TPACK Application of Chinese Preservice Teachers in Their Internship in Kindergartens

Zhong Wenqing[1*], Subadrah Madhawa Nair[2]*
[1] *Lecturer, Yongzhou Vocational and Technical College, Hunan, China,*
PhD Student in Education, City University of Malaysia, Petaling Jaya, Malaysia
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E-mail address: 642774428@qq.com.
[2] *City University of Malaysia*
E-mail address: subadrah.nair@city.edu.my.

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Abstract: Aims: The Objective Of This Study Is To Explore The Application Of Technological Pedagogical And Content Knowledge (Tpack) Of Preschool Trainees In The Early Children Development And Health Management Major In China. And The Factors Related To These Preservice Teachers' Tpack Application Is Also Studied.

Study design: In this paper, the author employed a descriptive research design using the online questionnaire to obtain the quantitative data.

Methodology: This study uses correlational design. The sample of this study consists of 45 preschool trainees (females final-year students from a public college in Hunan, China), who are majoring in the Early Children Development and Health Management and will be be future preschool teachers. The researchers used online questionnaire to investigate the trainees' TPACK and the related factors. The data was analyzed using SPSS Program for IOS version 25. The correlation test was carried out to investigate the factors related to the trainees' TPACK.

Results: The findings clearly indicates that trainees' application of Content Knowledge (CK) and Pedagogical Knowledge (PK), are strongly correlated with TPACK, which is consistent with former researches. Moreover, among this 45 samples, the degree of correlation between the application of PK and TPACK (r=0.821**) is stronger than the correlation between CK application and TPACK application (r=0.730**).

Conclusion: These findings have crucial pedagogical implications because it indicate factors related to preschool trainees' TPACK. The trainees' scores for their TPACK application does not show a good result, and the mean score is 65.11 percent, while the score range 0 to 100 percents. These results suggest that the trainees' TPACK application should be further improved. 71.1% of them scored under 75 percentage of their TPACK application and only 28.9% of them thought their TPACK application could be above 75 percentage, which could be considered as good at using TPACK during their teaching internship. In addition, the findings showed that their application of CK and the PK has strong positive correlations with their application of TPACK

Keywords: Preschool Trainees, Technological Knowledge, Pedagogical Knowledge, Content Knowledge, TPACK Level, Chinese College.

I.   Introduction

In this paper, the author employed a quantitative research design to explore the factors that related and influenced preschool trainees' Technological Pedagogical and Content Knowledge (TPACK). Tools used to obtain the self-assessment data in this research is the online questionnaire.

1.1 Problem statement

In this part, the background information and related problems about preschool will be stated. The issues of Chinese preschool teachers' knowledge and the preschool trainees' training program, which refers to TPACK framework and the main research subject in this study, will be mentioned as well.

As a basement of the whole education, the importance of preschool education has been realized and discussed for a long time, since it influences children's life and growth not only the emotional intelligence (EI) and social

emotional learning (SEL) abilities in preschool (Bracey, 1994; Gershon & Pelliteri, 2018). The quality of kindergarten education has a strong mediating effect on children's language development, and the out door activities in kindergartens also related to kids' reaction speed, adaptability and physical development (Shi & Wang, 2020). Many side effects such as mental disorders, psychosocial conflicts and academic difficulties may happen due to a lack of good preschool education (Gershon & Pelliteri, 2018).

During the whole preschool education period, preschool teachers or practitioners will help children develop physical, moral, intellectual and aesthetic abilities appropriately (Gershon &Pelliteri, 2018). Among the huge imbalance between supply and demand in China, parents have paid rising attention to high-quality preschool education which requires well-rounded teacher and comprehensive teaching knowledge (An, 2019; Li, 2018; Lou, 2020).

Through the data coming from the Ministry of Education, in 2019 more than half of the teaching personnel in Chinese preschool only got college diploma, and the vocational colleges will continue to undertake the task of training the mainstream future preschool education personnel (Lou, 2020). Based on this context, the research to explore the preschool trainees' in college level.

TPACK represents three fundamental knowledge that teachers must acquire, which refers to Technological Knowledge, Content Knowledge, Pedagogical Knowledge. Koehler and Mishra (2009, p. 62) mentioned the interplay of these components across various contexts influence as "*the extent and quality of educational technology integration*".

With an increasing trend of using technology appropriately in teaching and learning, pre-service teachers need to be equipped with the necessary competencies to combine educational technology with content and pedagogy (Habowski & Mouza, 2014). Thus, the importance of TPACK framework in teacher education programs has been showed (Habowski & Mouza, 2014; Mishra & Koehler, 2006; Mouza, Nandakumar, Yilmaz-Ozden, & Karchmer-Klein, 2017).

However, some research showed that many trainees' felt unsatisfied with their teaching programme in college (Li,2018; Gu & Tang, 2019; Luo, 2020). To this end, this study was situated in Chinese college students in the Early Children Development and Health Management major which aimed to train future preschool teachers in China and the research questionnaire was designed around the TPACK framework.

Thus, this study was carried out in a public college in Hunan, China. The purpose of this study is to investigate the preservice teachers' self-reported TPACK among the final-year trainees in Early Children Development and Health Management Major. The study also attempted to explore the relationship between the preservice teachers' TPACK and their main factors. After that, a reliable conclusion of preschool teachers' TPACK and their training curriculum will be proposed for improvement.

1.2 Research Questions

According to the research objectives, the research questions are formulated as following:
1. What are the preschool trainees' perceptions of their application of Technological Pedagogical and Content Knowledge (TPACK)?

2. Is there a relationship between the preschool trainees' application of Content Knowledge (CK) and their Technological Pedagogical and Content Knowledge (TPACK)?

3. Is there a correlation between the preschool trainees' application of Technological Knowledge (TK) and their Technological Pedagogical and Content Knowledge (TPACK)?

This paper is going to review the related literature as well as researches about the training of preschool teachers and TPACK, to introduce the research method applied and introduce the data research results as following. At the end of this paper, the author would draw a conclusion about this study with data support, to answer the research questions.

II.   Review Of Literature

In this section, the related research and literature about Preschool Education and Education of Preschool Teachers, Teachers' Development and Professional Development Theories. Teachers knowledge, especially TPACK will be reviewed.

2.1 Preschool education in China

Once people talk about the Chinese education and its weak link, the early childhood education or the preschool education, has seen unprecedented development (Feng, 2017). However, in recent years, the rapid development of Chinese, economy and education are experiencing the progress with challenges and difficulties. When facing the huge imbalance between the rapid expansion of economy and the need of higher and equal preschool education from parents site, Chinese government and its related Ministry of Education have been taking more responsibility for preschool location since 2010. In *the National Medium and Long-term Education Reform and Development Plan (2010–2020)* (Ministry of Education, 2010), the Chinese government stated the target of universalizing early childhood education (ECE) by 2020. Enhancing the professional capacity of preschool teachers has been highlighted as one of the major objectives of this educational plan. That is, millions of teachers have to be recruited, trained, and receive professional development opportunities to achieve the goals for 2020 (Ministry of Education, 2010). According to the statistics from the Ministry of Education, the gross enrollment rate in China's preschool education reached 85.2% in 2020 and there were 2,913,400 full-time kindergarten teachers across the country in 2020 (Ministry of Education, 2021a). Some researchers' concentration is on the improvement of the quality of teachers in poor areas (Xue & Li, 2020). Preschool education in poor areas, especilly the backward mountainous area, lags far behind developed areas which makes it difficult to implement educational equity. The backwardness of preschool education in poor areas and the low professional development of local preschool teachers were mentioned by the researchers (Xue & Li, 2020). On 14th December 2021, nine Chinese government departments, including Ministry of Education, jointly issued the new document "*The 14th Five-Year Plan Action Plan for the Development and Promotion of preschool Education*", which clearly described the overall aim of Chinese preschool education, to build a further improved public service system by 2025 to cover both urban and rural areas, with rationally distributed resources and benefits. (Ministry of Education, 2021b).

On January 16th and 17th, the 2022 National Education Conference was held in Beijing, which stressed the importance of improving the quality of education, accelerating the modernization of education and preparing students to become well-rounded individuals. More than 4% of GDP will be spent on education each year (Ministry of Education, 2022).

2.2 Teachers' professional development

In this part, a theoretical framework of a development process of a teacher from Feiman-Nemser (1983) is presented. Feiman-Nemser (1983, 2001) stated a framework of "becoming" and "being" a teacher with four phases as following: (1) the pretraining phase, (2) the pre-service phase, (3) induction phase, and (4) the in-service phase. The researcher made a diagram of Feiman-Nemser as following, from which the differences between two models could be identified.

For the second stage pre-service, trainees are fully prepared to enter the classroom and enter the world of being a teacher formally. They learn the theoretical base of teaching and are involved in teaching practice in colleges, universities or training institutions, where they learn how to teach scientifically. This stage is the research scope of this study, and the researcher focused on the diploma level and Early Children Development and Health Management major in colleges in Hunan, China.

According to Feiman-Nemser (1983, 2001) the third stage is the induction phase, and it is a transition stage from a trainee to a teacher, from "becoming" to "being" a teacher. Bashiruddin (2018) explained this phase of Feiman-Nemser's framework as '*in which the teachers are inducted into the school under supervision and learn how to teach*' and 'their first encounter with a real classroom and this phase can shape a teacher's decision to remain in the profession or to quit the profession.'(p.13). This stage refers to internship in this research, and preschool trainees have chances to practice what they learned according to their curriculum settings. Since this stage may influence whether the trainees remain in the teaching field or not, making them well-prepared and have enough knowledge may help them feel satisfied about this occupation, which restate and emphasis the research objectives, the importance of pre-service education and its curriculum setting in colleges.

2.3 Teachers' knowledge of TPACK

Technological Pedagogical Content Knowledge (TPACK), which is the major part of theoretical framework for this research, is build on the basement of Pedagogical Content Knowledge (PCK) (Shulman, 1986; Mishra & Koehler, 2006; Koehler & Mishra, 2009). That is to say, the birth of Technological Pedagogical Content Knowledge (TPACK) is on the basis of Shulman's (1986) idea of Pedagogical Content Knowledge (PCK).

Shulman and his colleagues (1986) posed some questions, like '*How might we think about the knowledge that grows in the minds of teachers, with special emphasis on content?* ' (p.9). Shulman and his colleagues (1986) distinguished three categories of content knowledge as following: (a) subject matter content knowledge, (b) pedagogical content knowledge, and (c) curricular knowledge. To sum up, there are two core elements of Schulman's concept of PCK. One is the presentation of subject content knowledge, and the other is the understanding of students' pre-concepts, concepts and specific learning difficulties. PCK refers to the knowledge that an experienced teacher must acquire, including knows what, when, why, and how to teach.

As for the related researches about Early Childhood Education and Preschool education major, Lin (2017) did a research using simulation teaching method to boost the development of PCK of preschool trainees in normal university. Gu and Tang (2019) did research among vocational colleges students (in teachers education program) and explored strategies to improve the professional core literacy of them, from the Perspective of PCK. Jiang (2020) did a research among Qiannan Minority Preschool Teachers College, and explored the Construction of PCK for junior college students majoring in Preschool Education (5-year learning program). Zhu (2020) did research on the structure and transformation mechanism of PCK in health field of preschool teachers.

The TPACK framework builds on Shulman's (1986) construct of Pedagogical Content Knowledge (PCK), and due to the requirement for effective technology integration from teaching and education, the TPACK framework include technology knowledge as situated within content and pedagogical knowledge (Mishra & Koehler, 2006). That is, apart from the PCK framework, with the development of technology, Mishra and Koehler (2006) recognized that it was necessary to consider the role of technological knowledge when the technology is designed to support instructional environment, and proposed the Technological Pedagogical Content Knowledge (TPCK) concept framework of teachers' knowledge. Moreover, scholars Schmidt, Baran, Thompson, Mishra, Koehler, and Shin(2009) designed a questionnaire to test purposive subjects' TPACK level.

2.4 Previous researches of TPACK

The domestic use of TPACK theory has been popular, Chinese scholars also realized the importance of TPACK and proposed their own framework in a specific subject. For example, scholar Cui(2018) did a research to explore the possible strategy of improving the informationalized teaching ability of students in Preschool Education major within the framework of TPACK. Cui(2018) assumed that the informationalized teaching ability of preschool trainees plays an important role in the cultivation of teachers' professional ability, which is also a key factor for the modernization of preschool education. In Cui's study, the researcher analyzed the application ability of preschool trainees' in information teaching under the TPACK framework (Cui, 2018). The strategy of improving the informationalized teaching ability of students in Preschool Education Major under the framework of TPACK is put forward in order to provide a basis for the training of information technology teaching ability of preschool trainees (Cui ,2018).

Unlike the Cui (2018) focused on the application of technological knowledge, in the same year, Li (2018) also did a research about problems and countermeasures of TPACK for preschool education undergraduates. Through Li's research (2018), there were some main problems and difficulties in preschool trainees' TPACK in the universities. Through interviews, the trainees were found that they did not pay enough attention to the technology which had a certain impact on their TPACK level. Trainees did not want to learn technology skills beyond the knowledge in textbooks (Li, 2018). Trainees in Li's research are in the universities and they assumed that preschool undergraduates should be inclined to study theoretical knowledge and thus they knew little knowledge of technical knowledge, while preschool trainees in colleges focused on technology (Li, 2018).

As for the research about trainees and related teaching reform, Ye and Qiu (2019) did an investigation on TPACK status of Preschool Major Students and offered some suggestions on teaching reform. In order to explored the application degree of Technological Knowledge (TK) to the teaching activities of preschool education trainees, the researchers modified the questionnaire of scholars Schmidt, Baran, Thompson, Mishra, Koehler, and Shin (2009) and used the scale to investigate 220 preschool education trainees, who were the preservice preschool teachers (Ye & Qiu, 2019). The statistical analysis of Ye and Qiu's (2019) research showed that the overall TPACK knowledge of preschool trainees was good, but the TK was still weak. They also found that among the whole grades, there was significant difference in TPACK knowledge of preschool trainees, which meant that the final-year trainees had better results than the second-year trainees, while gender difference was not significant. They also stated that hobbies and training of information technology will cause differences in TPACK knowledge among students in Preschool Education Major in normal university. Ye and

Qiu (2019) also mentioned that some countermeasures should be taken. For instance, more attention should be paid to the training of information technology knowledge and ability of preschool trainees; industry-university-research cooperation needs to be carried out for improving the TPACK level of preschool normal university students.

Based on TPACK framework, the "G-P-T" Ability Structure of preschool education major students was proposed by Wang (2020), as a research result about professional Competence of trainees from TPACK perspective. Wang (2020) stated constituent elements and connotation of such ability structure as a basic and well-rounded quality and abilities that a preschool teacher should conquer. "G" as *General Ability*, which refers to having rich General knowledge and mastering systematic theoretical knowledge of education and teaching, as well as good ability of organization, communication, cooperation, reflection and evaluation as well as teaching and research (Wang, 2020). While "P" means the *Professional Ability* involving effectively building relationships with Using ability of kindergarten material environment and spiritual environment, effectively organize and conduct the kindergarten day life with the ability of children's games, support and guide the children's cognitive, physical, social and other aspects for the development of ability and effective planning and implementation of the kindergarten education and conservation, to reflect, motivation and evaluation of young children's ability(Wang, 2020). And the last "T" refers to the *Technology Ability* including the Ability to use it to prepare for teaching activities, to use it to carry out activities, and to use it to evaluate and reflect on activities(Wang, 2020).

Xue, Wang, and Mi (2021) also made a study on TPACK status of preschool trainees, and their research results showed that not only the university trainees but also the college trainees had a good overall control of TPACK. Among those trainees, TPK had the highest mean score in all dimensions, and then the PK followed, which indicated that preschool trainees in university had a high level of integrative technology teaching knowledge and teaching knowledge (Xue, Wang & Mi, 2021). CK had the lowest average score, indicating that preschool trainees were relatively inadequate in the content knowledge of the five fields. According to the study of Xue, Wang, and Mi (2021), in all the technical elements involved dimensions - TK, TPK and TCK, TPK had the highest score, while TK had the lowest score. Xue, Wang, and Mi (2021) assumed this results were because those trainees can integrate the technology to their teaching design; as for the reason why those trainees' TK was relatively low, scholars explained that if simply discussed the technology, which is a broad concept, those trainees considered more about their technical proficiency. However, the improvement of TK knowledge can help to increase the level of TPK and TCK, so the learning of technological knowledge in normal university and college should be strengthened to make those preservice teachers can not only be familiar with the technology, but also accurately choose the appropriate technology to assist teaching in kindergartens (Xue, Wang & Mi, 2021).

III. METHODOLOGY

In this research, the descriptive research design was applied. The study was conducted at Yongzhou Vocational and Technical College which located in the southern part of Hunan Province of China. The population is about 200 final-year students in the Early Children Development and Health Management major, who were supposed to be graduated in the academic year 2021. Due to the research convenience, the convenient sampling was used to select 45 samples. The online questionnaire was posted on the website called "Questionnaire Star" which was widely used in China and could create QR code for scan and enter the start page of the survey. The online questionnaires, the quantitative data collection tool, were send to the group-chat which every trainee in the final year study in this major was contained. Thus, their TPACK knowledge were gathered and analyzed through the modified TPACK questionnaire.

As for the text of this questionnaire, it comes from a commonly used survey from Schmidt et al. (2009). This survey is recommended on the official website of TPACK as a common used research method. Since there are several factors or categories in TPACK framework, the original questionnaire posted on the official website of TPACK is designed according to these categories, while the author revised some question for get more useful information to answer the research questions.

IV. Results And Discussion

RQ1.What are the preschool trainees' perceptions of their Technological Pedagogical and Content Knowledge (TPACK)?

Table 4.1 *Distribution of Preschool Trainees' Self-reported Total TPACK Application*

Questionnaire Item (Range 0-100 percentage)	60 percentage or less	61- 75 percentage	76-100 percentage
In general, approximately what percentage will you give to your application of the Technology Pedagogy and Content Knowledge (TPACK) provided by your professors during your internship?	35.6%	35.5%	28.9%

Table 4.1 shows the distribution of 45 samples' TPACK application scores. 35.6% preschool trainees self-scored their application under the 60 percentage, while 35.5% of participant trainees scored themselves at the range of 61-75 percentage. That means totally 71.1% of them scored under 75 percentage. Thus, only 28.9% of them thought their application could be above 75 percentage, which could be considered as good at using TPACK during their teaching internship.

Table 4.2 *Descriptive data of Preschool Trainees' Self-reported Total TPACK Application (Range 0-100 percentage)*

	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Variance Statistic
TPACK Application	45	78	22	100	65.11	18.048	325.737

Table 4.2 shows that the mean score of TPACK Application is 65.11 percentage among 45 preschool trainees. Among the subjects who filled questionnaires, the lowest self-reported score of their TPACK application level is 22 points, while the highest score is 100 points. This score range spans 78 percentage.

Table 4.3 *Results of TPACK in Six subjects by Chinese Preschool Trainees in Public College*

TPACK (Technology Pedagogy and Content Knowledge) Items	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1. I can teach lessons that appropriately combine mathematics, technologies and teaching approaches.	0	0	60% (27)	35.6% (16)	4.4% (2)
2. I can teach lessons that appropriately combine literacy, technologies and teaching approaches.	0	0	53.3% (24)	42.2% (19)	4.4% (2)
3. I can teach lessons that appropriately combine science, technologies and teaching approaches.	0	2.2% (1)	57.8% (26)	35.6% (16)	4.4% (2)
4. I can teach lessons that appropriately combine social studies, technologies and teaching approaches.	0	0	55.6% (25)	40% (18)	4.4% (2)
5. I can teach lessons that appropriately combine art and craft, technologies and teaching approaches.	0	0	44.4% (20)	51.1% (23)	4.4% (2)
6. I can teach lessons that appropriately combine physical and mental health, technologies and teaching approaches.	2.2% (1)	0	53.3% (24)	40% (18)	4.4% (2)

Table 4.3 shows the result of specific TPACK items of 45 participants. Since the mathematics, science, literacy, socialization, health, as well as art and craft are the main teaching topics in Chinese kindergarten, the author adopted the questionnaire from TPACK official website and them modified these like above. Matching the five categories mentioned by *Early Learning and Development Guidelines for Children Aged 3 to 6 Years* (2012, MoE), 40% of the trainees agreed or strongly agreed that they can teach mathematics and science lessons with appropriate technologies and teaching approaches, which was the lowest in all subjects. As for the socialization, as well as physical and mental health, 44.4% trainees thought they could treat lessons in these two fields

appropriately. The lessons about literacy and art, participants showed relatively high confidence, since 46.6% and 55.5% of them agreed or strongly agreed that their abilities to treat lessons with TPACK in an appropriate way. Through the whole results, only in the art and handcraft field, over half of trainees, 55.5% of them considered their could apply TPACK appropriately, but it is still not pass the borderline (60 %).

RQ2. Is there a relationship between the preschool trainees' application of Content Knowledge (CK) and their Technological Pedagogical and Content Knowledge (TPACK) ?

Table 4.3 *Correlation between the application of Content Knowledge (CK), and Content Knowledge (TPACK) among preschool trainees*

CORRELATION			
		CK APPLICATION	TPACK APPLICATION
CK APPLICATION	Pearson Correlation	1	.730**
	Sig. (2-tailed)		0.00
	N	45	45
TPACK APPLICATION	Pearson Correlation	.730**	1
	Sig. (2-tailed)	0.00	
	N	45	45

**Correlation is significant at the 0.01 level (2-tailed).

Table 4.3 shows correlations among the trainees' application of Content Knowledge and their application of Technological Pedagogical and Content Knowledge. The correlation value between application of CK and application of TPACK is 0.730 (r=0.730>0.66, P=0<0.01) and shows significance at the level of 0.01,indicating that there is a significant positive correlation between TPACK and CK.Among the data from 45 samples in this research, there is a high percentage of company changes, which means when the score of application of CK rising, the application of TPACK will get a higher score.

RQ3. Is there a correlation between the preschool trainees' self-reported application of Technological Knowledge (TK) and their Technological Pedagogical and Content Knowledge (TPACK) ?

Table 4.4 *Correlation between Pedagogical Knowledge (TK) and Content Knowledge (TPACK) among preschool trainees*

Correlation between Pedagogical Knowledge (TK) and Content Knowledge (TPACK)			
		TK APPLICATION	TPACK APPLICATION
PK APPLICATION	Pearson Correlation	1	.821**
	Sig. (2-tailed)		0.00
	N	45	45
TPACK APPLICATION	Pearson Correlation	.821**	1
	Sig. (2-tailed)	0.00	
	N	45	45

**Correlation is significant at the 0.01 level (2-tailed).

Table 4.4 shows correlations among the trainees' application of Technological Knowledge and their application of Technological Pedagogical and Content Knowledge. The correlation value between application of PK and application of TPACK is 0.821(r=0.821>0.66, P=0<0.01) and shows significance at the level of 0.01, indicating that there is a significant positive correlation between TPACK and TK. Among the data from 45 samples in this research, there is a high percentage of company changes, which means when the score of application of TK rising, the application of TPACK will get a higher score. The correlation between the application of TK and TPACK (r=0.821) is stronger than the correlation between the application of CK and TPACK (r=0.730).

To sum up, among the 45 trainees, the mean scores for their TPACK does not show a good result, and the mean score is 65.11 %, while the score range 0 to 100 percentage. 71.1% of them scored under 75 percentage and only 28.9% of them thought their TPACK application could be above 75percentage, which considered their performance was good at using TPACK during their teaching internship. Among six subjects, trainees showed their confidence in the art and handcraft field and results also revealed their deficiency in teaching mathematics and science lessons. These results suggested that the trainees' TPACK should be further improved and also matched the results from previous research (Cui,2018; Li,2018; Ye & Qiu, 2019). In addition, the findings tested that above two factors (i.e. the CK and TK) are related to preschool trainees' TPACK application, and the correlation among these factors is strong and positive. Thus, to improve trainees' CK and TK could help to increase their application of TPACK in the teaching practice.

V.   CONCLUSION

These results suggest that for the Hunan province, where the author carried this research, the training program need to take some actions to modify and adjust, because the trainees' TPACK application level should be further improved. The findings indicated trainees' unbalanced content knowledge among six subjects or fields, especially in the math and science teaching. Colleges and lecturers should pay attention to provide better training courses to improve trainees' TPACK level in all field in a balanced way, which may lead the level of trainees to a better internship result. According to this current study, the CK and TK application, especially the TK application, plays an important role among trainees' TPACK application level. These results indicated that the improvement in trainees' CK and TK could help the trainees' TPACK application level increase, which should arose college lecturers' attention.

In this research, only 45 samples were tested by questionnaires, which only provide quantitative data to answer the research question. Further studies with larger samples in this college might suggest different score result, while participants from different colleges in other provinces of China perhaps discover more useful data and different results. In order to obtain more comprehensive data on trainees' TPACK and its application, it is suggested that in the future researches could focus on more components of TPACK such as the PCK, TCK, and other genres of influencing factors, such as trainees' study motivation and learning habits. Moreover, the qualitative research among trainees and their lecturers might provide more detailed and clearer clues about TPACK improvement in preschool trainees.

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