A Survey on the Current Situation of TPACK Among Teachers in Higher Vocational Colleges in China

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Abstract

Based on the application of TPACK in the field of education in China, this paper focuses on the investigation of the current situation of teachers' TPACK in vocational colleges and the practical exploration of teachers' TPACK ability training mode. The survey finds that the overall TPACK level of teachers in higher vocational colleges is above the average level, but there is still room for improvement, among which subject content knowledge (CK) is the highest level in each dimension, and subject teaching knowledge (TPCK) is the lowest level. Gender, teaching age, professional title and information technology training are the important factors that affect the TPACK level of teachers in higher vocational colleges, but educational background has no significant effect.

There are still some problems in the study of TPACK. It is necessary to further expand the research methods, explore the application of TPACK in various disciplines, and pay attention to the relationship between teachers' TPACK and students' learning. In order to improve the TPACK level of teachers, it is suggested that schools should strengthen the training of information technology for teachers, strengthen the construction of teachers, promote the reform of classroom teaching, optimize the curriculum system of normal education, do a good job in education and teaching practice, and introduce big data analysis methods to guide the development of teacher education. In a word, TPACK is of great significance and influence to modern education, and constantly improving teachers' TPACK level is the key to education reform.

1. INTRODUCTION

Today, with the continuous development of information technology, the teaching mode is also constantly changing, and the teaching level of teachers is paid more and more attention. The interaction of technology, education and content has an important impact on the teaching effect, so it is necessary to study teachers' TPACK ability. TPACK theory puts forward three aspects of knowledge that teachers need to master in the application of information technology: subject content knowledge, teaching knowledge and technical knowledge. However, at present, there is a lack of comprehensive research on TPACK in China, so it is necessary to discuss the status quo of TPACK and its influencing factors. At the same time, we should explore effective ways to improve teachers' TPACK level, promote education and teaching reform, and make contributions to modern education.

Information technology in the field of education has become an indispensable resource, which plays a vital role in the quality and effect of education and teaching. TPACK is of great theoretical and practical significance in teacher information technology training and teaching practice, aiming at teachers' ability requirements of information technology in education. This paper investigates and analyzes the current situation and influencing factors of teachers' TPACK in higher vocational colleges, and explores the ways and suggestions to improve teachers'

TPACK level from the aspects of training mode, teaching reform and normal education. This has important practical value and enlightenment for improving teachers' application ability of information technology and promoting education modernization.

In particular, the TPACK level and influencing factors of teachers in higher vocational colleges are investigated and studied. The specific research questions include: How is the overall TPACK level of teachers in higher vocational colleges? What factors affect teachers' TPACK level? What are the remaining problems with TPACK research? In view of these problems, this paper will analyze and discuss from many angles, aiming at providing useful reference and reference for improving teachers' TPACK level.

Taking teachers of higher vocational colleges as the research object, this study analyzes the current situation and influencing factors of teachers' TPACK level through investigation, research and practical exploration, and proposes corresponding training models and countermeasures in order to improve teachers' TPACK level and promote the reform and development of education and teaching. The research method mainly adopts the combination of literature review and empirical research. Through the review and analysis of relevant literatures at home and abroad, the evolution and development of the concept of TPACK is understood, and its specific application in educational practice is discussed, so as to provide theoretical support and reference for the subsequent empirical research. At the same time, by means of empirical research such as questionnaire survey and interview, the specific data information of teachers' TPACK level was obtained, and statistical software such as SPSS was used for data analysis and verification, so as to reveal its current situation and influencing factors, and provide practical exploration and countermeasures for improving teachers' TPACK level.

2. CONCEPT AND THEORETICAL FRAMEWORK OF TPACK

2.1 Concept and Definition of TPACK

TPACK refers to the educational knowledge system formed by the integration and mutual influence of technology, teaching and subject content. It includes technical knowledge (TK), teaching knowledge (PK) and subject content knowledge (CK), and their mutual relations, such as the integration of technology and subject content technology teaching knowledge (TPCK), the integration of technology and teaching technology and teaching knowledge (TPACK), the integration of subject content and teaching subject teaching knowledge (TCK). TPACK sees educational development as the core and is the key body of knowledge for teachers to effectively

educate students and support learning through their ability to integrate technology, teaching and subject content into each other.
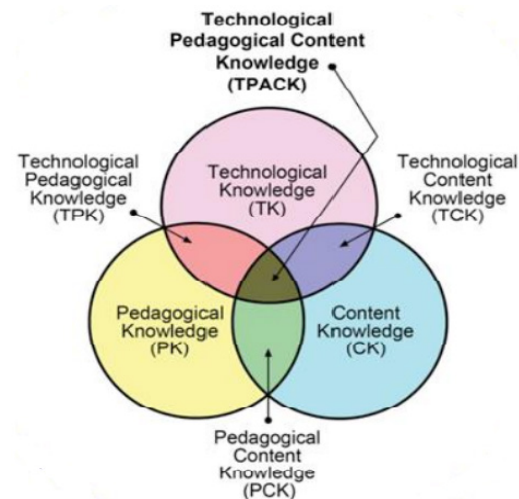

Figure 1
TPACK framework (Reproduced with the permission of the publisher, © 2012 by TPACK.org)

The theoretical framework of TPACK covers multiple knowledge areas and can be applied to different target groups and different teaching scenarios. Among them, technical knowledge is the basis for teachers to master various teaching tools, skills and resources, including hardware equipment, software application, information management and other aspects of technical knowledge; Teaching knowledge refers to the knowledge that teachers design specific teaching scenarios and formulate strategies for students, including the teaching knowledge of course design, teaching evaluation, classroom management, etc. Subject content knowledge refers to teachers' deep understanding and proficiency of subject content, including teaching objectives, curriculum map, knowledge point understanding and other aspects of subject content knowledge.

The concept and theoretical framework of TPACK play an important role in educational research and practice. It is not only one of the basic theories supporting the construction of modern education system, but also an effective tool to help teachers improve their professional teaching ability and promote teaching reform. It is necessary to deeply study its application in the process of educational modernization, further expand its research methods and application fields, and provide support and guidance for promoting the development of education.

2.2 Construction of TPACK Theoretical Framework

The construction of TPACK theoretical framework is based on the continuous understanding and improvement of teachers' educational accomplishment in modern educational technology and teaching practice. The theoretical framework of TPACK divides teachers'

teaching ability into three dimensions of knowledge: subject content knowledge (CK), instructional design knowledge (PK) and technology-integrated subject instructional knowledge (TPCK). The integration and integration of these three dimensions constitute an important part of teachers' educational accomplishment and also determine the effect of teachers' teaching practice. Among them, subject content knowledge (CK) is the core of teachers' professional foundation and the foundation of teaching effectiveness. Instructional design knowledge (PK) is the effective strategy and method that teachers need in the teaching process, and it is also the internal embodiment of subject content knowledge (CK). And TPCK is the teacher's skillful use and integration of technical tools, and the professional skills needed to use these tools in teaching.

Based on the construction of TPACK theoretical framework, teachers can better realize the integration of subject teaching knowledge and technology in the teaching process according to the teaching content in different subject areas, and improve the teaching effect. At the same time, by strengthening teacher training and information technology training, teachers can improve their TPACK level, realize the smooth organization and integration of course content, teaching strategies and technical means in teaching, and improve the teaching quality and level. The ultimate goal is to provide students with higher quality education and better promote students' learning and growth.

3. APPLICATION OF TPACK IN THE FIELD OF EDUCATION

3.1 Application of TPACK in Education and Teaching Practice

TPACK refers to a teacher's ability to integrate technology, subject knowledge and instructional design in the teaching process. The theory of TPACK has had a profound impact on the field of education, enabling teachers to make more effective use of technology in the teaching process to improve students' learning results. In the practice of education and teaching, the application of TPACK mainly includes the following aspects:

3.1.1 Teaching Design
Teachers should design appropriate teaching plans according to the characteristics of disciplines and students' learning needs. In the design process, teachers need to combine their own subject knowledge, educational theory and technology application ability to obtain better teaching results.

3.1.2 Teaching Management
TPACK theory holds that teaching management includes not only the management of students' learning, but also the management of the use of classroom technology.

Therefore, teachers need to be capable of using technology and subject knowledge to ensure the smooth running of the teaching process.

3.1.3 Evaluation of Teaching
In the evaluation of teaching, teachers need to consider the learning outcomes of students and the quality of classroom teaching. TPACK theory holds that teachers need to use technology flexibly to collect and evaluate students' learning in order to improve the effect of education and teaching.

In short, the application of TPACK enables teachers to better integrate technology, subject knowledge and teaching design, innovate education and teaching mode, and improve students' learning effect. Therefore, in the practice of education and teaching, strengthening the application of TPACK theory is of great significance for improving the quality of education and teaching.

3.2 Investigation and Research on TPACK Status Quo of Teachers in Higher Vocational Colleges

The survey on the current situation of teachers' TPACK in higher vocational colleges found that the overall level of teachers' TPACK is above the average level, but there is still room for improvement. Among them, subject content knowledge (CK) is the highest level in each dimension, and subject teaching knowledge (TPCK) is the lowest level. The specific factors affecting teachers' TPACK level include gender, teaching age, professional title and information technology training. Educational background had no significant effect. Therefore, in order to improve teachers' TPACK level, colleges and universities should pay attention to strengthening teachers' information technology training, promoting classroom teaching reform, optimizing the curriculum system of normal education, and strengthening the construction of teachers. The promotion of these improvement measures needs the support of big data analysis methods, so as to better guide the educational development of teachers. Exploring the application of TPACK in different disciplines while paying attention to the relationship between teachers' TPACK and students' learning is also an important direction for future research.

3.3 Practical Exploration of Teachers' TPACK Ability Training Mode

In the field of education, improving teachers' TPACK level is the key. Therefore, the practical exploration of teachers' TPACK ability training mode has become one of the research hotspots. In order to explore the TPACK training mode, scholars put forward many feasible training modes based on the actual situation. Among them, the training mode based on case teaching, the training mode based on course design, and the training mode based on teaching team cooperation have attracted much attention.

Under the training mode based on case teaching, teachers master how to integrate technology and form TPACK ability by studying cases and analyzing teaching scenarios. Under the training mode based on curriculum design, teachers can introduce new teaching strategies and interactive ways through curriculum reform and design, so as to improve TPACK integration ability. Under the training mode based on teaching team cooperation, teachers can establish cooperative relations with colleagues, share teaching experience and teaching methods, and improve TPACK ability.

However, there are still some problems in the application of the training mode, such as the selection of the training mode and the evaluation of the implementation effect. Therefore, further research and improvement are needed to improve the effectiveness and operability of TPACK training. In a word, the practical exploration of TPACK ability training mode is of great significance and value, which helps to improve the overall level of teachers' TPACK and promote the reform and progress of education and teaching.

4. FACTORS AFFECTING THE TPACK LEVEL OF TEACHERS IN HIGHER VOCATIONAL COLLEGES

4.1 The Influence of Gender, Teaching Experience and Professional Title

Among the influencing factors of TPACK level of teachers in higher vocational colleges, gender, teaching age and professional title are three important factors. It is found that the TPACK level of male teachers is higher than that of female teachers on the whole, which may be due to the higher interest and learning degree of male in information technology. In addition, teaching age is also one of the factors affecting TPACK levels, and the study suggests that teachers with shorter teaching age may have higher TPACK levels because they are more willing to embrace new educational technologies and methods. The influence of professional title can not be ignored. The research shows that teachers with higher professional title have higher TPACK level, which may be because the promotion of professional title requires more experience and practice in education and teaching. Therefore, in order to improve the TPACK level of teachers, it is necessary to consider the differences in gender, teaching age, professional title and other aspects, and adopt different training measures and strategies.

4.2 The Impact of Information Technology Training on TPACK Level

Information technology training is one of the important factors affecting the TPACK level of teachers in higher vocational colleges. The investigation shows that the TPACK level of teachers who have received IT training is higher than that of teachers who have not received IT training. Training can improve teachers' cognition and ability to use educational technology, and make teachers more confident in applying technology in teaching practice. Information technology training can include theoretical learning, practical exercise, experience sharing and other forms to form a systematic training model, which can effectively improve teachers' TPACK level.

In terms of information technology training, schools can take various measures, such as carrying out centralized training, providing online learning platforms, and promoting technology application cases. In addition, by organizing research projects and inviting experts to give lectures, they can promote communication and interaction among teachers and stimulate their enthusiasm for learning and awareness of innovation. At the same time, schools should provide necessary technical support and facilities for teachers to ensure that they can smoothly carry out information technology application and practice.

In a word, information technology training is one of the important ways to improve the TPACK level of teachers in higher vocational colleges. Schools should attach importance to information technology training, establish a sound training mechanism, meet the learning needs of teachers, promote the improvement of TPACK level, so as to make positive contributions to education reform and education development.

4.3 Influence of Educational Background on TPACK Level

Among the influencing factors of TPACK level of teachers in higher vocational colleges, educational background has no significant influence. Through the analysis of the survey data, it can be seen that the educational level of teachers can not directly reflect the TPACK level of teachers. Although the educational level and teaching experience of teachers can affect the teaching methods of teachers, they have no direct impact on the improvement of TPACK ability. Therefore, in the process of improving the TPACK level of teachers in higher vocational colleges, the educational level is not the key factor. It is more necessary to strengthen the information technology training of teachers, promote the classroom teaching reform, and improve the teaching ability and skill level of teachers, so as to improve the TPACK level of teachers.

5. EXISTING PROBLEMS AND PROSPECTS IN TPACK RESEARCH

5.1 Research Methods Need to be Expanded

At the same time, this paper believes that the research methods of TPACK research need to be expanded. At present, most studies use the questionnaire survey method, which can collect a large amount of data, but it lacks deep and specific information, which can not

deeply explore teachers' TPACK knowledge structure and practice performance. Therefore, it is necessary to introduce a variety of research methods, such as interview, observation, case analysis, etc., to comprehensively understand the characteristics and bottlenecks of teachers' TPACK in actual teaching, and provide scientific basis for their TPACK level improvement. At the same time, it is also necessary to explore the practical application of TPACK in various disciplines, so as to deepen the understanding of its development law and concrete realization.

5.2 The Application of TPACK in Various Disciplines

At present, most TPACK research is focused on STEM fields. Although teachers' TPACK level is high in these fields, the research on TPACK in other subject areas is insufficient. Therefore, it is necessary to further explore the application of TPACK in various disciplines in order to better promote the improvement of teachers' education level.

In addition, there are some problems in TPACK teacher training at present. Most training focuses on teaching at the technical level, and less consideration is given to the integration of subject knowledge and subject teaching knowledge. Therefore, it is necessary to further deepen the content of TPACK teacher training and focus on improving the overall education level of teachers, not only the knowledge level at the technical level.

To sum up, there are still many problems that need to be solved in TPACK research. Future studies need to learn from practical experience in other subject areas, explore more TPACK integration models, and establish a more scientific TPACK training system. At the same time, researchers also need to pay attention to the relationship between teachers' TPACK and students' learning, so as to promote students' learning effectiveness more effectively.

5.3 The Relationship Between Teacher TPACK and Student Learning

The TPACK model was originally teacher-centered, emphasizing the integration of teachers' knowledge skills and teaching strategies. However, with the change of students and educational environment, whether teachers' TPACK level is related to students' learning outcomes has become a question that needs to be discussed.

Some studies believe that the improvement of teachers' TPACK level will lead to the improvement of students' performance, because teachers can better use technology to present students with richer knowledge content and stimulate students' learning interest and enthusiasm. In addition, teachers' TPACK level can also affect students' learning attitudes and habits. For example, teachers' effective use of technology to promote students' interactive and cooperative learning can improve students' independent learning ability and thinking ability.

However, some studies have shown that there is no significant correlation between teachers' TPACK level and students' learning outcomes. This may be because teachers' TPACK level is only one of many factors that affect students' learning outcomes, and other factors such as individual differences of students and difficulty of courses can affect students' learning outcomes.

Therefore, future research needs to further explore the relationship between teachers' TPACK level and students' learning outcomes through more specific empirical studies. At the same time, students' needs and learning environment should also be taken into account, so as to better guide teachers to improve TPACK level and effectively promote students' learning.

5.4 The Development Trend of TPACK in Future Education

With the rapid development and application of information technology, the field of education is also facing new challenges and opportunities. TPACK model, as a tool to comprehensively evaluate teachers' teaching ability, will play a more important role in the future education.

First of all, TPACK model will be further extended to various subject areas to meet the needs of teaching in different fields. In addition, the combination and application of TPACK with students' learning process will also become an important direction of TPACK research.

Secondly, the training and evaluation methods of TPACK models will also become more systematic and scientific. With the development of big data and artificial intelligence technologies, the assessment of teachers' TPACK literacy will be more objective, comprehensive and accurate, and provide more targeted guidance for the development of teacher education.

Finally, as an important course content of teacher education, strengthening the construction of teacher strength and strengthening the construction of information technology training system will be an important way to improve teachers' TPACK level. Teachers will pay more attention to the comprehensive improvement of their own information technology literacy and teaching ability, so as to provide students with better educational services.

To sum up, TPACK model will continue to play an important role in the future education, driving the development and reform of the education field.

6. SUGGESTIONS TO IMPROVE THE TPACK LEVEL OF TEACHERS IN HIGHER VOCATIONAL COLLEGES

6.1 Strengthening Information Technology Training

In order to improve the TPACK level of teachers in higher vocational colleges, IT training of teachers needs to be strengthened. Specific suggestions are as follows:

First of all, schools should increase investment in IT training for teachers, provide diversified and personalized training courses and training methods, so that teachers can better understand the concept and application of TPACK in learning.

Secondly, schools should also establish a complete teacher strength system, build a professional trainer resource base, and equip professional trainers and technical support personnel to help teachers obtain real-time and effective technical support, and improve teachers' teaching level and practical ability.

In addition, schools should also promote classroom teaching reform, improve teachers' ability to integrate TPACK knowledge by introducing interdisciplinary courses and practical teaching, and cultivate students' ability to innovate and start businesses and solve practical problems.

Finally, schools should optimize the curriculum system of teacher education, combine the theoretical knowledge of TPACK with practical operation, establish a multiple evaluation system of teachers' professional ability, and introduce big data analysis methods to provide quantitative guidance and feedback for the development of teacher education.

6.2 Construction of Teacher Strength

Teacher strength is one of the key factors to improve the TPACK level of teachers in higher vocational colleges. Schools should pay attention to the construction of teacher teams and introduce more teachers with professional knowledge and information technology capabilities.

First of all, schools should establish a sound recruitment mechanism to attract teachers with high-level professional knowledge and IT capabilities. Secondly, schools should provide various training opportunities to help teachers improve their TPACK level. Teachers can participate in activities related to information technology such as seminars and training courses to learn about the latest IT trends and teaching practice experience.

In addition, schools can also strengthen the management and evaluation of teachers, establish a sound assessment mechanism, help and guide teachers with low TPACK level, and encourage teachers to constantly improve their TPACK level.

Finally, schools should also attach importance to the construction of subject tutor system, strengthen the support and training of subject tutors, so that they can become a bridge between students and teachers, guide students to better use information technology for learning, and guide teachers to better use information technology to improve teaching effect.

In a word, by strengthening the construction of teachers, schools can provide better working environment and more adequate training opportunities for teachers in higher vocational colleges, improve their TPACK level, and then promote education reform and the popularization of modern teaching methods.

6.3 Promote the Reform of Classroom Teaching

In order to improve the TPACK level of teachers in higher vocational colleges, promoting classroom teaching reform is an indispensable part. Specific suggestions are as follows:

First, schools should actively encourage teachers to try new teaching methods and tools in the classroom, such as providing diversified subject learning resources with the help of information technology, introducing gamified teaching and so on. At the same time, in the implementation of these new teaching methods, it is necessary to combine the actual situation and needs of students, constantly trial and error, reflection and optimization of teaching methods, so as to improve teachers' TPACK level.

Secondly, schools can encourage teaching interaction and communication among teachers through the establishment of "teaching research groups" and other mechanisms to promote knowledge sharing and continuous innovation of learning methods. At the same time, schools can also carry out various forms of teaching evaluation and feedback mechanisms to help teachers find their own problems and shortcomings, promote teaching improvement and enhance teaching effectiveness.

Finally, schools should provide all kinds of support and resources to support teachers' classroom teaching reform as much as possible. For example, provide rich educational technology resources and teaching curriculum design support, provide teachers with a variety of training and learning opportunities, and encourage teachers to participate in various teaching competitions and teaching activities.

Through these measures, we can effectively improve the TPACK level of teachers in higher vocational colleges and promote the continuous improvement of teaching quality. At the same time, it can also provide useful reference for the application of TPACK in a wider range of educational scenes.

6.4 Optimize the Curriculum System of Teacher Education

In optimizing the curriculum system of normal education, it is recommended that schools adopt a variety of means, including but not limited to the following points. First of all, schools can clarify the basic tasks and objectives of education and teaching by re-examining and adjusting the curriculum setting and content of normal education, and run through the concept and requirements of TPACK. Secondly, schools can invite educational experts and teachers with TPACK level to give lectures and lectures, so as to improve the comprehensive quality and application ability of normal students. In addition, schools can also guide normal students to continuously improve their TPACK level in practical work outside classroom teaching through practical teaching and curriculum design. Finally, schools should strengthen the guidance

and evaluation of teaching practice for normal university students, cultivate teachers with excellent TPACK level in practice, and comprehensively improve the quality and level of education and teaching.

6.5 Emphasis on Education and Teaching Practice

In the process of improving the TPACK level of teachers in higher vocational colleges, education and teaching practice is a very important part. Only through practical operation, teachers can understand the TPACK model more deeply and apply it to teaching practice, so as to improve the teaching quality and effect.

It is suggested that schools should strengthen the training and guidance of teachers' education and teaching practice, encourage them to actively participate in classroom teaching, and explore more effective teaching methods and strategies. On this basis, teachers are required to develop TPACK teaching plans and put them into practice, using a large number of examples to demonstrate the effectiveness of their course design and teaching programs.

At the same time, strengthening education and teaching practice should fully consider the characteristics of the subject and the needs of students, and pay attention to the cultivation of students' learning experience and practical ability. In addition, the introduction of big data analysis methods to the evaluation and guidance of education and teaching practice can effectively improve teachers' TPACK ability and better promote the development of teacher education.

6.6 The Introduction of Big Data Analysis Means to Guide the Development of Teacher Education

In order to improve the TPACK level of teachers in higher vocational colleges more effectively, we propose to introduce big data analysis methods to guide the development of teacher education. With the popularization and development of information technology, big data analysis has become one of the important research tools in the field of education. Through big data analysis of teachers' teaching behavior, students' learning behavior and curriculum design, more teaching references and optimization programs can be provided for teachers.

Specifically, big data analysis can help teachers find information about students' knowledge mastery, interest points and learning difficulties, so that course content and teaching methods can be formulated more pertinently. At the same time, big data analysis can also monitor and analyze teachers' teaching behaviors, thus providing personalized education development guidance for teachers to help them grow more comprehensively and healthily in terms of TPACK ability.

It should be noted that while introducing the means of big data analysis, we should also pay full attention to issues such as data privacy protection and protect the rights and interests of teachers and students. At the same time, we also need to analyze and evaluate the results of big data analysis to ensure its accuracy and reliability.

In a word, the introduction of big data analysis to guide the development of teacher education can help improve the TPACK level of teachers in higher vocational colleges and better meet the needs of modern education.

7. CONCLUSION

Combining the research results of this paper, we can draw the following conclusions:

(1) In the field of higher vocational college education, TPACK theory can explain and guide teaching practice well.

(2) The TPACK level of teachers in higher vocational colleges is above the average level on the whole, but there is still room for improvement. Among them, subject content knowledge is the highest level, while subject teaching knowledge integrating technology is the lowest level.

(3) The influencing factors of TPACK level of teachers in higher vocational colleges mainly include gender, teaching age, professional title and information technology training. Educational background has no significant influence on TPACK.

(4) There are still some problems in the study of TPACK. It is necessary to further expand the research methods, explore the application of TPACK in various disciplines, and pay attention to the relationship between teachers' TPACK and students' learning.

(5) In order to improve teachers' TPACK level, it is suggested that schools should strengthen information technology training for teachers, strengthen the construction of teachers, promote classroom teaching reform, optimize the curriculum system of normal education, and introduce big data analysis methods to guide the development of teacher education.

To sum up, TPACK is of great significance and influence to modern education, and continuously improving teachers' TPACK level is the key to education reform.

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