

Path of Improving the Intelligent Literacy of Vocational College Teachers from the Perspective of Human-machine Symbiosis

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Keywords: Human-machine Symbiosis Perspective, Vocational College Teachers, Intelligent Literacy, Initial Average Score

Abstract: With the rapid development and increasing application of artificial intelligence technology in education and teaching, improving the intelligence literacy of teachers has become an important aspect of current teaching reform in higher vocational schools. Through various research methods such as literature analysis, case analysis, and questionnaire survey, this article comprehensively analyzes the opportunities and challenges faced by vocational college teachers in the human-machine symbiotic environment, and explore how to combine information technology with teaching practice. The construction of a training practice feedback mechanism can be utilized to improve the intelligence literacy of teachers, thereby promoting innovation and efficiency in education and teaching. The research results show that the homework grades of Class D have experienced fluctuations: the initial average score was 85.6 points, then increased to 88.2 points, and finally decreased slightly to 86.8 points. Despite fluctuations, the score remained above 85, reflecting the stability of the class's homework performance. This article proposes an "Intelligent Literacy Training Program" for higher vocational and technical colleges, which can meet the needs of future educational development.

1. Introduction

Today, with the rapid development of artificial intelligence technology, vocational colleges are facing new opportunities and challenges. How to improve students' learning ability is an important issue in computer-aided teaching. According to some important publications on computers and education, the intelligence literacy of teachers is directly related to improving teaching quality and enhancing student abilities. However, existing research mostly focuses on the application of information technology and the improvement of educational methods, and there is currently a lack of systematic research on how to improve the quality of vocational education. This article intends to explore the ways to enhance the intelligent literacy of vocational college teachers from the perspective of "human-machine symbiosis". It can not only promote the application of educational technology in practice, but also promote the construction of a more efficient and creative teaching environment, which has certain theoretical and practical significance

This article attempts to systematically explore and analyze the ways to improve the intelligent

literacy of vocational college teachers in the context of human-machine symbiosis. This article uses literature review and in-depth interview methods to collect and analyze in detail the experience and feedback of vocational college teachers participating in intelligent educational technology training. On this basis, by comparing and analyzing different teaching scenarios and strategies, the article explored effective ways to improve teachers' intelligent abilities, and evaluate the effectiveness and sustainability of their implementation.

The main content of this article includes the following parts: Firstly, it elaborates on the research background and significance of this article, and analyzes the current research status of the intelligent literacy of teachers in Chinese higher vocational schools. Then, the main content of this article was analyzed, and a detailed discussion was given on the selection of survey targets and the use of survey tools. Finally, through empirical research, the current status, main challenges, and effective countermeasures of the intelligent literacy of vocational college teachers are summarized, and further analysis and discussion are conducted on their implementation effects. The purpose of this article is to provide scientific and practical suggestions for improving student intelligence literacy in higher vocational colleges, and to promote the effective integration of educational technology and teaching.

2. Related Work

Exploring ways to improve the intelligent literacy of vocational college teachers from the perspective of human-machine symbiosis has significant theoretical and practical significance. Quan Guolong explored the intelligent literacy of rural teachers: a bridging framework, evolutionary stages, and guarantee conditions [1]. Mao Yuting analyzed the information literacy of primary school teachers under the background of artificial intelligence [2]. Yang Tian studied the construction, empirical analysis, and optimization of an intelligent literacy indicator system for international Chinese teachers [3]. Dong Hui explored the concept, framework, and development strategies of teacher's intelligent educational literacy [4]. Zheng Zhiyong conducted an empirical survey of 11703 teachers to analyze the current situation and improvement paths of intelligent education literacy among primary and secondary school teachers [5]. However, existing research has mainly focused on the effects of using intelligent technology, and the specific strategies and implementation methods for improving the individual intelligence literacy of teachers are not yet clear, especially the lack of in-depth analysis of teacher behavior and cognitive changes in human-computer interaction.

With information technology as the core, teachers can improve their adaptability to information technology, innovate their teaching methods, develop targeted talent cultivation strategies for schools, and promote the improvement of teaching quality and efficiency [6]. Zhu Long explored the essential core competencies of teachers in the era of intelligence from the perspective of design thinking. Cai W studied the innovation and path of basic education teacher literacy in the era of artificial intelligence [7]. Kim S W designed an artificial intelligence literacy scale for middle school students [8]. Hassan M M explored the digital intelligence literacy of Indian school teachers from a teacher's perspective [9]. Sulasmi E studied the digital intelligence literacy of primary school teachers and analyzed their skills in using technological devices [10]. However, existing research has mostly overlooked the role of individual differences among teachers in improving intelligence literacy, and there is a lack of empirical research on teacher behavior adaptability in complex human-machine symbiotic contexts.

3. Method

3.1 Theoretical Framework Construction

Based on a large number of literature reviews, this article analyzes the development trends of educational technology in the perspective of human-machine symbiosis, as well as its impact on teachers. A theoretical framework was constructed to elucidate the connotation and dimensions of student intelligence literacy, and based on this, discussions were conducted. At this stage, this article can draw on the latest research results on educational technology internationally, and establish a theoretical basis suitable for this article based on the practical needs of higher vocational schools.

The growth rate of technical proficiency can be used to calculate the growth rate of technical proficiency of teachers after participating in intelligent literacy training:

$$R_j = \frac{T_H - T_Q}{T_Q} \times 100\% \quad (1)$$

Among them, T_Q and T_H respectively represent the technical proficiency scores before and after the training.

3.2 Field Investigation and Data Collection

This article takes vocational colleges as the research object, and through questionnaire surveys and in-depth interviews, understands their application status, existing problems, and needs in educational practice. This article can cover multiple higher vocational schools to ensure the representativeness and comprehensiveness of the data. In addition, observation is used to record a specific teaching action in order to obtain deeper level data.

The Teaching Innovation Index I_s evaluates the changes in teaching innovation after teachers use intelligent educational tools:

$$I_s = \frac{\sum_{i=1}^n C_{i,h}}{n} - \frac{\sum_{i=1}^n C_{i,q}}{n} \quad (2)$$

Among them, $C_{i,q}$ and $C_{i,h}$ respectively represent the performance ratings of teachers in innovative teaching practices before and after training, and n represent the total number of activities evaluated.

3.3 Development of Intelligent Education Technology Training Module

Based on data collection and theoretical analysis, this article develops an intelligent educational technology training model. Among them, the use of artificial intelligence teaching tools, the intelligent design of teaching content, and the intelligent analysis of student interaction behavior are all problems that need to be solved. The course can be conducted in a modular manner to meet the learning progress and methods of different teachers, and an evaluation and feedback mechanism can be established to ensure the effectiveness of the course.

Weighted average of student satisfaction S_m :

$$S_m = \frac{\sum_{j=1}^m w_j \times S_j}{\sum_{j=1}^m w_j} \quad (3)$$

Among them, S_j is the satisfaction score of the j th student, w_j is the corresponding weight (for example, weighted based on the student's academic performance or participation), and m is the total number of students participating in the evaluation.

3.4 Exploration and Feedback

This article establishes a control group to conduct teaching experiments by offering practical training modules in the selected vocational colleges. This article takes experimental classes and control classes as research objects to explore the effectiveness of intelligent educational technology training in improving teachers' intelligent abilities. In addition, the satisfaction level of teachers with the training can also be collected, and improvement suggestions can be adopted to continuously improve the training plan.

3.5 Long-term Tracking and Evaluation

Through long-term tracking of teachers participating in training, the sustainability of their learning outcomes and their future development trends were analyzed. By combining online surveys with remote visits, this study explores the effectiveness and sustainability of the path to improving intelligent literacy, as well as how to continuously utilize intelligent technology to improve teaching quality and effectiveness [11].

Assess the correlation between the frequency of use of intelligent educational tools and student learning outcomes:

$$\rho_{p,s} = \frac{\Sigma(F_k - \bar{F})(E_k - \bar{E})}{\sqrt{\Sigma(F_k - \bar{F})^2 \Sigma(E_k - \bar{E})^2}} \quad (4)$$

$\rho_{p,s}$ is the correlation coefficient, and F_k represents the frequency of using intelligent tools in the k th course. E_k is the student's learning performance score after the course, while \bar{F} and \bar{E} are the average frequency of use and average learning performance of all courses, respectively.

4. Results and Discussion

4.1 Experimental Setup

(1) Experimental environment

This experiment was conducted in three different vocational colleges, focusing on the fields of technology, business, and healthcare. The article selected several teachers from each school as experimental subjects to ensure the diversity of the samples and the wide applicability of the experimental results. The facilities used in the experiment include a standardized computer classroom equipped with the latest teaching software and intelligent teaching equipment equipped with advanced human-computer interaction interfaces.

(2) Experimental parameter settings

The architecture design of this experiment is committed to exploring diverse educational models, covering three main scenarios: traditional classroom teaching, online education, and blended learning. In this experiment, the article focused on variables such as the effectiveness of various intelligent education tools in the classroom, the level of active participation of students, the frequency of classroom interaction, and analyzing the growth of teachers' intelligent skills at the beginning and end of the experiment. This process not only tests the practical application effect of technology, but also deeply observes its comprehensive impact on educational experience.

4.2 Result Analysis

(1) Single intelligent tool application

The main application of this article's single intelligent tool is for teachers to evaluate changes in

teaching management efficiency after only using an intelligent attendance system to manage student attendance and participation.

The efficiency data of attendance management is shown in Table 1.

Table 1: Attendance Management Efficiency Data

Date	Class	Total number of students	Number of attendance students	Number of absent students	Attendance rate	Sign in time (minutes)	Attendance management time (minutes)
2023-09-01	A	30	28	2	93.3%	5	2
2023-09-02			29	1	96.7%	4	1
2023-09-03			30	0	100%	3	0
2023-09-04	B	40	38	2	95%	6	2
2023-09-05			39	1	97.5%	5	1
2023-09-06			40	0	100%	4	0
2023-09-07	C	25	24	1	96%	3	1
2023-09-08			25	0	100%	2	0

Class attendance:

Within 3 days of September 2023, the attendance rate of Class A steadily increased from 93.3% to 100%, demonstrating continuous progress; During the same period, the attendance rate of Class B also increased from 95% to a perfect 100%, showing an equally encouraging trend; Class C increased the attendance rate from 96% to 100% in just 2 days, showing a significant improvement in attendance.

The trend of attendance rate changes:

During the monitoring period, each class achieved at least one perfect 100% attendance rate, reflecting the overall excellent attendance performance of students. In addition, the gradually decreasing number of absent students may also indicate the effectiveness of attendance management strategies.

Check in process and management time:

As attendance continues to increase, the total time required to complete check-in has been reduced, which may reflect students becoming more proficient in the check-in process or an improvement in management efficiency. Due to the increase in attendance rate, the time required for attendance management has also decreased, reducing the burden on management personnel in handling tasks such as investigating the reasons for absenteeism.

Class size comparison:

Although there are more students in Class A and Class B, with 30 and 40 students respectively, and only 25 students in Class C, this difference has not had a significant impact on the attendance rate of each class, suggesting that class size is not a key determinant of attendance performance. Each class should achieve at least one full attendance during the observation period, indicating an active attitude of students towards learning.

(2) Integrated intelligent tool application

Under the setting of blended learning, teachers have adopted various tools including intelligent attendance systems and intelligent assignment and feedback systems. The integration of this technology aims to improve teaching efficiency and optimize student learning outcomes. The article can conducted an in-depth analysis of the specific contributions of the combined use of these tools to the teaching process and student performance, with a focus on exploring how they collectively promote the improvement of educational quality.

The basic information of the DEF class is shown in Table 2.

Table 2: Basic Information of DEF Classes

Date	Class	Total number of students	Average homework score
2023-10-01	D	35	85.6
2023-10-03			88.2
2023-10-05			86.8
2023-10-08	E	40	87.5
2023-10-10			89.1
2023-10-12			87.0
2023-10-15	F	28	86.2
2023-10-17			85.8

Changes in class homework scores:

In early October 2023, the homework grades of Class D experienced ups and downs: the initial average score was 85.6 points, then increased to 88.2 points, and finally dropped slightly to 86.8 points. Despite fluctuations, the score remained above 85, reflecting the stability of the class's homework performance. The situation in Class E is similar, with slightly higher scores, starting at 87.5 points and reaching a high of 89.1 points before slightly falling back to 87.0 points. The scores of Class F showed greater consistency, with two assignments of 86.2 and 85.8, respectively, indicating that compared to Class D and Class E, Class F's grades were slightly more stable.

Class differences:

Although the number of students in Class D, Class E, and Class F varies, with 35, 40, and 28 students respectively, the average homework score is not significantly affected by class size. This indicates that scores are influenced by various factors such as individual student abilities, teaching quality, and difficulty of homework.

Overall trend:

All classes showed a high quality of homework completion. During this period, there was no significant increase or decrease in homework performance, reflecting that factors such as students' learning status, difficulty of questions, and teacher grading standards may have a comprehensive impact on their grades.

The attendance rate, homework submission rate, classroom teaching efficiency score, and student satisfaction score for different dates are shown in Figure 1 (Figure 1 (a) shows the classroom teaching efficiency score and student satisfaction score, and Figure 1 (b) shows the attendance rate and homework submission rate).

Attendance rate analysis:

All classes maintained a high attendance rate of over 90%, demonstrating a high level of student participation. The attendance rates of Class D and Class E fluctuated over multiple days. Although the attendance rate of Class F is slightly insufficient, it is still above an acceptable level. On October 10, 2023, the attendance rate of Class E was as high as 97.5%, which may be related to

certain special incentive policies or activities on that day.

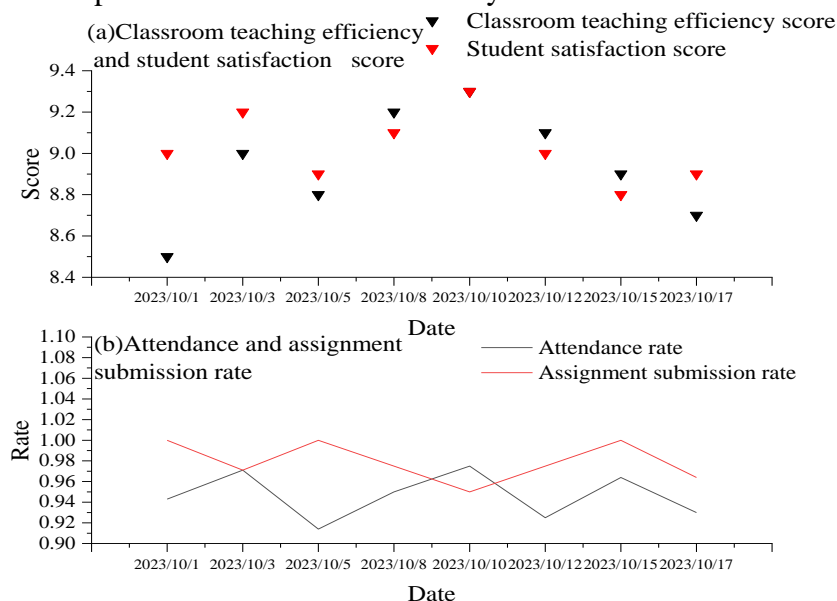


Figure 1: Attendance rate on different dates, homework submission rate, classroom teaching efficiency score, and student satisfaction score

Analysis of homework submission rate:

Most classes showed extremely high homework submission rates, although there were fluctuations in homework submission between Class E and Class F, the overall submission rate remained high. However, it is worth noting that although Class E had a very high attendance rate on October 10th, its homework submission rate was slightly low (95%), which may suggest the need for further exploration of the situation on that day.

Analysis of classroom teaching efficiency rating:

The classroom teaching efficiency of all classes is scored at least 8.5 points, indicating the efficient teaching of the teachers. Especially for Class E, its classroom teaching efficiency score has exceeded 9 points three times in a row, highlighting the high quality and consistency of its teaching. Although the teaching efficiency ratings of Class D and Class F have fluctuated slightly, overall, their performance is still satisfactory.

(3) Intelligent teaching and student interaction

Class numbers 1, 2, and 3 refer to Class G; Classes 4, 5, and 6 are H classes; Class 7 and 8 are Class I. The total number of students is 30, 40, and 25, respectively. The results of intelligent teaching and student interaction are shown in Figure 2.

(4) Comprehensive Intelligent Teaching Environment Experiment

This article demonstrates how to comprehensively improve the teaching environment by integrating all intelligent education tools and systems into medical professional courses. This comprehensive intelligent reform has significantly improved the quality of teaching and also significantly enhanced the learning effectiveness of students. It can delve into the synergistic effects of these tools and systems, as well as how they collectively promote the improvement of education quality and learning outcomes.

With the deeper integration of educational technology tools (ranging from 6 to 10), the article has observed a significant improvement trend in teaching quality, student satisfaction, and their academic performance improvement (the direct trend of variable changes is consistent). This discovery reveals the potential benefits of highly integrated intelligent tools for educational outcomes.

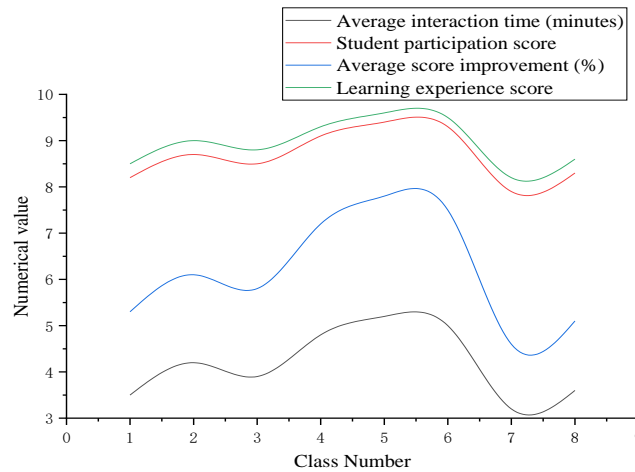


Figure 2: Results of intelligent teaching and student interaction

The linkage effect between teaching quality and student satisfaction is significant: as teaching quality improves, student satisfaction also increases step by step. This association highlights the impact of high-quality teaching on students' feelings.

Furthermore, the improvement of teaching quality is not only a numerical increase, but also a direct driving force for improving academic performance. This proves that the quality of teaching directly affects the improvement of student academic achievement.

Although there is a positive correlation between student satisfaction and academic performance improvement, the significance of this relationship is not as significant as the first two. This indicates that although satisfaction is important, its direct driving effect on grades is limited.

One anomaly discovered in the analysis is that with a level of 7 integration of intelligent tools, the student satisfaction score is 7.8, which exceeds the corresponding teaching quality score of 7.6. This suggests that student satisfaction may be influenced by other factors such as teaching methods and the personal charm of teachers. The experimental results of the comprehensive intelligent teaching environment are shown in Figure 3.

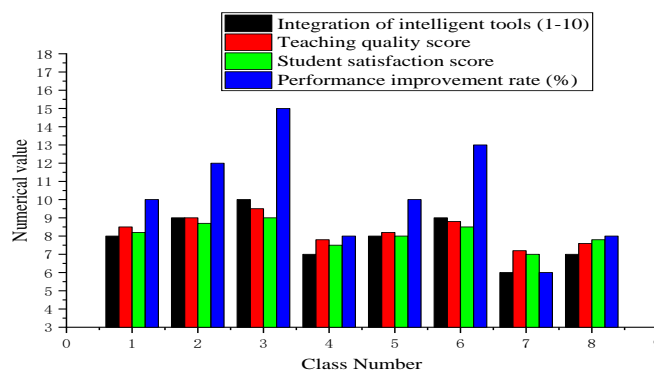


Figure 3: Experimental results of a comprehensive intelligent teaching environment

For the above analysis, the data clearly shows the close correlation between the integration of intelligent tools and teaching effectiveness, student satisfaction, and their grades. Obviously, deeper integration of these intelligent tools seems to significantly improve teaching effectiveness and student satisfaction, and may thus promote the improvement of student performance. Furthermore, it is worth mentioning that student satisfaction is influenced by multiple factors, far beyond a single dimension of teaching quality.

5. Conclusions

This article takes the perspective of human-machine symbiosis and explores in depth the ways to improve the intelligent literacy of vocational college teachers. By combining literature research, on-site research, and experimental analysis, a set of teaching and training modules covering multiple intelligent teaching methods are designed and developed to improve the technical application ability, teaching innovation ability, and teacher-student interaction ability of vocational college teachers. This article aims to evaluate the use of different types of intelligent teaching tools and analyze their effectiveness. Research has found that teachers who participate in intelligent teaching training have significantly improved their skill proficiency, teaching innovation ability, and student feedback. Especially in the use of intelligent interactive tools and the design of personalized learning routes, students have stronger adaptability and creativity. Meanwhile, with the improvement of teachers' intelligence literacy, the learning effectiveness of students has also significantly improved. Although there have been good results, there are also certain limitations. Firstly, due to the limited number of higher vocational schools surveyed, the generalizability of research conclusions is somewhat limited. Secondly, the experimental design of this article focuses on the short-term performance of teachers and feedback from students, lacking tracking and evaluation of their long-term effectiveness. In addition, due to technological constraints and other factors, some high-level intelligent teaching tools may not be fully applicable to various experimental scenarios. Future research needs to further expand sample size, increase experimental scale, and improve the universality and depth of research results. In addition, a long-term tracking study is needed to evaluate the sustained effect of improving intelligent literacy on the professional growth of teachers and the learning outcomes of students. Meanwhile, given the rapid development of technology, it is necessary to explore more new intelligent teaching tools, especially the application of augmented reality and virtual reality in higher vocational education.

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