A STUDY ON THE PATHWAY OF IMPROVING THE SUBJECT CORE LITERACY OF CHINESE RURAL SECONDARY SCHOOL TEACHERS BASED ON MOBILE LEARNING

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ABSTRACT

In this era of globalization, mobile learning is increasingly becoming a new paradigm to promote teachers' core literacy. In this study, teachers in rural secondary schools in South China were selected as respondents, and the correlation between mobile learning and teachers' subject core literacy was proved by using SPSS22.0 software. The study concluded that mobile learning for Chinese rural secondary school teachers is deficient at the level of social interactivity, the learners (teachers) themselves and mobile learning devices. Therefore, enhancing the social interaction level of mobile learning, stimulating the demand for m-learning among rural secondary school teachers and Increasing Equipment Support are crucial to improving teachers' subject core literacy in rural secondary schools.

KEYWORDS

Mobile Learning, Teachers' Subject Core Literacy, Chinese Rural Secondary Schools

1. INTRODUCTION

Since the 21st century, information and communication technologies have developed rapidly and the Internet is widely used in various fields. Mobile technology has become a new tool for professional development of teachers, and mobile learning is gradually entering the field of teacher development. Mobile learning is a way of learning that transcends geographical limitations and makes full use of portable technology. This learning approach is expected to contribute to the improvement of teachers' subject core literacy through teacher professional development and changes in the form of teacher education. Teachers' subject core literacy refers to the necessary competencies (language skills, learning skills) and required qualities (cultural awareness, thinking skills) of the subjects teachers acquire. As a huge part of Chinese teachers, it is urgent to improve the subject core literacy of rural secondary school teachers. In the context of global informatization and the COVID-19, mobile learning is particularly important for the enhancement of subject core literacy of rural secondary school teachers.

2. LITERATURE REVIEW

In this study, we used 10 November, 2022 as the time point,and "mobile learning" as the keyword, then we searched in the China Knowledge Network (CNKI: www.cnki.net) .. We got a total of 8521 academic papers. and 1253 of the papers were from the CSSCI（Chinese Social Sciences Citation Index） When we entered "teachers' core literacy", 1924 academic papers were shown on, including 507 papers selected by the CSSCI. The third keyword is "rural secondary school teachers", and 105 academic papers were shown, 24 of them were published in core journals selected by the CSSCI. This study composed the above papers and summarizes the main following parts.

2.1 Studies on M-Learning for Teachers' Subject Core Literacy Enhancement

Scholars have focused on the positive impact of mobile learning on teachers' subject core literacy enhancement. Mobile learning has become an important way for teachers to enhance their subject core literacy. For example, American scholars Micah Shippee and Jared Keengwe (2014) pointed out that Internet technology continues to emerge to break geographical barriers in education and teaching on a global scale, build information platforms, narrow opportunity gaps, promote educational equity, and build bridges of communication. Chinese scholar Xiao-yu, Hua (2017) pointed out that with the increasing development of mobile Internet technology, it is proven to explore the path of teachers' subject core literacy development, and the mobile learning model helps teachers understand the frontier knowledge of education, accumulate relevant knowledge and skills, and achieve subject core literacy improvement.

2.2 Challenges of Mobile Learning for Chinese Rural Secondary School Teachers

Scholars have focused on the negative impact of mobile learning on teachers in rural areas where online technologies are not well developed. For example, Chinese scholars Jian-jun, Ma et al. (2017) pointed out that teachers in rural area were not sufficiently prepared to use mobile learning, and they were unfamiliar with the operation of mobile devices. Meanwhile, some of them were less motivated to accept new things on the whole and had a narrower and lower level of cognitive scope, and the conditions and environment of mobile facilities in rural areas were not perfect, so the overall effect was poor. Chinese scholars Shao-rong,Guo and Zhi-ping,Zhou (2021) talked about the serious loss of good students in rural schools, the loss of good students can be traced to the loss of good teachers. Teachers are the first resource for education, so retaining good teachers is fundamental. The workload of teachers in rural schools is heavy, and their welfare and benefits are low. Long-term overload makes teachers physically and mentally exhausted. All of which affects the enthusiasm of the majority of teachers' work.Teachers' low sense of professional achievement and gradual loss of enthusiasm for education will lead to burnout. There are serious challenges to enhance their own subject core literacy.

2.3 Improving the Subject Core Literacy of Rural Secondary School Teachers Based on Mobile Learning

Scholars have focused on the possible paths of mobile learning to enhance teachers' core literacy in the subject, and three different arguments have been formed in the academic community. First, the subject theory, which was pointed out by Chinese scholars such as Qi-guang,Yang(2021)..In order to enhance the awareness of mobile learning among rural secondary school teachers, we must start with rural secondary school teachers themselves. By Changing their cognitive concepts, stimulating their intrinsic motivation to engage in mobile learning, and enhancing their mobile learning. The teachers' confidence in mobile learning should also be enhanced. Second, the institutional theory. Chinese scholars such as Wei-rong, Huang (2017) proposed that to enhance the information technology of Chinese rural secondary school teachers requires the collaboration of government departments, mobile learning researchers, universities, and international organizations. Chinese scholars such as Yan-hong,Cao (2017) agree with this point. Third, the methodological theory. Teachers' subject core literacy enhancement should be carried out in the context of Chinese basic national conditions and local educational realities, and the professional literacy practices of teachers should be tailored to local conditions.

As we can see above, the existing studies on the enhancement of subject core literacy of rural teachers have made a lot of attempts in many aspects and have come up with many useful conclusions, providing many references for the enhancement of subject core literacy of rural teachers. However, the research on mobile learning for teachers is not only few but also unsystematic, most of the studies are based on macroscopic assumptions. And the research on mobile learning and teachers is from a microscopic perspective, research which from the perspective of rural secondary schools is still rare. Therefore, the importance of this study has been highlighted.

3. RESEARCH DESIGN

3.1 Theoretical Foundation

The Framework for the Rational Analysis of Mobile Education (FRAME) is a model for mobile learning analysis that describes the intersection of mobile learning as a process involving mobile technology, human learning capabilities, and social interaction (Ally, 2009). The model was proposed by Marguerite Koole of Athabasca University in Canada in 2006 and has been widely adopted by mobile learning researchers and practitioners in China and abroad in recent years.

In the FRAME model, Koole (2006) primarily views mobile learning as a learning experience in which learners are placed in a specific information environment. Learners individually and collectively use and create information, and this information interaction takes place through technology. It is through this complex interaction that information becomes meaningful and contributes to learning. In this information environment, the FRAME model presents the intersection of three different dimensions through the Venn Diagram, as illustrated in figure 1. The framework shows that in the information context and theory logic, device, learner and society constitute the three core circles of mobile learning, which overlap to form the intersection of Interaction Learning, Social Technology and Device Usability. This study uses the model as an analytical framework to explore the path of enhancing teachers' subject core literacy in the context of mobile learning in practice.

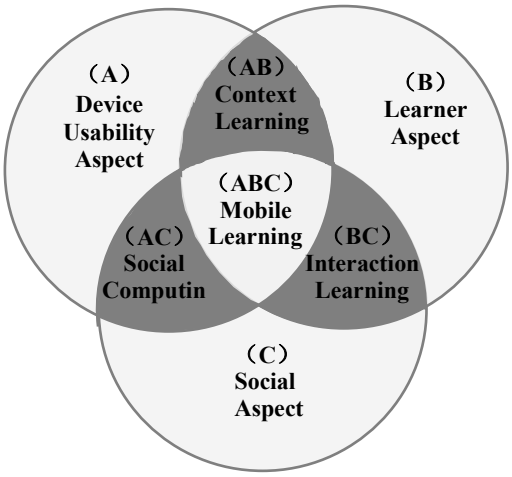

Figure 1. The FRAME modal

3.2 Research Hypothesis

Based on the literature review and the analysis of the questions, this study attempts to investigate the current situation of mobile learning among Chinese rural secondary school teachers and the impact of mobile learning on the development of subject core literacy among rural secondary school teachers. The research hypothesis was also proposed: the subject core literacy development of Chinese rural secondary school teachers is positively related to mobile learning ability.

3.3 Research Objects and Research Tools

3.3.1 Research Objects

The subjects of this study covered rural middle school teachers in South China.1260 questionnaires were distributed and 1245 were collected, excluding invalid questionnaires, 1225 valid questionnaires were obtained, with a recovery rate of 98.80%. The respondents were all rural middle school teachers, including 660 males and 565 females, other basic information of teachers is shown in Table 1.

Table 1. Basic information about the research subjects

Classification	Length of teaching experience				Academic		
	1-3years	4-9years	10-15years	15+ years	Specialized and below	Bachelor's Degree	Postgraduate
Number of people	155	435	405	230	146	380	135
Ratio (%)	12.7	35.5	33.0	18.8	59.0	31.0	7.3

Classification	Qualifications Title			
	Not rated	Secondary Level 2 Teacher	Secondary Level 1 Teacher	Senior Secondary Teacher
Number of people	90	380	730	25
Ratio (%)	7.3	31.0	59.6	2.0

3.3.2 Research Tools

The research instrument for this study was a self-designed questionnaire. The main sources for the question design are form China's Professional Standards for Secondary School Teachers (for Trial Implementation) (2012), Research on the Construction of Professional Core Literacy Models for Primary and Secondary School Teachers (He Zhongqi,2021), and the FRAME Model. The questionnaire consists of four main parts: basic information, society, learner,and device, as shown in Table 2. The second and third parts of the questionnaire are based on the five-point scale of Likert,The Cronbach's alpha coefficient of this questionnaire was 0.921, which was greater than 0.85, and the KMO value was 0.763, which was between 0.7 and 0.8, indicating that the reliability of the questionnaire was good.

Table 2. Questionnaire dimensions

Level 1 Indicators	Level 2 Indicators
1 Basic information	Gender, teaching experience, title, education, IT level
2 Society	2.1 Mobile Learning Community 2.2 Mobile learning sharing platform
3 Learner（Teacher）	3.1 Consciousness of Mobile Learning 3.2 Effectiveness of Mobile Learning
4 Device	4.1 Personal mobile learning device usage 4.2 Mobile Learning Resources Sharing

4. RESEARCH RESULTS

4.1 The General Situation of Mobile Learning for Rural Secondary School Teachers in China

Firstly, the overall situation of mobile learning among Chinese rural secondary school teachers is not bad. The average score of this indicator for the participating teachers was 3.758, and the average scores of the dimensions within mobile learning ranged from 3.63 to 3.90, rated them in descending order.

Secondly, there was no significant gender difference in Chinese rural secondary school teachers' engagement in mobile learning ($t=-0.409$, $p=0.683$). However, it appeared that the overall level of mobile learning was slightly higher among females ($m=4.03$) than males ($m=3.97$) in terms of average scores.

Thirdly, there were significant differences in mobile learning among Chinese rural teachers with different teaching ages and job titles ($F=18.037$, $p<0.001$; $F=21.234$, $p<0.001$). Chinese rural teachers with 1-3 years of teaching experience had the highest average score ($m=4.174$), followed by teachers with 10-15 years of teaching experience ($m=4.052$), 4-9 years of teaching experience ($m=3.758$) and those with more than 15 years of teaching experience ($m=3.589$). In terms of job title, secondary level 2 teachers had the best performance in mobile learning ($m=4.300$), followed by senior secondary teachers ($m=4.176$), unrated teachers ($m=3.917$), and secondary level 1 teachers ($m=3.501$) in descending order.

Fourthly, teachers with different levels of IT skills showed significant differences in mobile learning ($F=10.934$, $p<0.001$). Teachers with appropriate IT training experience or IT certification had an overall higher level of mobile learning than those teachers who did not have IT training before.

4.2 The Correlation Between M-learning Ability and Teachers' Subject Core Literacy Enhancement in Rural Secondary Schools

4.2.1 Calculation of Model Validity

The Pearson correlation coefficient is applicable to the study of continuous linear data, therefore, before analyzing the correlation empirically, the scientific validity of the Pearson correlation coefficient should be verified. The linear correlation between the two variables of "mobile learning" and "subject core literacy" was verified by using SPSS22.0 scatter plots, as shown in Figure 2.

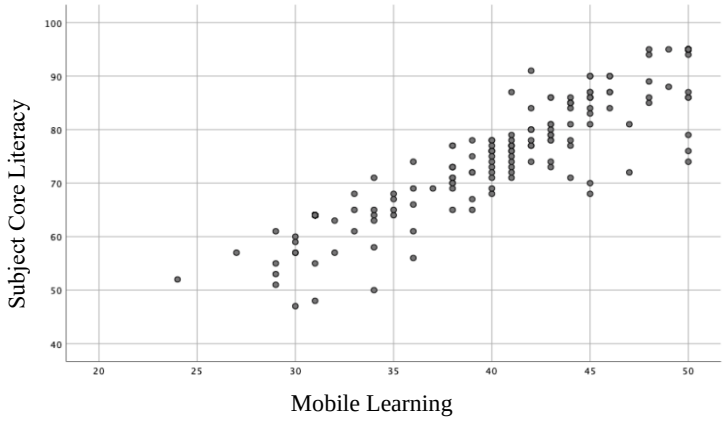

Figure 2. Scatter plot

In this study, the linear correlation between the mobile learning score as the independent variable and the disciplinary core literacy score as the dependent variable was verified. The R^2 equals to0.752 and was obtained. The fitted equation:y =11.944+1.606* x, presenting a linear relationship between the two variables. Regression analysis was performed by using SPSS 22.0. It shows that the model is validity.

4.2.2 The Correlation Between Social Interactions of Mobile Learning and Teachers' Disciplinary Core Literacy

The social interaction of mobile learning in this study is mainly concerned with the interaction between teachers and mobile learning content, but also includes the interactive communication between teachers using mobile platforms. For example, teachers' communication in online forums. The survey showed that most of the schools were slightly inadequate in providing mobile learning social interactions for teachers (M=3.61). In the correlation analysis, it was also revealed that teachers' social interactions using mobile learning were highly correlated with teachers' subject core literacy (r=0.730, p=0.000).

4.2.3 The Correlation Between Learner and Teachers' Subject Core Literacy

Overall, the subject core literacy status of Chinese rural secondary school teachers was average (M=3.89). The score of subject knowledge was 3.77, the score of professional competence was 3.59, and the score of professional affect was 3.85. Based on the validity verification of the previous computational model, this study used SPSS22.0 with Pearson correlation coefficients and conducted a correlation analysis study of the data using a two-sided test (two-tailed). It was found that teachers' mobile learning cognition, knowledge, and competence in mobile learning in general showed a high correlation with teachers' subject core literacy. Where correlation coefficient equals to 0.867 and p = 0.000.

4.2.4 The Correlation Between M-learning Devices and Teachers' Subject Core Literacy

From the data findings, schools are still inadequate in terms of devices support to teachers for mobile learning, the data showed that the average level of input equals to 3.80. The results showed that there is a positive correlation between the equipment situation of schools on mobile learning and subject core literacy of teachers in rural areas (r=0.861, p<0.001).

5. CONCLUSION

In summary, the research hypothesis was verified that teachers' mobile learning competency has a positive relationship with their subject core literacy development. The overall mobile learning competencies of Chinese rural secondary school teachers were average, with teachers' mobile learning competencies showing significant differences in terms of teachers' teaching experience, job title, and information technology level. At the same time, Chinese rural secondary school teachers' m-learning condition was deficient in social interactivity, learners' (teachers themself) performance and mobile learning device.

5.1 Weak Social Interaction of M-learning among Chinese Rural Secondary School Teachers

From the results of the study, there is a deficiency in social interaction in mobile learning for teachers in Chinese rural secondary schools. The average score of social interaction is 3.61 and the standard deviation is 0.896. Teachers were independent of each other and had less interaction when learning online. In the survey of Chinese rural secondary schools, the question "What do you think are the main difficulties of mobile learning for teachers' subject core literacy development?" was asked. 78.05% of teachers believe that schools currently lack effective interactive communication. This is mainly because most teachers only focus on their knowledge during mobile learning, and teachers lack communication and interaction with each other. For example, some online training in the China Teacher Development Network is mainly based on listening to lectures, and learning is evaluated mainly by the total minutes teachers spend when watching online courses (40% of the total) and independently complete assignments. The communication part such as forum and salon occupies only 5% of the score.

5.2 Low M-learning Conscience among Chinese Rural Secondary Schools Teachers

According to the results of the study, mobile learning showed a high positive correlation with teachers' subject core literacy development ($r=0.911$), and the current subject core literacy status of Chinese rural secondary school teachers is average ($M=3.89$), which shows that rural secondary school teachers have more room to improve their subject core literacy and can use mobile learning to promote their own subject core literacy development. However, the overall situation of mobile learning among rural secondary school teachers in China is average ($M=3.758$). Among them, teachers' awareness of mobile learning is at a low level ($M=3.63$), which shows that the internal motivation for mobile learning among rural secondary school teachers is not strong. The study also showed that there were significant differences in mobile learning among Chinese rural teachers with different teaching ages and job titles ($F=18.037$, $p<0.001$; $F=21.234$, $p<0.001$), and rural secondary school teachers' motivation to engage in mobile learning decreases as they grow older and develop professionally, relative to younger teachers. In addition, the situation of rural secondary school teachers conducting mobile learning was closely related to their information technology level, and teachers with different information technology levels showed significant differences in conducting mobile learning ($F=10.934$, $p<0.001$). Some rural secondary school teachers had low awareness of information technology and low initiative in using mobile learning devices.

5.3 Insufficient Device Support Among Chinese Rural Secondary Schools Teachers

According to the survey data, there is a positive correlation between schools' material support on mobile learning and rural secondary school teachers' subject core literacy development ($r=0.861$, $p<0.001$), and according to the questionnaire results, rural secondary school teachers are very concerned about the support of classroom network condition, mobile device performance, learning resources quality and other factors on their mobile learning. But at present, the investment in these resources in rural secondary schools is at an average level($M=3.80$). In addition, funding is also a factor of particular concern to teachers. Because local economic

development in rural middle schools is slower than that in cities, educational resources and funds are often limited, and there are still some differences in the use of mobile platforms from urban areas, so teachers' needs in terms of financial investment and information technology in teaching cannot be fully met, and the construction of advanced mobile learning platforms has not been built in rural middle schools. In the open-ended questionnaire, 74.7% of teachers said that the singularity of training content and form is also one of the biggest obstacles to their mobile learning. In terms of training methods, teachers in rural middle schools often participate in group training, online training, and lack of expert guidance and systematic learning.

6. SUGGESTIONS

The level of teachers' subject core literacy will eventually affect the level of students' literacy. According to Koole's framework, improving teachers' mobile learning ability is an inevitable development of the times, and also an important way for rural middle school teachers to improve their professional quality in the context of information society.

6.1 Enhancing the Social Interaction Level of M-learning among Rural Secondary School Teachers

Social interactivity is an essential element of mobile learning. Focusing on the social interactivity of mobile learning is an important way to enhance the effectiveness of mobile learning for teachers. The social interactivity of mobile learning is mainly reflected in online interaction and communication. Therefore, this study proposes the following recommendations.

Firstly, building an interdisciplinary learning community for teachers' mobile learning. The construction of interdisciplinary learning communities can establish close ties among teachers, break the barrier of "non-interaction" among teachers in mobile learning, enhancing emotional communication among different disciplines teachers， and provide emotional and social support for the sustainability of mobile learning. Secondly, building a sharing mechanism for teachers' mobile learning. On the one hand, theme-based social groups can be constructed. This could start with key skills that teachers urgently need for professional development, for example by designing different subject teaching skills exchange themes. Teachers can design mini-lessons through online education platforms such as Tencent Classroom, which is popular in China, in order to share their experiences with each other and thus promote self-reflection and subject skills development. On the other hand, problem-based social groups can be constructed. Design a mobile learning exchange mechanism based on subject teaching problems. For example, with the theme of thorny problems encountered in subject education and teaching practice, teachers in rural secondary schools can use social tools such as QQ and WeChat, to share their confusion and insights in classroom teaching, showcase teaching problems they have encountered, share their problem-solving strategies, etc.

6.2 Stimulating the Demand for M-learning among Rural Secondary School Teachers

While mobile learning as a new learning model has made great strides in some developed countries or regions, there are still many teachers in rural areas of some developing countries who do not have a good understanding of mobile learning models. Targeted training is needed for the teachers concerned.

First, teachers in rural secondary schools should be made more aware of the mobile learning model. Make teachers aware that mobile learning is based on modern multimedia mobile terminals such as mobile phones, laptops and IPDADs, which allow for personalised learning that is not restricted by time and space. This mode of learning, due to its convenience, affordability and speed, can help teachers in rural areas to make up for such shortcomings as limited resources and time and space constraints. This can have a unique and important impact in promoting the development of their subject core literacy. In addition, incentives such as rewards and credit systems can also be set up to enhance the internal motivation of teachers in rural secondary schools to participate in mobile learning. Second, the effectiveness of mobile learning in developing the subject core literacy of rural middle teachers should be improved. To help teachers in rural middle schools master mobile

learning skills, regularly conduct centralized training, and invite teachers who are good at mobile learning mode to conduct one-on-one tutoring. On the one hand, we should help teachers in rural middle schools establish the teaching concept of "learning for teaching and teaching for learning" and change the concept of separating learning from teaching. On the other hand, we should improve the application effect of mobile learning tools for teachers in rural middle schools, so that they can personally feel that they will achieve greater and better development in subject core literacy with the help of mobile learning.

6.3 Increasing M-learning Equipment Support For Rural Secondary School Teachers

It should increase investment in mobile learning equipment construction and resources, optimise mobile learning equipment and innovate public mobile learning content, so as to provide the most advanced support for mobile learning for teachers in rural secondary schools.

First, optimise personal mobile learning equipment. On the one hand, the government should increase funding for township secondary schools, enrich the quantity of mobile learning tools and improve the quality of mobile learning devices. On the other hand, it should also accelerate the construction of mobile high-speed Internet networks to ensure smooth, high-speed and efficient network signals, so as to ensure that teachers in township secondary schools can carry out mobile learning effectively. Second, innovate the content of public mobile learning. Large social platforms such as Qzone and WeChat space should be fully utilised to enrich the content of mobile learning resources for teachers in rural secondary schools. For example, teachers should be encouraged to upload their mobile learning materials to their personal social networking platform spaces for sharing and learning. In addition, a school mobile learning database could be established. This means that a school-level teacher subject core literacy learning database can be established based on different subjects and teachers' personal teaching literacy characteristics, and AI technology can be used to select different mobile learning content and learning resources for teachers of different subjects, thus forming a unique and systematic subject core literacy development programme for each teacher. This will enable the mobile learning model to better promote the development of subject core literacy among teachers in rural secondary schools.

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