

Methods and approaches to strengthen the cultivation of digital literacy and technical abilities of teachers

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Abstract: In order to strengthen the cultivation of digital literacy and technical abilities of teachers, this study used the K-means algorithm to group teachers, in order to more accurately understand the individual needs of each teacher. A comprehensive evaluation index was constructed to measure and balance the importance of teachers in digital literacy by calculating their level of demand and technological challenges. Based on this evaluation, a novel teacher training model has been proposed, which combines traditional face-to-face training with modern online learning to provide more diverse learning opportunities and greater flexibility. After the improvement, the teaching satisfaction of teachers and students was 77.78% and 89.5%, respectively, indicating that the method proposed in this article can help teachers continuously improve their educational level, better meet the needs of students, and improve the quality of education.

1. Introduction

With the rapid development of information technology, communication technology, and the Internet, digital technology has become an important component of various industries, including the education sector[1]. Educational institutions are increasingly relying on digital tools and online resources to support teaching and learning processes[2]. The education sector is undergoing a digital transformation, which requires teachers to have up-to-date digital literacy and technological capabilities[3]. This is because digital technology has brought more teaching methods and tools to education, which can improve the efficiency and quality of education. Students are increasingly using digital devices and online resources in their daily lives, so education needs to be aligned with their digital needs to provide more attractive and useful educational experiences[4]. Digital technology enables educational institutions to collect, analyze, and utilize large amounts of data to improve teaching and student performance. Teachers need to possess digital literacy to effectively manage and interpret this data[5].

The research by Karabey, S et al. suggests that both students and teachers need to strive to encourage seeking help and enhance their belief that mental health issues may be resolved. It is crucial to prioritize mental health services and reduce the incidence of mental illness[6]. Hardhienata, S et al. used descriptive qualitative methods to explore models for strengthening technical literacy by observing and interviewing middle school teachers in Maomu City. Research has found that this model involves communication and cooperation, emphasizing active participation in learning and research activities. This also includes personal abilities such as usage skills, critical understanding, and communication skills, which are of great significance for improving the technical literacy of middle school teachers in Bogot á[7]. Susan, A et al. proposed that there are differences in students' understanding of the textbook before and after the development of modules. Fresh graduate students are better at selecting local contextual issues, design modules, and presentation modules. The local context based on the literacy mathematical module meets effective standards in terms of structure, material, language, and readability [8]. Potyrała, K et al. used knowledge and ability tests and diagnostic surveys to measure digital literacy. Research has found that although teachers perform well in certain fields such as image protection and pornographic SMS knowledge, there are shortcomings in copyright and online information reliability assessment. Teachers need to receive more support through informal and informal forms

of education to improve online security[9]. Anisimova, E pointed out that digital literacy is developed from a young age and needs to evolve with age to adapt to the digital world. Especially for preschool teachers, their level of digital literacy is crucial for early education[10].

By continuously tracking the skills and needs of teachers, the K-means algorithm can be used to dynamically adjust the learning path. As teacher skills improve or their needs change, they will be reassigned to different groups to ensure that teachers always receive the most suitable learning support for themselves. By analyzing the data provided by the K-means algorithm, education managers and policy makers can better understand the specific needs of teachers in terms of digital literacy and technological capabilities, and thus develop more effective teaching methods and policies.

2. Design of online education model

2.1 Teacher needs analysis

When analyzing the needs for cultivating digital literacy and technical abilities of teachers, the K-means algorithm can be combined to divide teachers into different groups, in order to better understand their needs [11].

The formula for calculating teacher needs is:

$$A_i = \sum_{j=1}^n (S_{ij} \times I_{ij}) - E_i \quad (1)$$

A_i represents the level of digital literacy needs of teacher i , while for teacher i , I_{ij} represents different digital literacy skills, such as using educational software, data analysis, etc., and E represents the importance of different skills [12].

The calculation formula for technical challenge assessment is:

$$S_i = \sum_{k=1}^n (S_{ik} \times I_{ik}) \quad (2)$$

S_i represents the assessment of the challenges faced by the i -th teacher in the digital field, while i represents the challenges faced by the i -th teacher in different technologies, such as data privacy and network security [13].

The comprehensive indicators can be calculated using the following formula:

$$T_i = \alpha_i \cdot A_i + \beta \cdot S_i \quad (3)$$

T_i represents the evaluation index of the i -th teacher, while α and β are weight coefficients used to balance the importance of digital literacy needs and technical challenges, and meet $\alpha + \beta = 1$.

2.2 Training Model Design

Based on the evaluation of the challenges faced by teachers, a new teacher training model is constructed with the aim of better meeting the professional development needs of teachers [14]. This model combines face-to-face training with online learning to provide diverse learning opportunities and flexibility.

The teacher training model is shown in Figure 1, which includes:

(1) Traditional face-to-face training remains an important component of teacher professional development and can be conducted in schools, educational institutions, or specialized training centers.

(2) Classroom training can include educational expertise, teaching techniques, curriculum design, and other aspects, taught by experienced educational experts or peer teachers.

(3) Provide online self-study courses on various topics such as educational technology, educational psychology, and teaching methods. Enable teachers to learn and choose appropriate courses based on their own schedule and interests.

Classroom Training (Face-to-Face Training)	Use graphics in Visio to represent schools, educational institutions, or training centers.	Add connecting lines and text boxes to describe educational expertise, teaching techniques, and course design.
Online Self-study (Online Self-Study)	Insert an icon representing online learning, such as a computer or tablet.	Attach a text box next to it, listing course topics such as educational technology, psychology, and teaching methods.
joint-operated project (Collaborative Projects)	Use graphics to represent team collaboration, such as connected character icons.	Add text describing group teaching research, interdisciplinary collaboration, and course design.
Mentoring (Mentorship Program)	Use arrows to connect two character icons, Master He and the student.	Additional text box explaining how the mentor provides support and guidance.
Evaluation and feedback (Assessment and Feedback)	Use the check and feedback icons.	Add text explaining the importance of regular evaluations and ways to provide feedback.
Resource sharing platform (Resource Sharing Platform)	Use cloud computing or network icons to represent online platforms.	The platform is used to share educational resources, textbooks, and teaching plans.
Continuous-learning culture (Culture of Lifelong Learning)	Use permanent loops or growth icons to represent continuous learning.	Add a text box to explain the effects of incentives and rewards.

Figure 1 Teacher Capability Enhancement Model

(4) Through collaborative projects, teachers have the opportunity to collaborate with other teachers, share experiences and best practices. Such as group teaching research, interdisciplinary collaboration, curriculum design, etc., aimed at improving the collaborative and problem-solving abilities of teachers.

(5) The educational institution or school administration should establish a mentor system to pair experienced teachers with new or supportive teachers to provide personalized guidance and support. Mentors help new teachers adapt to the educational environment, share teaching experiences, and provide feedback and suggestions.

(6) The school administration or educational authorities should regularly evaluate the professional development of teachers to ensure that they achieve the expected learning goals. They should provide targeted feedback to help teachers identify areas for improvement and develop personal development plans.

(7) The educational institution or school administration should create an online platform for teachers to share educational resources, textbooks, teaching plans, etc. This initiative aims to promote cooperation and resource sharing among teachers, ultimately leading to an improvement in teaching quality.

(8) The educational institution or school leadership should cultivate a culture of continuous learning, encouraging teachers to continuously pursue knowledge and improve their educational level. Schools and educational institutions should provide incentives and rewards to encourage teachers to actively participate in professional development.

This new teacher training model combines the advantages of traditional face-to-face training and modern online learning, providing teachers with more choices and flexibility. By combining multiple learning methods and resources, this model aims to help teachers continuously improve their educational level, better meet the needs of students, and improve the quality of education.

3. Analysis of experimental results

3.1 Digital literacy improvement

Teachers are the backbone of educational reform, and without their active participation, it is difficult to achieve substantial progress in any educational reform. Therefore, teachers must always pay attention to improving their own qualities in order to better guide students in learning. Participants in the survey generally believe that teachers of ideological and political theory courses in universities should improve their teaching literacy in the following aspects: teaching philosophy, information technology skills, teaching wit, etc. Table 1 shows the perspective statistics of teachers on improving digital literacy. For the skills that teachers should strive to improve, there is an aspect that requires special attention, namely the information technology skills training of teachers. The average score of their perspective statistics reached 0.9, which is higher than the average score of the other two. From this, it can be seen that the information literacy of teachers is also crucial, and the combination of classroom teaching and online teaching, as well as real-time interaction and communication with students, is very important. At the same time, it also indicates that teachers should follow the principles of overall promotion and key breakthroughs in cultivating their teaching literacy, focusing on information technology skills training and improving overall comprehensive literacy in all aspects.

Table 1 Statistics on Improving Digital Literacy

	Transforming teaching philosophy	Strengthen online information training	Enhance teaching rationality	Other
Effective	200	200	200	200
Deletion	0	0	0	0
Mean value	0.84	0.9	0.7	0.02
Standard deviation	0.33	0.22	0.41	0.08
Variance	0.12	0.74	0.16	0.08

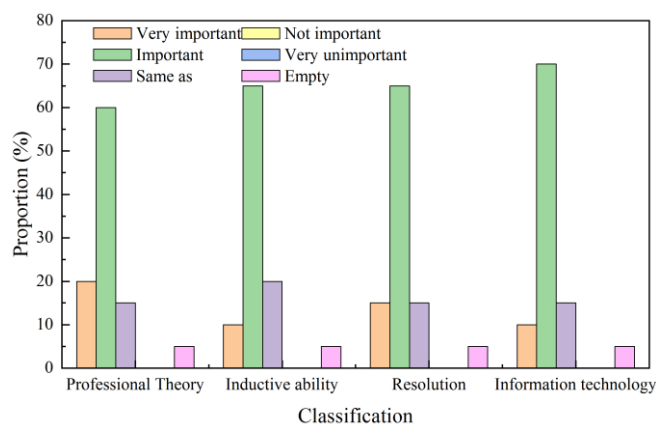


Figure 2 Teacher's Teaching Technology Ability

Figure 2 shows that among the professional skills that teachers should master, basic information processing ability and operational ability are considered the most important, while analytical, summarizing, discerning, and capturing information ability, as well as professional theoretical knowledge, are also considered very important. Under K-means, the role and positioning of teachers are redefined. Teachers are not only the main body implementing teaching activities, but also the

organizers and designers of teaching activities. Teachers are no longer participants in the curriculum, but rulers of the curriculum. Teachers are no longer simply knowledge transmitters, but teaching organizers, managers, and designers. So teachers need to actively change their teaching philosophy, gradually entering teaching as guides, collaborators, learners, and researchers, and mastering the necessary skills and qualities of the new teaching model as soon as possible.

Conduct a survey and analysis of teachers and students. The satisfaction level of course teaching quality evaluation is shown in Figure 3. 35.56% and 30% of teachers and students were very satisfied, while 42.22% and 59.50% were basically satisfied. The sum of the two items was 77.78% and 89.5%, respectively. This indicates that teachers and students are highly satisfied with the improved teaching effect and the teaching effect is very ideal.

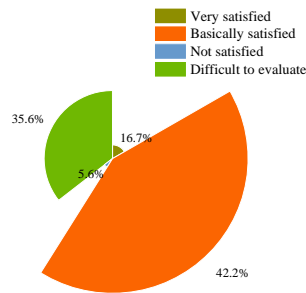


Figure 3 Satisfaction with the evaluation of course teaching quality

4. Conclusion

This article uses the K-means algorithm to obtain methods and approaches to strengthen the cultivation of digital literacy and technical abilities of teachers. Among them, the average score of information technology skills training in viewpoint statistics is the highest at 0.9, indicating that teachers should pay special attention to information technology skills training when improving digital literacy. The effective combination of classroom teaching and online teaching, as well as timely interaction and communication with students, is crucial for improving teaching quality. Teachers not only need to master the basic information processing and operational abilities, but also need to have the ability to analyze, summarize, distinguish and capture information, as well as professional theoretical knowledge. From the high satisfaction with the evaluation of course teaching quality, it can be seen that when the digital literacy and technical ability of teachers are improved, the teaching effect is significantly improved. Therefore, continuously improving the digital literacy and technological capabilities of teachers is crucial for improving teaching quality and meeting the needs of teachers and students.

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