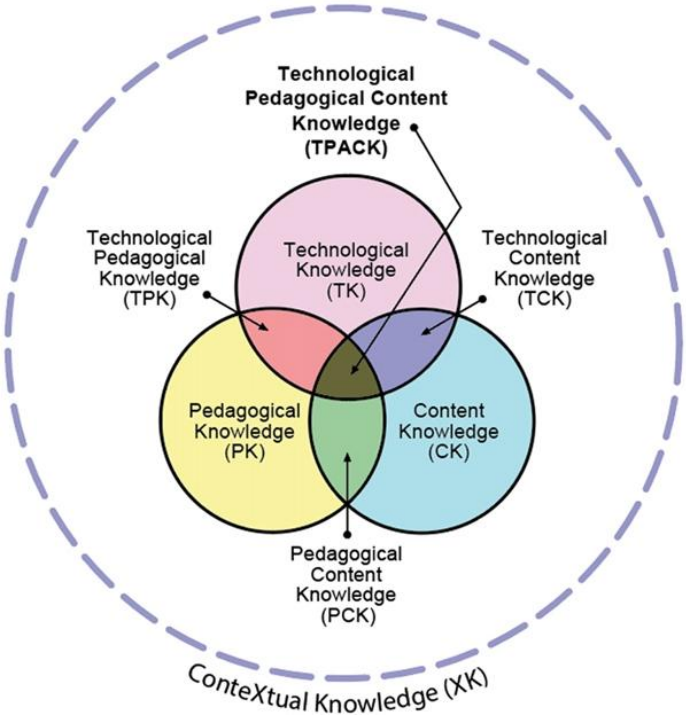

Figure 1. The TPACK Diagram (Mishra, 2019)

In the TPACK diagram, there are three fundamental elements: technological knowledge (TK), pedagogical knowledge (PK) and content knowledge (CK). These three domains represent the necessary knowledge areas that teachers must master independently. When the three factors interact and interplay with one another, the process produces other interconnected components: technological pedagogical knowledge (TPK), technological content knowledge (TCK), pedagogical content knowledge (PCK), technological pedagogical content knowledge (TPACK). In order to tackle with the semantic inconsistency issue in the original TPACK diagram, contextual knowledge (XK) was introduced to the TPACK framework (Mishra, 2019). The following are detailed explanation of the elements of TPACK framework.

TK: it belongs to a dynamic and evolving domain within the TPACK framework, emphasizing the ability to understand, adapt and use technology for various tasks in professional and personal contexts. It fosters the teachers' ability to integrate technology into pedagogy and content knowledge, enabling constant professional growth and adaptation to emerging technologies.

PK: it means the knowledge that is connected with the teaching and learning methods, processes, and strategies. It includes various aspects like educational objectives, underlying values and overarching goals, as well as foundational skills such as classroom management, lesson planning, student assessment and so on. Teachers with advanced pedagogical skills comprehend how students build knowledge, enhance abilities, and foster a constructive approach toward learning. Moreover, strong pedagogical knowledge involves a thorough understanding of social and developmental theories of learning (Koehler & Mishra, 2009).

CK: it is the knowledge that is related to a teacher's mastery of the subject they are teaching. It includes an in-depth grasp of core concepts, principles and theories within a particular subject, along with knowledge of how these components are structured and connected in the field. Teachers equipped with CK are able to enhance teaching outcomes and respond confidently to students' inquiries.

TPK: TPK requires teachers to leverage technology into their teaching and learning processes, and enabling them to choose appropriate tools and strategies that are in accordance with teaching objectives. Incorporating TPK into teachers' professional development helps them adapt the technology-driven educational context.

TCK: it involves teacher's ability to choose appropriate tools and technologies to deliver subject content. The combination of technology and teaching content assists teachers to present knowledge in a more interesting and engaging way. For example, the English teachers can use video clips and vr scenes to present the features of different tourist attractions. In this way, the content can be understood both interactively and meaningfully.

PCK: PCK focuses on teachers' expertise in converting subject matter into effective teaching strategies. This process includes interpreting content, utilizing various instructional methods, and personalizing approaches to align with students' prior knowledge and solve misconceptions.

XK: XK encompasses a teacher's understanding of the various factors that shape the educational atmosphere, such as students' backgrounds, school culture, social context, and available teaching resources. As Punya Mishra (2019) said: "using X for contextual could be appropriate because X usually denotes a variable, and contextual knowledge often is highly variable."

TPACK: TPACK is a theoretical model that explains the integrated knowledge teachers need to effectively teach their students, design meaningful learning plan, and incorporate technology to enhance education quality (McGraw-Hill, 2018). It highlights the combination of three core areas of knowledge: content, pedagogy and technology. Comprehending the connections between the three domains enables teachers to apply teaching strategies and technology to help students grasp lesson content.

2.2 A Brief Review of Studies on Teachers' Professional Development

Teachers' professional development is an ongoing process in which teachers promote their expertise, instructional abilities, and professional competencies over the course of their careers through continuous learning, self-reflection, and practical application. The demand for teacher professional development originates primarily from the rapid change in the educational landscape. As information technology becomes increasingly pervasive, educational informatization has emerged as a crucial aspect of broader societal informatization (Li et al., 2022).

There are numerous factors that influence teacher professional development. For one thing, an increasing number of scholars start to investigate the influence of personalized learning systems on teacher professional development. For instance, Lachner et al. (2021) conducted a quasi-experimental study, illustrating that a personalized learning platform significantly enhances pre-service teachers'

technological pedagogical content knowledge. Likewise, Zimmermann et al. (2021) examined differences in TPACK self-efficacy, attitudes, and curriculum planning skills between students from two universities. Their findings indicate that personalized learning atmosphere effectively narrow the gap between novice and expert teachers. For another thing, others also focus on the application of andragogical principles in TPD. Chaipidech et al. (2021) explored the effectiveness of andragogical approaches in TPD through workshop-based methods. Their research demonstrated that this kind of way can foster teachers' sustainable professional growth and equip teachers with the abilities required to integrate technology into STEM teaching practices. Chan (2010) noted that adult learners tend to seek new knowledge that can be applied immediately rather than information that is only useful for the future. Therefore, the relevant educational workers are supposed to take this feature of adult learners into account when designing teacher professional development programs.

In order to evaluate teacher professional development, a great deal of scholars begin to design innovative assessment tools. The TPACK-21 scale, developed by Valtonen et al. (2017), is recognized as one of the most significant tools for evaluating pre-service teachers' competencies within the framework of 21st-century skills. Grounded in the TPACK framework, this scale evaluates not only the traditional dimensions of TK, PK, and CK but also additional components related to teachers' innovation and critical thinking skills. Amber Yayin Wang (2022) introduced a two-dimensional TPACK scale designed to help EFL teachers evaluate their ability to integrate technology and foster thinking skills.

2.3 A Brief Review of Studies on Teachers' Professional Development within the TPACK Framework

The application of Technological Pedagogical Content Knowledge (TPACK) framework on teacher professional development has transformed alongside technological advancements. Early studies primarily emphasized the practical use of TPACK. For instance, Bos (2011) demonstrated that teachers could design innovative instructional activities within the TPACK framework. However, the effective integration of technology still requires great improvements. With the onset of the Fourth Industrial Revolution, studies by Agustini et al. (2019) and Istiningsih (2022) highlighted that while educators possess strong content knowledge (CK) and pedagogical knowledge (PK), their technological integration capabilities still need substantial enhancement in order to address contemporary educational challenges.

Recent research has shifted focus to the dynamic relationship between teacher development and knowledge structures. Benedict Osei-Owusu (2022) illustrated that initiatives aimed at teacher professional development (TPD) play a crucial role in significantly improving educators' professional knowledge (PK) and boosting students' academic outcomes. Additionally, Chen and Jang (2014) observed a strong association between advanced levels of TPACK and higher stages of teacher concern, such as refocusing and collaboration, indicating that teachers' attention on technological integration may effectively enhance their professional competencies. The supportive role of professional development programs has also gained recognition. Mujallid (2021) highlighted that online

professional development programs effectively help teachers overcome challenges in technological integration. Likewise, Topan et al. (2020) highlighted the value of the TPACK framework in inspiring teachers' learning and supporting the development of multimodal educational materials. At the same time, Topan et al. (2020) pointed out that future studies should explore methods to utilize professional development programs in strengthening teachers' expertise and tackling with the challenges presented by digital education.

3. Challenges in Senior High School English Teachers' Professional Development (TPD) within the TPACK Framework

Although there is a growing focus on professional development within the TPACK framework, senior high school English teachers still encounter some obstacles that impede their progress in adopting this framework. These obstacles arise from a combination of external limitations and internal challenges, which can be grouped into three primary categories: difficulties in integration, constraints related to time and resources, and reluctance to embrace change. The subsequent sections will delve into each of these issues in depth.

3.1 The Integration Dilemma: Bridging Technology, Pedagogy and Content Knowledge

The TPACK framework advocates the integration between technology, pedagogy and content knowledge. However, it is not easy for teachers to combine them together. For pre-service high school English teachers, they often face dual challenges in integrating TPACK. For one thing, they usually lack guidance in effectively integrating technology and pedagogy (TPK) with content knowledge (CK) in language teaching areas such as speaking, listening, reading, and writing. What's more, teacher education programs do not systematically focus on subject-based technology integration. Valtonen et al. (2020) conducted a mixed-methods study and analyzed the teaching plans of Finnish pre-service teachers, the research result revealed that while educators were confident in their pedagogical knowledge (PK), they still faced notable difficulties with technological pedagogical knowledge (TPK). These challenges were particularly evident in classroom management, supporting students' effective use of technology, and avoiding distraction during lessons. Based on this, Syamdianita and Cahyono (2021) examined pre-service English teachers. Then they identified critical barriers to TPACK integration, including limited computer skills, inadequate content knowledge (CK), and restricted access to instructional media, which hindered the effective incorporation of technology into English teaching. Valtonen et al. (2023) further examined interdisciplinary courses, emphasizing challenges such as the unclear definition of technology's role, minimal utilization of advanced tools like learning management systems and limitations caused by inadequate course duration and resources.

For novice English teachers in senior high school, although they already possessed a foundational understanding of the TPACK theoretical knowledge, they still face some challenges in adapting it to real-world teaching practices. Demanding responsibilities, such as lesson preparation and classroom management, significantly limit the energy available for acquiring new technological skills and

exploring their integration in TPACK framework. Furthermore, the absence of systematic in-service training also hampers their ability to effectively incorporate technology into teaching, particularly in enhancing students' English communication skills. Lu and Zheng (2024) examined the practical challenges of incorporating AI technologies into the TPACK framework. Their findings highlighted three key issues: the absence of cohesive training philosophies, the reliance on simplistic training models and the lack of collaborative mechanisms. These shortcomings collectively resulted in a significant disconnect between AI applications and effective English teaching practices. In addition to this, Shambare and Simuja (2024) explored TPACK integration in South African rural schools through case studies, their study demonstrated that while novice teachers shows strong content knowledge (CK) and pedagogical knowledge (PK), their technological knowledge (TK) and overall TPACK proficiency were underdeveloped. This gap was largely attributed to limited resources, insufficient training, and environmental constraints.

For experienced senior high school English teachers, some of them may encounter difficulties in integrating technology into TPACK framework due to their deep-rooted reliance on traditional teaching methods and a diminished inclination to adopt new technologies. On the one hand, with years of professional experience, experienced teachers have developed extensive content knowledge (CK) and pedagogical knowledge (PK), which allow them to effectively meet diverse teaching requirements. On the other hand, they still encounter various obstacles in adopting the TPACK framework into teaching practices. These obstacles mainly stem from their strong reliance on traditional teaching methods such as grammar translation method and direct instruction method, which lead to reluctance toward integrating technology, and they are not willing to apply the rapidly evolving educational tools into their teaching. Additionally, it challenges their technological knowledge (TK). The absence of collaborative learning also hindered their steps towards technology knowledge. Furthermore, psychological barriers and declining enthusiasm on professional development amplify these difficulties. Thus, despite their robust foundational knowledge, it is still necessary for experienced teachers to enhance their capacity of integrating TPACK framework into their professional development.

3.2 Limited Time and Resources: Obstacles to Professional Development

In recent years, more and more scholars find that the limitations on the time and resources are great elements that affect the development of teachers' TPACK capability. Smith et al. (2019), in a systematic literature review, noted that teachers often struggle to find sufficient time for technology training due to heavy teaching workloads, while inadequate hardware resources further impede the practical implementation of the TPACK framework. Similarly, Ghayyur and Mirza (2021), through a qualitative study, reported that pre-service teachers in Pakistan face challenges such as outdated resources, insufficient technical training, and limited access to learning applications and computer laboratories. These obstacles significantly hinder the integration of technology and pedagogy (TPK). Focusing on English teachers, Muliani et al. (2024) identified that resource shortages, including unstable internet connections and insufficient hardware equipment, combined with privacy concerns,

restrict the effective application of technological knowledge (TK). Collectively, these studies underscore the pervasive influence of time and resource constraints across diverse educational contexts, offering theoretical foundations for addressing these issues.

Research on training models has provided further insights into mitigating these challenges. Cheng et al. (2022), through an empirical study involving the "Cloud Class Room" and "DECODE" models, demonstrated that collaborative training can effectively enhance technology-related knowledge (TK, TPK, and TCK). However, they also highlighted that tight course schedules and limited resource availability remain significant obstacles. In conclusion, time and resource limitations present critical challenges at both pre-service and in-service stages of TPACK integration.

3.3 Resistance to Innovation: Understanding Barriers to Change

Resistance to innovation in the field of education is a complex phenomenon influenced by psychological, institutional, and environmental factors. As a matter of fact, the resistance to innovation often happen due to fears of failure, unease about abandoning familiar routines, or conflicts with deeply rooted teaching philosophies. This resistance is particularly pronounced among experienced teachers who heavily rely on traditional methods or lack confidence in their technological competence. Drugova et al. (2021), using a case study method that combined semi-structured interviews and online surveys, examined the acceptance of and resistance to digital learning environments among faculty and students in three Russian universities. Their study recognized key sources of teacher resistance, including fears of being replaced by technology, rejection of new teaching materials, and psychological aversion to educational reform. Additionally, institutional issues, such as unclear TPACK implementation plans and inconsistencies in educational policies, further exacerbated resistance. The findings suggest that reducing resistance requires clear incentive mechanisms and systematic support strategies to facilitate the deeper integration of technology into teaching practices.

Based on the institutional and psychological dimensions, Al-Takhayneh et al. (2022) conducted a survey, and studied 600 teachers from Jordanian business and entrepreneurship schools under the framework of innovation theory and planned behavior theory. The study revealed that school culture and an innovation-friendly climate significantly influenced teachers' digital innovation. Teachers' attitudes toward educational technology also affect this relationship, intensifying the impact of innovation-friendly environments on their resistance to change.This highlights the importance of managing teachers' attitudes toward technology and fostering supportive school environments to overcome resistance.

From the perspective of reflection, McLay and Reyes (2024) explored the attitudes and beliefs of pre-service teachers in technology-oriented teacher education programs. Despite the widespread adoption of frameworks such as TPACK for cultivating and assessing teachers' technological skills, the study found that emotional attitudes and internal beliefs often serve as important barriers to technology integration, particularly when external resources and support are inadequate. This underscores the need to address internal psychological factors alongside external support systems to ensure effective

integration. Alférez-Pastor et al. (2023), through a systematic literature review, identified two primary drivers of resistance to digital innovation among teachers: disruption of existing comfort zones and conflicts with their deep belief systems. The study further predicted that such resistance is likely to persist over the next decade, emphasizing the necessity of flexible and collaborative training approaches to mitigate teachers' psychological resistance to technological change. Finally, Chang et al. (2024) conducted a comparative study and examined the TPACK development of pre-service and in-service teachers in Indonesia. The study found that while experienced teachers demonstrated strong content knowledge (CK) and pedagogical knowledge (PK), their resistance to technology and innovation still limited the development of their technological knowledge (TK) and overall TPACK proficiency. The findings also highlighted that although government-funded training programs positively influenced TPACK development, overcoming psychological barriers to technology integration remains a critical challenge for effective TPACK implementation.

4. Pathways to Enhance Senior High School English Teachers' Professional Development within the TPACK Framework

Although the previously discussed challenges, such as the integration dilemma, constraints in time and resources, and resistance to innovation, pose substantial obstacles to the effective professional development of senior high school English teachers within the TPACK framework. On the other hand, these challenges also provide opportunities for targeted solutions. Overcoming these barriers necessitates a well-structured approach that integrates creative training initiatives, efficient resource management and supportive motivational systems. Thus, the following pathways will propose practical and meaningful strategies to address these issues.

4.1 Specialized Training and Reflection for Advancing Integration Skills

Specialized training is essential for equipping senior high school English teachers with the targeted skills and knowledge needed to effectively integrate technology, pedagogy, and content, thereby addressing the complexities of TPACK development.

4.1.1 Differentiated Training Across Career Stages

It is necessary for policymaker and relative administration faculties to have differentiated training course for senior high school English teachers. More specifically, for pre-service English teacher, the primary focus is to establish a solid foundation in technological knowledge (TK). Training programs should aim to equip pre-service teachers with essential skills, such as using online teaching platforms and interactive tools. While introducing them to fundamental principles for integrating technology with pedagogy and content knowledge, simulated teaching scenarios should be incorporated to help teachers build confidence in applying these skills, thereby preparing them for future classroom practices.

The novice phase should focus on integrating technology (TK), pedagogy (PK), and content knowledge (CK), encouraging teachers to engage in case-based teaching and problem-solving practices. Senior high school English teachers are supposed to explore virtual classroom designs and utilizing

multimodal tools in specific subject areas to enhance their TPACK integration skills. For experienced teachers, the training is expected to leverage their strong content knowledge (CK) and pedagogical expertise (PK) to adopt advanced technologies, such as VR and chatbot and other learning and interactive platforms. These initiatives aim to optimize the practical application of the TPACK framework and meet the evolving demands of modern education. This phased training approach can not only facilitate systematic TPACK integration from theory to practice but also offers tailored interventions for teachers at different career stages. Ultimately, it seeks to elevate the quality of English language instruction through a deeper fusion of technology, pedagogy, and content knowledge.

4.1.2 Case Studies and Simulated Teaching

Establishing a repository of teaching cases is an effective strategy because it offers clear examples of how innovative tools can be applied in English classrooms. For instance, teachers can use ChatGPT to provide efficient and personalized feedback on student essays or design listening tasks on online platforms with real-time feedback. Apart from that, simulated classroom activities and teaching further bridge the gap between theory and practice. Through continuous simulated teaching, teachers are able to improve teaching proficiency and classroom management skills.

The combined use of case-based learning and practice teaching helps teachers integrate technology, pedagogy, and content knowledge effectively. This dual approach also addresses practical challenges and creates more efficient and personalized teaching.

4.1.3 Reflective Practices for Sustained Development

After acquiring integration skills through measures like differentiated training and case studies, teachers are expected to engage in structured reflective practices to bridge the gap between theoretical learning and practical application. Reflection enables teachers to critically analyze their teaching experiences by evaluating the effectiveness of technology integration strategies, identifying successes, and recognizing areas requiring improvement or adaptation. For instance, teachers might assess how tools such as AI-based feedback systems or multimodal platforms influence student engagement and learning outcomes. Reflective practices also prompt teachers to examine their pedagogical beliefs and attitudes toward technology, fostering a stronger alignment between technology, pedagogy, and content knowledge (TPACK). It also helps teachers consolidate their TPACK skills while gaining deeper insights into their students' dynamic needs and evolving educational contexts. Additionally, collaborative reflection, through peer discussions or professional learning communities, can further enriches this process by enabling teachers to share feedback, discuss challenges, and co-develop innovative solutions.

Ultimately, reflective practices are essential for fostering continuous professional growth. They empower teachers to refine their instructional approaches to meet diverse classroom demands, address emerging challenges, and enhance the integration of technology into teaching. Reflection can not only sustains professional development but also improves teaching efficacy and student outcomes.

4.2 Optimizing Time and Resources through Personalization and Collaboration

To effectively tackle with the issues of limited time and resources, this part will discuss two strategies, which focus on personalized learning and resource sharing along with the importance of collaboration ability.

4.2.1 Technology-driven Personalized Support

To address the time constraints faced by senior high school English teachers in their professional development, intelligent technologies offer efficient solutions. By integrating AI-driven learning management systems or educational technology platforms, teachers' technological proficiency, instructional needs, and learning preferences can be analyzed, which enables the appearance of personalized learning pathways. For instance, the platform can recommend technology tools and pedagogical resources tailored to teachers' specific needs based on their career stages, such as pre-service, novice, or experienced teachers. Additionally, the platform supports flexible learning plans, allowing teachers to engage in self-paced study according to their schedules. This personalized learning approach can not only significantly enhances teachers' learning efficiency but also enables them to acquire technology integration skills with minimal time investment, better equipping them knowledge to address the learning and teaching challenges.

4.2.2 Team Collaboration and Resource Sharing

For the purpose of dealing with the issue of resource shortage, it is necessary to share teaching resource and promote teacher collaboration. In terms of collaboration, teachers can engage in collective lesson planning with clear role division and mutual complementation. For instance, teachers with strong technological skills can design plans for implementing digital teaching activities, while more experienced teachers can focus on optimizing content and pedagogy. Regarding resource sharing, establishing communication mechanisms among teachers can facilitate the recommendation and practical exchange of teaching tools. For example, AI tools like ChatGPT can be recommended for providing personalized feedback in writing instruction, while learning management systems such as Rain Classroom can be shared for classroom management with operational insights. By strengthening teamwork through collaboration and improving tool utilization through resource sharing, senior high school English teachers are supposed to overcome the limitation of teaching resources.

4.3 Transforming Resistance into Acceptance through Progressive Strategies

In the context of the TPACK framework, teachers' resistance to technology integration is a prevalent issue. This resistance commonly manifests as reluctance to adopt new technologies, dependency on traditional teaching methods, and a lack of confidence in their technological competence.To address this issue effectively, it is essential to focus on three key strategies: shifting teachers' mindsets, adopting a progressive approach to technology integration, and establishing incentive mechanisms and innovation-friendly teaching environments (figure2). These measures can systematically help teachers overcome psychological and practical barriers, facilitating the deep integration of technology and pedagogy and content knowledge.

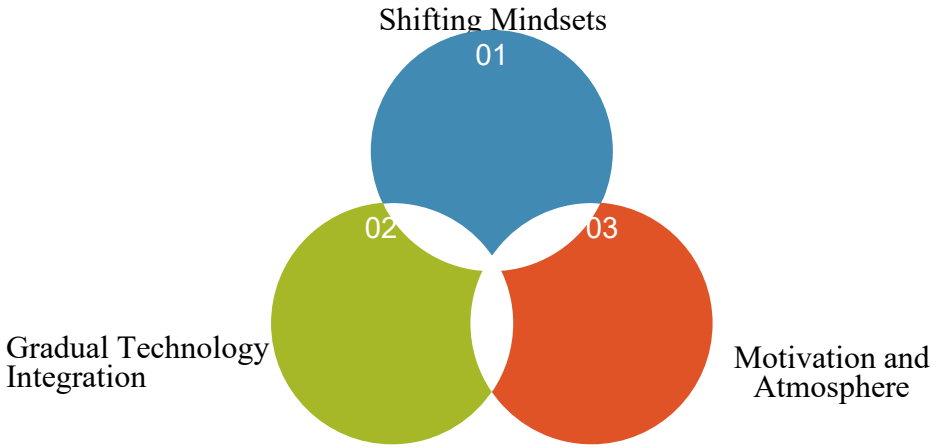

Figure 2. Three Key Strategies toward Teachers' Resistance on Innovation

4.3.1 Shifting Mindsets: Redefining the Role and Value of Technology

There are three ways to shift senior high school English teachers' mindset to technology. To begin with, it is crucial to redefine the role of technology in education, emphasizing its function as a complementary tool that enhances traditional teaching methods rather than replaces them. This redefinition can be facilitated through lectures, workshops, and seminars designed to effectively convey this perspective. Then, another important thing is the provision of emotional support to build trust and confidence among teachers. Encouraging the sharing of success stories or peer demonstrations can alleviate fears of failure and promote acceptance of technology. What's more, theoretical support plays a vital role in reinforcing the benefits of integration. Utilizing frameworks such as TPACK and presenting empirical evidence enables teachers to recognize the practical advantages of technology in improving teaching outcomes, ultimately fostering a more open attitude toward innovation.

4.3.2 Gradual Technology Integration: Transition from Simplicity to Complexity

In fact, a step-by-step implementation approach is crucial for teachers' professional development. Initially, the basic stage emphasizes the use of easy and accessible tools, like platforms for online vocabulary exercises and interactive classroom applications, helping teachers acquire foundational experience and boost confidence. The subsequent intermediate stage involves the introduction of moderately advanced technologies, including tools for data analysis and systems for providing real-time classroom feedback. It aims to reinforce the relationship between pedagogy and technology. Ultimately, the advanced stage encourages teachers to delve into more sophisticated resources, such as VR and chatbot to improve a deeper and more meaningful integration of technology into teaching methods. This phased approach not only ensures a seamless transition but also enables teachers to handle increasingly complex technological applications with experience.

4.3.3 Fostering Motivation: Building Incentives and Supportive Atmosphere

When it comes to the challenge of resistance on innovation, it is worth noting that both internal motivation and external environments play crucial roles in fostering teachers' confidence and

enthusiasm for adopting innovation. Thus, it is also crucial to establish strong support systems that include incentives and supportive environments. One effective approach involves introducing incentive programs, such as awards or recognition initiatives, to highlight successful technology integration efforts and inspire greater teacher engagement in innovative practices. Additionally creating experimental teaching environments, such as simulated classrooms or low-pressure experimental classes. Teachers also should be provided opportunities to do experiment with technology integration without the stress of performance evaluation. To maintain continuous progress, ongoing support can be offered through professional learning communities or specialized technical assistance teams. In a word, these strategies are expected to build a robust support framework that encourages teachers to experiment, adapt, and confidently apply technology in their teaching practices.

5. Conclusion

In summary, this study explored the challenges toward senior high school English teachers' professional development within the TPACK framework, and proposed a systematic set of solutions with both academic significance and practical value. First of all, the research focuses on the specific group of senior high school English teachers, effectively help them enhance expertise and teaching quality. Second, it constructs a practice-oriented strategy framework, which includes training models, a phased technology integration path, and the establishment of support systems, providing practical guidance for education policymakers and teacher training institutions. Third, the study emphasizes the personalization and long-term sustainability of these strategies, designing interventions based on different stages of teachers' professional development. Finally, it effectively integrates reflective practices into the development of TPACK capabilities, enabling teachers continuously refine their teaching methods through self-assessment and peer discussions.

However, this study also has certain limitations. For example, there is a lack of large-scale empirical data to further validate the applicability of the strategies in different educational contexts. Additionally, the specific implementation methods for resource sharing and collaboration require further exploration. Future research can focus on the following aspects: conducting empirical studies across diverse educational contexts to assess the effectiveness and applicability of the proposed strategies in different regions. Additionally, it is also crucial to incorporate students' perspectives to evaluate how TPACK integration influences their learning outcomes and classroom experiences.

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