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Blended Learning as a Strategy to Improve Sustainability and Equity for Professional Development of Rural Teachers

Yanfen Huang

<https://orcid.org/0000-0001-6617-2145>
Universiti Putra Malaysia, Selangor, Malaysia

Sharifah Intan Sharina Syed-Abdullah

<https://orcid.org/0000-0002-9697-8913>
Universiti Putra Malaysia, Selangor, Malaysia

Nurul Nadwa Zulkiflie

<https://orcid.org/0000-0002-2232-3885>
Universiti Putra Malaysia, Sarawak, Malaysia

Norliza Ghazali

<https://orcid.org/0000-0002-4735-1209>
Universiti Putra Malaysia, Selangor, Malaysia

Abstract

Teachers in rural areas should receive equal support and professional development training as those in urban areas. It is a strategy to promote education equity for the students in the former area. This study takes the learning experience and teaching practice experience of rural teachers who participated in the Rural Teacher Replacement Training Program (RTRTP) in Guangdong Province, China, as a case. Seventeen rural teachers who participated in the blended training program were chosen as a research sample. The effect of blended training was evaluated at four levels: participants' reaction, participants' learning, behavior, and learning results. A model of influencing factors for rural teachers' blended training was developed. The results showed that rural teachers' overall satisfaction with the blended training program was relatively high. Teachers reported a greater increase in knowledge skills, but the translation into practical knowledge and the impact on the organization was not as high as expected. Four dimensions and 14 main categories influence the blended training effect of rural teachers. This study provides a reference for improving the efficiency of

rural teacher blended training, especially for promoting the teaching practice after teacher training.

Keywords: Blended learning, digital divide, education equity, rural teachers, teacher training.

Introduction

The present study focuses on investigating the utilization of blended learning as a pedagogical approach in teacher education with the aim of addressing sustainability issues, particularly the disparities in educational quality and the digital divide. Online learning provides instructors with the chance to engage in continuous learning and cultivate personal learning abilities, enabling them to be self-directed and have control over their own learning (Mirke et al., 2019). Blended learning systems combine face-to-face instruction with computer-mediated or online instruction (Graham, 2006). As blended learning has experienced more than 20 years of development, many studies have been conducted to design blended learning and identify its effectiveness. Improved teaching methods, access/flexibility, and cost-effectiveness were the most common reasons teachers chose a blended learning approach in their teaching (Graham et al., 2005). In addition, the richness of teaching is enhanced in a blended learning environment that supports active learning, peer interaction, access to rich resources, and opportunities to apply the newly learned knowledge (Goos et al., 2020).

Although blended learning offers the above mentioned advantages in teacher training, the discussion on its implementation in the context of its application for rural teachers' training courses is still in its infancy. In addition, as the study entailed a collaborative effort among writers with diverse areas of expertise in primary and secondary teacher training, educational technology, and sustainability, we are writing this paper to present a discussion on an empirical study of this topic in relation to digital divide and sustainability concerns.

Blended learning presents a promising avenue for promoting sustainability and equity in education. The notion of sustainability was initially introduced as a means of addressing environmental concerns. The concept posits that addressing environmental issues necessitates solutions that encompass the simultaneous development of the environment, economy, and society. As explained by Huckle (2012), the primary objective should entail a comprehensive transformation including economic, social, and cultural aspects, with the aim of eradicating capitalism and fostering novel, enduring connections between individuals and society, as well as between individuals and the natural environment.

From this perspective, one of the sustainability concerns pertains to the provision of quality education. The significance of the emphasis on this can be seen when the United Nation dedicates a specific goal on this issue in Sustainable Development Goals (SDGs). The agreement on the SDGs was made in September 2015 during the United Nations Sustainable Development Summit in New York. The SDGs place an even greater emphasis on the social aspects of development (Waage et al., 2015) than the others. This is because the SDGs follow the developing international trend to regard the environment much more holistically. Out of the 17 goals outlined in the blueprint, the fourth goal (SDG 4) specifically dedicated on quality education. The goal aspires to ensure that all people have access to high-quality education and that lifelong learning

opportunities are available. This reflects concerns on the long-term viability and resilience of educational systems. This goal therefore features as a high priority (Vladimirova & le Blanc, 2016). In addition, the goal is crucial due to its potential to facilitate the attainment of other objectives.

In educational technology, a commitment to this goal, among others, is to address the issue of the digital divide. The matter of the digital divide is not a recent event. In his scholarly article, Huckle (2012) examined the disparity between children's engagement with technology in non-school settings and the instructional methods employed within educational institutions. In addition to their academic pursuits, children engage in autonomous exploration of intricate digital environments. However, within the educational setting, children are required to adhere to a conventional instructional approach that does not align with their practical encounters in the real world. There is often a lack of alignment between the technology utilized in schools and how children utilize technology in their daily life, resulting in a disparity between their school and home experiences.

In this study, the digital divide refers to the disparity between those who have sufficient access to technologies and resources and those who do not (Moore et al., 2018; Resta et al., 2018). Geographic isolation and resource constraints are identified as contributing barriers to the digital divide. Due to these problems, digital divide in developing countries is particularly prevalent and manifested between communities in rural and urban areas.

Blended learning requires high-quality online learning resources, mature and easy-to-use learning platforms, and friendly interactive platforms (Garbe & Louloudi, 2018; Geng et al., 2019). However, due to the unavailability of internet and broadband infrastructure, inability to purchase technology devices due to low income, and low levels of digital literacy among the community in the area do not have the same opportunity to enjoy the benefits of blended learning as the urban community (Ye & Yang, 2020). This concern regarding the digital divide is more alarming, especially when its implications are evident during the pandemic after the breakout of the novel coronavirus 19 (COVID-19).

While it is crucial for providing equity education for rural students to access education, professional development training for teachers in the area is equally important. However, very little literature was found to discuss the issue of the application of blended learning in professional development training of rural teachers. In addition, a lack of studies has pointed out which part of the content or explained how blended learning plays a greater role and what factors will affect the teaching practice after teacher training. The study by Eaton et al. (2015) reports that various factors affect different subjects; however, the study is not directly applicable among rural teachers, which is the focus of the current research. Past literature suggests that the effects and influencing factors of teachers' blended training in different places according to their actual situation could be different. For example, Yang and Zhu (2019) found that teachers in rural areas of China have significantly lower digital learning power than teachers in urban areas. However, rural teachers' satisfaction with blended learning is high among urban teachers (Liu et al., 2021).

Hence, this study intends to provide answers to the following questions: (1) What are the outcomes of blended training for rural teachers? (2) What are the factors that influence the outcomes? and (3) How to implement the blended training to assist to the mitigation of sustainability concerns related to digital divide? The answers to these questions are significant for planning better teacher professional development courses

in the future (Kennedy, 2016). Particularly in this study, the answers to these questions are based on a case study conducted in Guangdong, China.

Rural Education and Digital Divide in China

Rural education has long served as the “short board” in China’s education system, which significantly impacts the overall quality improvement of education in China. Constructing primary and secondary school teachers is critical in developing rural education to achieve educational equity (Chen & Lu, 2019). Rural teachers include teachers in rural centers and village schools across the country (Office of the State Council, China, 2015). Due to conditions such as geographic environment, economic base, and social status, the professional foundation of rural teachers in primary and secondary schools in rural areas is still relatively weak. Their professional growth rate lags compared to urban teachers (Ling et al., 2020), and professional development is a prominent and urgent issue. For example, rural teachers’ professional identity is not strong, and they lack development awareness (Fu, 2018; Zhou, 2018); their overall quality is low compared to urban teachers, and they lack development motivation (Fu, 2018; Zhang et al., 2020); uneven allocation of resources and inadequate guarantee mechanisms for teachers’ professional development (Fu & Fan, 2018; He & Zhao, 2021). In addition, rural teachers tend to have a lower level of acceptance of the integration of new technologies and education than urban teachers and do not have a positive attitude toward applying new technologies in education (Wang & Hu, 2021).

In the information society, the differences in teachers’ ability to use ICT can lead to whether students can equally enjoy the convenience and benefits of ICT for teaching and learning, which can lead to injustice in the process and outcome of education (Shi et al., 2018). Teachers need adequate and continuous training to enhance their ability to integrate technology for subject teaching to form ICT literacy among students (Fernández-Cruz & Fernández-Díaz, 2016; Ranieri et al., 2017). Currently, the training demand of most rural teachers is to connect and extract the existing learning experience, which is a habit consumption demand (Zhao, 2018b). However, if this need is met, it becomes an enhancing consumption need, where they creatively complete tasks and generate personal and unique insights during the training. However, rural teachers’ professional development in China suffers from insufficient offline training and ineffective fully online training (Gao, 2018; Wang & Hu, 2021). As the impact of ICT on teacher training continues to deepen, rural teachers are no longer the traditional “take it all as it comes” and “mechanically copy it” but generally show the need for changes in training content and methods. The blended learning strategy not only reflects the progressive change of teachers from theoretical concepts and methodological skills to practice improvement but also reflects the behavioral improvement process of teachers learning, practicing, and improving, which promotes the integration of teachers’ learning and use (Calleja, 2022). It also facilitates the development of lifelong learning capacity for teachers, thus contributing to promoting equity and quality in education (Mavropoulos et al., 2019; Krasnova & Shurygin, 2019). However, current blended learning research has focused more on design models, strategies, and methodological tools. There is a lack of evaluation models and less focus on relevant variables influencing blended learning (Halverson et al., 2014). It will hinder future teacher professional development programs from enjoying the benefits of blended learning strategies. Therefore, various factors must be addressed to create meaningful learning environments (Singh, 2021). Investigating the application of

blended learning in rural teachers' professional development and assessing its effectiveness and influencing factors makes it meaningful to plan more effective blended professional development strategies for rural teachers.

Methodology

Research Design

This study is an embedded single case study. The research focuses on the practical problems experienced by rural teachers in Guangdong Province, China. The study then describes the perceptions of village teachers undergoing blended learning training and explains why and how the training influenced their teaching practices. Yin (2018) suggests that a case study design should be considered when research is focused on answering "how" and "why" questions. One of the advantages of the case study approach is the close collaboration between the researcher and the participant while enabling participants to tell their stories (Baxter & Jack, 2008). Therefore, the qualitative case study method is appropriate for this study. Detailed descriptions provided through qualitative research help better explain the reasons behind teachers' views.

Research Location and Participants

The cases and analysis units selected in this study are purposeful. That is purposeful sampling. The case selected for this study is a typical blended training program for rural teachers: The 2017-2018 Rural Teacher Replacement Training Program (RTRTP) in Guangdong Province, China.

RTRTP is a comprehensive training program for rural teachers implemented in China. This program addresses the problem of the lack of rural teachers, weak professional ability, and lack of learning time. It dispatches normal university students to volunteer teaching in rural schools, and replaces rural teachers to participate in the training. The training target is 300 rural teachers in Guangdong Province. The training period was from 2017 to 2018, divided into two years, with 270 credit hours per year. The training was conducted in a blended model, including 30 days for face-to-face learning, field learning in urban schools and seminars (180 credit hours), and 90 days for online learning (not less than 90 credit hours) and on-the-job practice.

Informative case studies and analysis units were chosen as an approach to answer the research questions. The analysis unit in this study is rural teachers who participated in RTRTP. Formal approval to conduct the study was obtained from the program implementation department. This study purposefully selected 17 participants from 300 teachers who participated in RTRTP, which involved different genders, age groups, teaching subjects, and regions (Table 1). Selected participants were knowledgeable persons who could provide useful information during the study process.

Table 1

Distribution of Samples

Participant	Gender	Teaching experience	Education Qualification	Teaching Subject
Teacher A	Female	3 years	Bachelor	Multi- disciplinary
Teacher B	Female	8 years	Bachelor	Chinese
Teacher C	Female	9 years	Bachelor	Chinese
Teacher D	Male	14 years	Bachelor	Multi- disciplinary
Teacher E	Female	8 years	Bachelor	English
Teacher F	Male	5 years	Bachelor	Mathematics
Teacher G	Female	19 years	Bachelor	Multi- disciplinary
Teacher H	Female	12 years	Bachelor	English
Teacher I	Female	6 years	Bachelor	Sports
Teacher J	Male	15 years	Bachelor	Sports
Teacher K	Male	4 years	Bachelor	Art
Teacher L	Female	16 years	Junior college	Multi- disciplinary
Teacher M	Male	12 years	Bachelor	Sports
Teacher N	Female	9 years	Bachelor	Mathematics
Teacher O	Male	5 years	Junior college	Sports
Teacher P	Female	7 years	Bachelor	Art
Teacher Q	Male	3 years	Bachelor	Sports

Data Collection

This study uses semi-structured interviews to obtain participants' perceptions of the blended training process, the acquisition and application of new knowledge and skills, and participants' school organization and student learning changes. All participants in this study provided informed consent and were invited to confirm the accuracy and completeness of the information after collation. Participation in the program was free of charge. They could also refuse to return to any questions or make the interview public, and each step would be kept confidential.

An interview protocol was developed to guide the researchers during the interview process (Table 2). The interview protocol of this study first stated the purpose of the interview and the protection of participant information. Then, with the participants' willingness, it was possible to conduct a semi-structured interview according to the following outline. Kirkpatrick's (Kirkpatrick & Kirkpatrick, 2006) evaluation theory indicates that evaluation is to confirm the effectiveness of training programs, and then the upper management can make further decisions based on the evaluation results (Alsalamah & Callinan, 2021). The four levels of the Kirkpatrick's model include reaction, learning, behavior, and results. According to Kirkpatrick's

evaluation model, this study divides the interview outline into four dimensions to set interview questions.

Table 2

Semi-Structured Interview Outline

Dimension	Interpretation	Question
General perception	Evaluate the trainees' feelings towards the whole training process.	How satisfied are you with the training? Why is that? How did you perform in the training?
Perceived learned knowledge and skills	Evaluate whether teacher training has resulted in changes in participants' knowledge, skills, and attitudes.	What new knowledge, skills, methods, and ideas did you learn during the training?
Implication to teaching practice	Whether trainees have applied what they have learned in the training course to practical work and whether there is an opportunity to apply it.	Are the new knowledge and skills you learned effectively applied to teaching practice? Why? What factors do you think will affect the training effect and teaching practical application?
Implication to organizational performance	Whether trainees have contributed to organizational performance after receiving training.	Has what you learned had an impact on your colleagues or teachers in a wider range? Why? How does your training affect the students?

Data Analysis

Yin (2018) mentioned four general strategies for data analysis in the case study: relying on the theoretical proposition, working your data from the "ground up," developing a case description, examining plausible rival explanations. This study is based on the second analytical strategy, which is not to think about any theoretical propositions but to focus on the data, and analyze concepts and themes from data. These processes assign various codes to the data, each representing an underlying concept or abstraction. This inductive strategy can produce obvious benefits, again demonstrated in grounded theory studies (Corbin & Strauss, 2015). The specific data analysis method is interpretive analysis. An interpretive analysis is a process of scrutinizing case study data to find structures, themes, and patterns that can be used to describe and explain phenomena (Thorne et al., 2004).

The coding method of interview data in this study was referred to the procedure of grounded theory (Corbin & Strauss, 2015). Coding is done to analyze and generate themes and conclusions. Coding consists of three levels: open coding, axis coding, and selective coding. According to the classification and themes obtained by coding, a theoretical model of influencing factors of rural teachers' blended learning is developed. Focus was given to these themes and sub-themes when reviewing documents to ensure triangulation. Finally, models were determined based on the analytical induction, and relevant information was placed into categories and themes.

Findings and Discussion

In order to further understand the target issue "effective blended learning for rural teachers", this study attempts to describe the blended learning experience of rural teachers and the influencing factors mentioned by them in the interview session. After obtaining and analyzing rich data, this study summarizes the findings of two research questions.

The Outcomes of Blended Training for Rural Teachers

The first research question aimed to investigate the outcomes of blended training for rural teachers. Based on the Kirkpatrick's four-level evaluation model, this study systematically evaluated the effectiveness of blended training for rural teachers in Guangdong Province, China. As seen in the open coding, the outcomes of blended training for rural teachers are presented below.

Participants' General Perception of the Entire Training Process

Participants believe that the blended learning modes enable them to learn and practice new knowledge and skills in multiple ways (Teacher B, D, G, H, I, J, L, M). Some of the participants also noted that the learning effect of online courses was not ideal, but it had little influence on the overall program satisfaction (Teacher E, G, L, N, O). Most participants indicated that they had fewer opportunities to go out to study due to their heavy teaching loads, as well as insufficient training funds and inconvenient transportation. In this respect, blended training benefits teachers as it allows them to experience and master new teaching concepts and methods in a way that centralizes face-to-face learning and forms a close learning community. Teachers can practice teaching when they return to school, and through online learning and learning communities, they can get appropriate support more conveniently for problems they encounter in the practice process. As a result, learning becomes more convenient and fulfilling for rural teachers as the digital disparity in learning modes begin to reduce the gap with urban teachers. Thus, this model provides rural teachers with opportunities for sustainable learning and allow them to perceive the potential of technology, which is to facilitate learning and teaching, laying the foundation for their future implementation of blended or online teaching and enhancing students' information literacy. Teacher J said:

"I am delighted with the training content and arrangement. This mode (blended learning mode) has improved my theoretical knowledge and practical level. It can promote the development of teachers and education in rural areas."

This also validates some of the existing studies, which found that blended professional learning could provide opportunities for professional development and

other resources for educators working in remote and rural areas (Eaton et al., 2015; Kim & Martin, 2020).

Participants' Perceived Learned Knowledge, Skills, and Attitudes Through Blended Training

From the teacher interview data, rural teachers' significant gains from blended training include the new education and teaching idea (teacher G, H, J), interdisciplinary teaching methods (teacher B, G, H, J, L, M, Q), research topic organization, and management (teacher E, H, L, P), education activity organization (teacher D, I, J, O, P), information technology and curriculum integration (teacher A, B, C, D, F, H, I, N, P), essay writing (teacher A, F, L), and others. Most participants reported learning new teaching methods and changing their teaching philosophy. In addition, the improvement of information technology ability is the most obvious. Nine participants said they had learned PPT making, video editing, and publishing skills. This encompasses technological pedagogical and content knowledge (TPACK) (Niess, 2011). Such skills are not only acquired from their training courses but are also perceived, acquired and enhanced in their learning communities and practice. However, in terms of cognitive engagement, rural teachers still have a predominantly habitual consumption needed for training. For this demand, the level of cognitive engagement required is low. It can be satisfied by the necessary behavioral manipulations (Zhao, 2018b). For example, they are trained mainly by providing specific objectives, tasks, processes, and requirements.

Teachers must apply their knowledge and skills in teaching practice or impart them directly to their students in order to retain learned knowledge and skills (Marcial & Habalo, 2017). It indicates that the blended learning model enables and makes it possible for rural teachers to master more knowledge and skills needed for sustainable development and improves their lifelong learning ability.

Participants' Implication to Teaching Practice

Solving problems in practice is an important demand of teachers in learning. In this study, almost all interviewees stated that they had applied new knowledge and skills to varying degrees after various forms of learning, including integrating information technology and curriculum teaching, subject teaching methods, educational and teaching activities organization, and essay writing. Their behavior has a certain promotion effect on the education and teaching of the school and the professional development of teachers. Li and Wang (2020) show that the blended training model can effectively promote the generation of teachers' practical knowledge compared with the traditional training model. The learning process and knowledge and skills acquired by the rural teachers during this blended training provided strong support for their online classroom activities during COVID-19. Teachers receiving blended training help narrow the digital divide and promote equality in rural education. Teacher A, for example, is a young teacher with four years of teaching experience. When it comes to the training harvest, she was very happy to say:

"Micro-class production learned in training is the most helpful to me, especially during the epidemic period. We have to conduct online lessons for students, and all the skills learned in training have been applied. Including my online learning experiences!"

The study also found that most rural teachers use digital teaching resources as a tool to assist teaching; however, they demonstrated insufficient understanding of the function of digital teaching resources in transforming teaching methods and changing

teaching modes. This illustrates that digital teaching is still underutilized in terms of its functionality and potential to develop efficient and innovative teaching strategies.

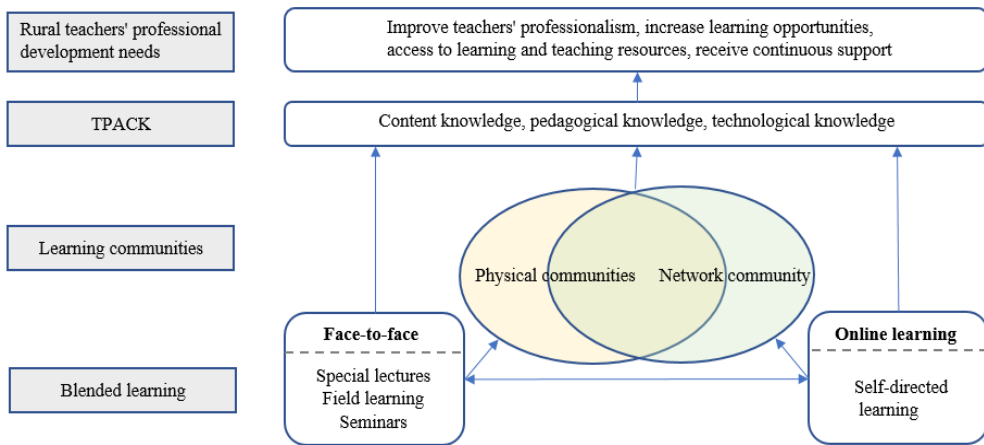
Participants’ Implication to Organizational Performance

In this study, 15 participants shared their learning with their colleagues after the training, with some teachers training their colleagues in information technology and teaching and research methods. Organizational change was more pronounced in schools with leadership support (Day et al., 2020). At the same time, teachers’ blended learning also impacts students’ learning results by encouraging more active learning attitudes, creating more active classroom atmospheres, and boosting students’ academic performance. For example, Teacher E said:

“I have learned to search for more useful resources on the Internet, such as electronic picture books, which greatly enrich my classroom. I think the biggest impact of my change in teaching method on students is to make reading and writing reading notes a habit for them.”

The current finding indicates that teachers have the ability to convey correct learning attitudes and methods to students through their actions and interactions. However, some participants reported that they could not effectively apply the knowledge and skills they had learned to practice due to the lack of space and equipment in rural schools and the lack of support from leaders and parents. Nonetheless, there is no denying the importance of well-trained and qualified teachers to achieve the goal of equity and quality education (Nakidien et al., 2021). Overall, rural teachers are expected to improve their professionalism, increase learning opportunities, have better access to learning and teaching resources, and receive ongoing support. The blended learning program allowed them to form a network and physical learning community through multiple learning modalities and learning content, pedagogical and technological knowledge. A model of the blended learning strategy to support rural teachers’ professional development is shown in Figure 1.

Figure 1
A Model of Blended Learning Strategy to Support Rural Teachers’ Professional Development

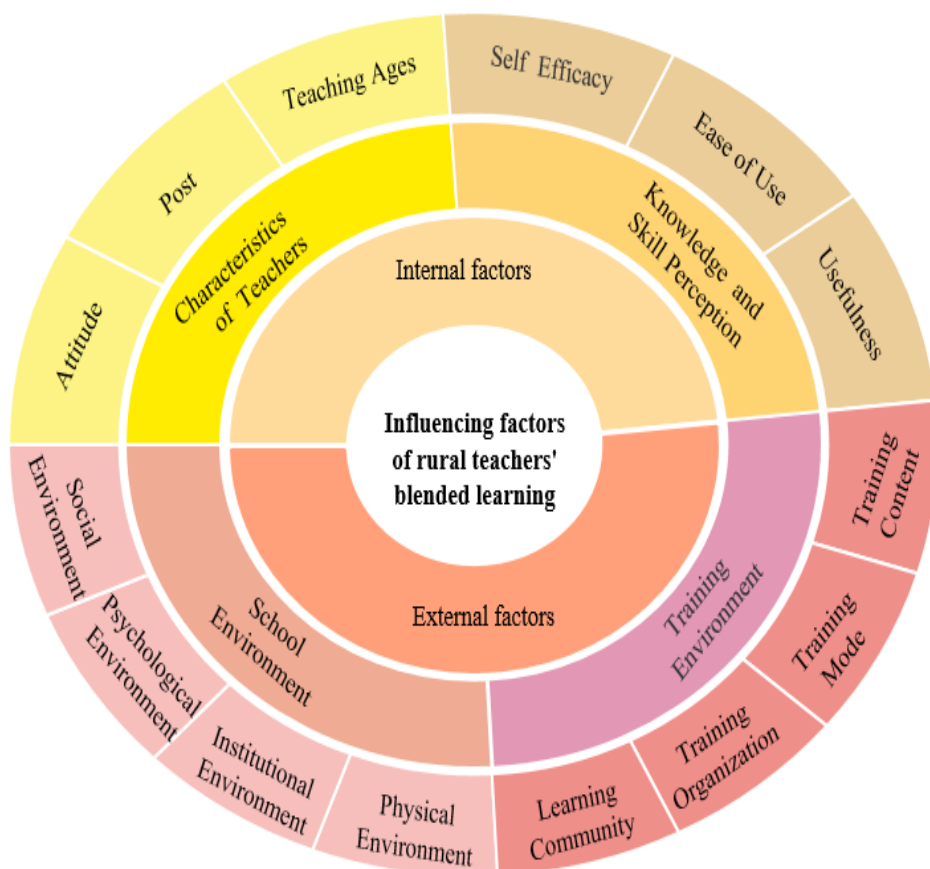


Influencing Factors of the Blended Learning Outcomes

As the study conducted inductive analysis, various themes emerged concerning the themes related to the factors influencing rural teachers' blended learning. The influencing factors of rural teachers' blended learning are divided into internal and external factors with four dimensions and 14 main categories: (1) the characteristics of teachers: teaching experience, post, attitude; (2) perception of knowledge and skills: sense of usefulness, sense of ease of use and self-efficacy; (3) training environment: training content, training mode, training organization, learning community; and (4) school environment: physical environment, institutional environment, psychological environment, and social environment. Based on these dimensions and categories, the influencing factors framework of rural teachers' blended learning effect were constructed (see Figure 2). Each factor in the framework influences the blended training outcomes of rural teachers from different angles. The following is a summary interpretation of the four dimensions as themes.

Figure 2

A Model of Influencing Factors of Blended Training for Rural Teachers



Characteristics of Teachers

The individual differences that affect the blended training for rural teachers include the difference in teaching ages, post, and attitude.

Based on the findings, teachers' teaching age had indirectly affected teachers' behavior in applying new knowledge and skills. Most of the participants among rural teachers with older teaching experience are less motivated to use innovative digital teaching after training. It was found that teachers of different teaching duration experiences had little difference in their reaction to training and learning new knowledge and skills. However, younger teachers are more receptive to the use of new ICT (Šabić et al., 2022). For example, teachers B, C, D, F, H, I, N, and P indicated that they used the new technology in their teaching practice after training; their average teaching duration was 8.2 years. However, compared to urban schools, rural schools have a significantly higher proportion of older teachers. Teacher H said that the average age of teachers in most rural schools was over 45, The more remote the school, the older the teachers. The results of the study performed by Pang et al. (2020) also confirm this finding. Their ICT literacy is moderate and low, and they are less eager to learn new teaching methods, especially those using ICT. For example, Teacher M is a secondary school physical education teacher. There are six PE teachers in his school and four of them are over 50 years old. He said:

"Older teachers are more stubborn and it is difficult for them to change. It's usually me who tries (new teaching method) with another teacher of a similar age."

Digital learning is a powerful weapon to break the inequitable distribution of educational resources. However, in digitizing education, digital divide has formed between urban and rural teachers in China due to differences in teaching ages and attitudes toward digital learning. This significantly affects the application of ICT in the classroom and limits the development of rural students' ICT literacy.

In addition, the teachers' post seems rather had a more direct impact on organizational performance after teacher training. The difference in posts is reflected in whether rural teachers also hold other posts in school besides teaching, such as school principal, dean of studies and subject leader. Zhao's (2018a) finding suggests that principals' informatization leadership is a key factor influencing the effectiveness of informatization teaching in schools. The interview result shows that teachers with certain posts in rural schools could use their positions to promote and apply new knowledge and technologies to other teachers. For example, Teacher D is the head of a small rural school:

"After the training, I have a great passion for practicing those new ideas and technologies. Under my influence, my colleagues have greatly improved their work enthusiasm, attitude, and class management quality."

On the other hand, teacher's attitude toward learning directly affected their training satisfaction, learning gain, teaching practice behavior, and students' performance. Specifically, teachers' learning attitudes were closely related to their acceptance and application of the training content. Some teachers can actively integrate what they have learnt into their teaching practice after the training, while others may find it difficult to do so because of their inherent teaching habits or resistance to new technologies. Such differences not only affect the professional growth of individual teachers but also profoundly impact the overall educational environment and student learning outcomes. Drent and Meelissen (2008) show that learning-oriented pedagogical attitudes, positive attitudes toward technology, computer experience, and teachers' personal competencies positively influenced teachers' IT adoption transfer.

Hence, teachers of high positioned in the leadership ranks who have favorable attitudes towards digitalized learning can bring about positive improvement and change within the school organization. As Teacher A mentioned:

"I think my training will have a particular impact on me and my students. (Her learning attitude) has changed their minds. They feel that teachers are still learning, so they have to learn more. Children in rural areas are more simple-minded, their source of knowledge mainly comes from teachers, and are easily influenced by teachers' attitudes and behavior."

Knowledge and Skill Perception

The perception of knowledge and skills includes rural teachers' perception of usefulness and ease of using knowledge and skills and self-efficacy for learning and using new knowledge and skills. It reflects teachers' trust in new knowledge and skills. Many studies on blended learning technologies take these factors as predictors of technology-related learning effects (Padilla-Meléndez et al., 2013). Rural teachers trust ICT when they perceive its usefulness, ease of use and usability (Xu et al., 2020). Many evaluations of online and blended learning programs tend to focus on the effectiveness of technology rather than learning (Eaton et al., 2015); however, the current finding highlights teachers' learning in blended training programs.

Useful knowledge is a teacher's subjective cognition of whether new knowledge and skills can meet the need of education and teaching and improve work performance. Using certain knowledge and skills can significantly improve its teaching effect. In that case, teachers will recognize its usefulness, invest more time and energy in learning, and actively apply this knowledge and skills. That is to say, teachers' judgment of the usefulness of new knowledge and skills directly affects their learning behavior and application behavior. Teacher B said:

"I feel that training in information technology would be more useful and easier, such as making micro-lessons. Now I often make micro-videos to record the critical learning points and send them to students. I also use the function of WeChat to assist my work."

The perceived ease of use is embodied in the low cost of learning and applying specific knowledge and skills for rural teachers. It does not require time and effort to acquire specific knowledge and skills. Therefore, when teachers think that particular knowledge and skills are easy to learn and apply, rural teachers will be indirectly encouraged to learn and apply them actively.

Self-efficacy is the conjecture and judgment of whether rural teachers can learn and utilize new knowledge and skills to complete tasks in the process of teaching. For example, experienced teachers are more likely to control the classroom, so they are not afraid of trying new teaching methods. At the same time, young teachers are more receptive to new technologies, so they are more receptive and able to apply them more willingly and with ease. Therefore, self-efficacy indirectly affects teachers' attitudes and behavior in learning and applying new knowledge and skills (Xu et al., 2020). There are also studies that suggest that teachers with moderate levels of efficacy are more likely to use the knowledge and skills learned than teachers who report high or low levels of efficacy (Schleicher et al., 2016). Hence, the perceptions of the usefulness and ease to acquire knowledge and skills in blended learning are subjective; nevertheless, moderate and positive perceptions may influence teachers' tendency to engage with the digital learning community. Therefore, when asked what factors might affect participants' teaching practice, Teacher B replied:

"The most important thing is to put what you learn into practice and believe that you can do it. Because you do not try, it is unclear whether it is suitable. The teaching process also needs teachers to continue to learn and accumulate experience."

Training Environment

As the external factors, the training environment of rural teachers' blended learning mainly includes training content, mode, organization, and learning community. The training content and mode directly impact teachers' satisfaction with training and learning harvest; training organization indirectly affects teachers' training satisfaction and application behavior of new knowledge and skills. However, the influence of the learning community on training satisfaction and acquisition and application of new knowledge and skills is indirect.

Participants in this study are generally satisfied with the content arrangement of the program's training mode. They found the training to be more comprehensive and integrate theory and practice. The online learning was informative but loosely organized, which left them disoriented. Some studies have shown that the text coverage of negative evaluations in online teacher training evaluations is 83.6 % (Li et al., 2020). It is evident that the advantages of the online learning component are not well utilized in the current blended learning programs. Some studies have shown that the variable that has the greatest impact on teachers' blended learning satisfaction is technology effectiveness (Kannan & Narayanan, 2015). However, participants' feedback in this study reported that the main factors affecting their online learning were time and availability of learning content. They felt they did not have enough time for independent learning. It was more difficult for them to learn autonomously for technologies they did not think they could use immediately. This relates back to the lack of digital facilities available at rural schools as opposed to urban settings.

The training organization theme of this study includes various arrangements and services during training. Participants are more satisfied with the blended training program because the training is relatively well done in the demand survey, training content design, training model application, and various training services. The teacher's learning experience is better, indirectly affecting the teacher's learning reaction and learning gains. Some participants indicated that in rural schools, teaching teams and teaching and research activities were not well organized. They are eager to have good teachers to follow up and guide them continuously after their training. It can be helpful motivation and confidence for teachers to enhance their use of new knowledge and skills. Past research has shown that passive large-scale training does not improve teachers' teacher practice (Loyalka et al., 2019). One of the factors in the success of the RTRTP was the provision of more active learning activities and opportunities for participating teachers.

Lastly, the learning community is an essential part of the blended training among rural teachers. Many participants expressed that the professional dedication and professionalism of training experts, instructors, and other teachers who trained together have greatly influenced them. These influences include enthusiasm for learning and work, educational beliefs and others. Doğan and Adams' (2018) research has shown that participation in professional learning communities can improve teachers' practical motivation and practice level. This study has found that continued learning breeds professionalism. Teacher E said:

"I was fortunate to meet famous teachers during the training and listen to their courses; their professional knowledge and charisma greatly inspired me. I have also made

friends with a group of like-minded teachers in the training, and we have been exchanging ideas and sharing resources in our teaching work."

Thus, it is essential that rural teachers engage themselves in the learning community, whether online or offline, in order to interact, maintain learning motivation, and update their knowledge and skills with other teachers and professionals in similar fields.

School Environment

The school environment in this study refers to the environment where the participants work. It includes the physical environment, institutional environment, psychological environment, and social environment. Lin (2015) argues that schools are the "workplace learning environment" for teachers and play an important role in producing teachers' practical knowledge. The school organizational environment and climate are potential levers for teacher change (Ouellette et al., 2018).

However, the working environment of teachers and the school, and the regional educational environment will also have a particular impact on the teachers' teaching practices. When discussing the influencing factors of blended learning, Teacher I mentioned:

"Both software and hardware will affect. Software refers to the county and the school's teaching and research level and atmosphere. If the county does not pay much attention to the teaching and research of the subject, you will only admire yourself and have no official evaluation. Hardware refers to the supporting facilities and equipment of the school. If the school conditions are difficult, many activities cannot be conducted."

The above excerpts reflect the overall challenge of rural teachers in learning and practicing digital teaching technology in schools. Four themes of the school environment will be presented below.

This study discovered a direct correlation between the physical environment of school and teachers' willingness to continue learning and teaching practices. The lack of ICT equipment was reported to affect teachers' ability to translate the technology learned in training into practical digital teaching skills. Research showed that adequate preparation of ICT tools and facilities was one of the main factors for the success of technology-based instruction (Ghavifekr & Rosdy, 2015). For example, if a school has advanced and sufficient multimedia equipment, teachers will have more information-based teaching behavior. The results of the interview data show that the infrastructure conditions of rural schools in Guangdong vary widely. In particular, the outdated and ineffective use of information technology teaching equipment seriously affects teachers' learning and application of new teaching methods. It is a major factor in creating a digital divide between rural and urban areas. As Ali (2017) argues, pedagogical reform through teachers can only be effective by addressing classrooms, school structure, and culture and improving working conditions such as basic facilities and structural resources. However, in recent years, with China's emphasis on rural education, many rural schools have been equipped with new ICT devices. Many remote rural schools have video recording devices and can access the Internet that allow for remote interactive teaching. These devices and technologies enable better quality remote teachers to teach remote rural students. The aim is to solve their teacher imbalance problem. However, remote interactive teaching is still challenging to implement due to the lack of insufficient bandwidth and technical staff support. For example, Teacher D mentioned:

"Our network bandwidth is unstable, the equipment is not easy to operate, and few teachers can use our remote interactive system. Therefore, teachers feel that implementing remote interactive teaching is troublesome and ineffective."

School institutional environment indirectly affects teachers' learning opportunities, learning motivation, learning engagement, and the motivation for teachers to apply and promote new knowledge and skills. Most participants expressed that schools encouraged and had relevant policies to support teachers to learn and update their knowledge and skills. In contrast, a few said that teachers had few opportunities to study out of school. The current trend shows that few institutions and policies in rural schools encourage teachers to promote and apply new knowledge and skills. Teacher L said:

"The school requires that our first priority be the safety of students and regular instruction. The school leaders also encouraged our innovation, but only verbally, without clear institutional and policy incentives."

The results of this and previous studies have shown that the lack of incentive policies in rural schools restricts teachers' enthusiasm for continuous learning and teaching practice, especially if their school environment lacks initiatives and support for teachers' professional learning.

In addition, the psychological environment will directly affect teachers' learning satisfaction, teaching practice, and organizational performance. According to the data analysis, the support of school leaders and colleagues as well as a strong climate for digital teaching in the school can make teachers more motivated and confident to learn and practice new educational technologies. Hallinger and Liu (2016) had similar findings. School psychological environment includes the atmosphere in which teachers work and study. Research has shown that encouragement from school administration is a key factor in teachers' continued use of technology (Kafyulilo et al., 2015). Thus, despite challenges to providing upgraded and new digital facilities, rural schools can initiate better digitalized learning when fellow teachers and school administrators support teachers' blended learning efforts. Teacher E said:

"After the training, I shared my learning experience with the school leaders and colleagues. Then carry out group cooperative learning in the school. I feel that everyone's learning and working atmosphere are much better. School leaders support teachers' learning, which makes us willing to participate in all kinds of learning."

The social environment expresses the interactive situations in which teachers learn and apply new knowledge and skills, such as interactions between teachers' peers, teachers and students, parents, teachers, and leaders. The attitudes of those surrounding the teacher regarding new knowledge and new skills will also affect teachers' attitude towards learning and teaching practice; this consequently affect their learning. Prior research has also shown that organizational environment and peer support can promote innovative practices among rural teachers. (Wu et al., 2022). In addition, the findings show that if parents and students support teachers to adopt new teaching tools or respond favorably to their attempts at new teaching methods, teachers will be more enthusiastic about teaching innovation. Teachers K, O and Q adversely noted that it was difficult to get parental support for instructional reform in rural schools. Teachers K said:

"In my rural area, parents are more conservative and do not readily accept new methods and ideas. In addition to the limited hardware of the school, a lot of what I learned could not be used in my teaching. I feel quite distressed."

Parental acceptance would increase if there were successful cases. Therefore, encouraging rural teachers to be bold in innovative practices, establish typical success cases, and expand their influence has also become an issue for future research.

The Implementation of Blended Training to Assist the Mitigation of Sustainability Concerns Related to Digital Divide

As mentioned previously, blended training, which integrates online learning with traditional face-to-face methods, emerges as a promising avenue to alleviate the digital divide and sustainability concerns prevalent in rural education settings. The findings from Section 4.1 indicate that rural teachers are satisfied with the blended training programs, which offer them learning opportunities and resources. This provides ongoing support for their professional development and student development. However, Section 4.2 summarizes the challenges faced by rural teachers in blended learning and practice. In light of these findings, this section delineates the main issues that need to be addressed in the future provision of blended training for rural teachers to help better mitigate the sustainability issues related to the digital divide.

Focus on the Design and Development of Training Content

The design and development of training content should meet the needs of rural teachers working in these communities. This is in line with the study by Mirke et al. (2019), who emphasize that the customization of e-learning courses should consider the socio-demographic aspects of learners and their level of preparation for online learning. It is imperative that training content considers the self-efficacy levels and perceptions of usefulness among rural educators, as studies have shown these factors positively influence learners' willingness and behavior towards online learning (Hidayat et al., 2019; Kalogiannakis & Papadakis, 2019). An important reason why some of China's past large-scale teacher training programs have failed to improve teacher practice and student achievement is because the content tends to be overly theoretical (Loyalka et al., 2019). According to the findings, ensuring the relevance of training materials helps increase rural teachers' participation and the absorption of learning outcomes, thereby promoting educational equity and sustainability.

Provide Continuous Digital Resource Development and Training Support

This study, as supported by Li and Yang (2022), has also found that rural teachers are less involved in developing quality digital teaching resources. This leads to lower levels of ownership of resource application by rural students and teachers. Therefore, the development of training resources and school-based resources requires enhancement to effectively support rural teachers in applying new knowledge and skills. Appropriate teaching equipment and resources play a crucial role in motivating teachers to actively engage with new technologies. However, this study has also found that rural teachers often struggle to keep pace with technological updates, hindering their timely adaptation to new tools and resources. Therefore, training initiatives must ensure timely participation in technology-focused training to facilitate rational utilization of teaching resources, particularly in rural areas. In addition, rural teachers need high-quality training rather than large-scale, universal, passive training (Zhao et al., 2024). Training departments should provide teachers with equipment suitable for rural school conditions and offer support in collecting, organizing, and transforming accumulated resources into valuable teaching assets for their schools. Such efforts not only empower teachers but also foster a culture of resource ownership and utilization

among rural educators, thereby promoting sustainability in digital learning environments.

Establish a Conducive Community Learning Environment

It is imperative to establish a conducive community learning environment and enhance teachers' communication and monitoring. An affirmative community learning environment has the potential to inspire individuals to acquire knowledge and engage in practical application (Garet et al., 2001), hence fostering the growth and progress of students (Doğan & Adams, 2018). A unified teacher community can provide support to its members by engaging in reciprocal communication, sharing of work, collaborative efforts, reciprocal feedback, and reciprocal evaluation (Portillo & de la Serna, 2021).

Through the integration of online and offline learning communities, teachers in rural areas are able to tap into a wider network of colleagues, including those in urban areas, in order to engage in the exchange of advanced teaching concepts and methodologies. Blended learning, when appropriately structured, has the potential to surpass geographical limitations, enabling the formation of teacher learning communities that foster innovation and advancement in the field of education (Ginesti & Impedovo, 2020). The interconnection between various factors not only fosters fairness in education but also plays a role in the sustainable growth of rural educators and learning settings. This, in turn, addresses issues associated with the digital divide and guarantees the long-term sustainability of educational endeavors.

Conclusions

This qualitative case study has provided insights into the impact of blended training on rural teachers in Guangdong Province, China, and has constructed a thorough model of the components that influence this phenomenon. This study has highlighted the potential of blended learning as a solution to promote sustainability and equality in professional development for rural educators by examining the opportunities and constraints associated with its implementation. This research has yielded useful insights into the intricacies of professional development for rural teachers by identifying four dimensions and 14 primary categories of characteristics that influence blended learning outcomes.

Furthermore, this research has provided pragmatic approaches to optimize the effectiveness of blended training in several fields, encompassing training content, training, school-based learning resources development, communication and supervision, tracking and guidance, improvement of the training system, and creating a positive community learning atmosphere.

The results of this study have provided some reference for the research and practice of teachers' blended training. Effective blended learning will allow rural teachers to move from closed to open, externally driven to internally demanded, and from passive training to self-directed learning and development. Future research is proposed to complete the framework for effective blended learning for rural teachers to provide a more inclusive and effective learning environment for rural teachers and students by addressing the effects and influencing factors of blended learning for different types of teachers.

Significantly, this study makes a valuable contribution to the current body of literature on sustainability by emphasizing the significance of blended learning in cultivating a learning environment that is both inclusive and successful for teachers and

students residing in rural areas. This study establishes a basis for future research that seeks to enhance frameworks for effective blended training, with the ultimate objective of promoting sustainable educational growth in rural communities. It achieves this by examining the effects and influencing elements of blended learning.

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Correspondence concerning this paper should be addressed to Dr. Sharifah Intan Sharina Syed-Abdullah, Faculty of Educational Studies, Universiti Putra Malaysia, Selangor 43400, Malaysia. Email: sharifahintansharina@upm.edu.my