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A study of digital literacy enhancement paths for physical education teachers in vocational undergraduate colleges based on multiple linear regression modeling

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ABSTRACT

With the deepening of education modernization, improving teachers' digital literacy has become the key to promoting the digital transformation of education. The growing demand for professionals in modern society has made the digital literacy of physical education teachers in vocational undergraduate colleges more and more important. This paper defines digital literacy and the digital literacy of vocational undergraduate teachers in turn, explores the four connotations of digital literacy, and proposes strategies to improve the digital literacy of physical education teachers in vocational undergraduate colleges. The entropy value method was used to measure the digital literacy level of physical education teachers in vocational undergraduate colleges, determine the weight of teachers' digital literacy evaluation indexes, and select and analyze the influencing factors of teachers' digital literacy. Pearson correlation analysis was conducted on teachers' digital literacy and influencing factors, as well as various dimensions and influencing factors, and multiple linear regression models were constructed to analyze the improvement path. The measurement results show that in the dimension of digital awareness, the mean values of digital willingness, digital cognition, and digital will are 4.4269, 4.3484, and 4.3748, respectively, indicating that the subject vocational undergraduate physical education teachers are highly willing to learn and use digital technology resources. The correlation coefficients between the dimensions and influencing factors of digital literacy were roughly in the range of 0.4~0.7, and the P values were all < 0.01, indicating that there was a significant positive correlation between them. The path coefficients of "TS→DA", "TE→DA" and "TM→DA" were 0.0533, 0.0796 and 0.0789, which did not reach the significance level, while the other paths reached the significance level (P<0.05), indicating that there was a significant positive impact.

Keywords: Entropy method, Indicator weights, Pearson correlation, Multiple linear regression model, Digital literacy

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1. Introduction

Teachers' digital literacy refers to the knowledge, skills and attitudes that teachers have in order to be able to use information technology for information acquisition, information processing, knowledge innovation and education and teaching activities in a digitalized environment [1-3]. It includes several aspects of teachers' information awareness, information competence, information spirit and information ethics. Information awareness is the foundation of teachers' digital literacy, which requires teachers to have a keen awareness of information and the ability to understand information correctly [4-5]. Information competence is the core of teachers' digital literacy, which requires teachers to be able to skillfully utilize information technology tools, acquire, integrate and evaluate information, and apply information to teaching practice [6-8]. Information spirit is the soul of teachers' digital literacy, which requires teachers to have the spirit of openness, innovation, cooperation and sharing [9]. Information ethics is an important part of teachers' digital literacy, which requires teachers to abide by ethical norms when using digital technologies and treat the acquisition, processing and application of information correctly [10]. Teachers should have the ability to acquire and evaluate information, be able to make good use of various information technology devices, master the ability to retrieve, integrate and innovate information, and increase the richness of knowledge [11-12]. Moreover, they need to flexibly utilize digital technology for teaching design according to the characteristics of the subject and the needs of students, and create an inspiring and interactive teaching environment. In addition, teachers should be good at using some new digital teaching aids and multimedia technology to provide rich and diverse teaching resources to stimulate students' interest and enthusiasm in learning [13-15]. At the same time, the use of digital technology for classroom evaluation and student performance evaluation, timely understanding of student learning, adjusting teaching strategies.

A teacher with a high level of digital literacy can better adapt to the challenges brought by teaching changes, improve teaching effectiveness, and cultivate students' innovative thinking and information literacy [16]. Physical education in vocational undergraduate institutions tends to incline most of the resources to students in order to develop professional sportsmen or outstanding sports talents or teachers. For this reason, physical education teachers also need to keep up with the trend of the times, using digital technology applied to the classroom, diversified teaching, and improve students' interest and physical education skills, and with the emergence of more and more new technologies, teachers' digital literacy needs to be constantly improved [17-18].

In this paper, we sort out the relevant concepts of digital literacy and analyze the interrelationship between digital literacy, information literacy and media literacy. And on this basis, it proposes digital literacy for vocational undergraduate teachers, and proposes the digital literacy competence that physical education teachers in vocational undergraduate colleges should have. The connotation of digital literacy was summarized, including the four aspects of digital technology cognitive ability, digital technology application ability, digital resource integration ability, and correct digital values. According to the proposed connotation of digital literacy, digital literacy enhancement strategies for physical education teachers in vocational undergraduate colleges are obtained from the directions of improving awareness, enhancing application, and perfecting assessment mechanism. Using the entropy value method, after polarizing the indicators, the evaluation measurement indexes of digital literacy level of physical education teachers in vocational undergraduate colleges are determined and the measurement results are analyzed. Multiple linear regression model was constructed to study the improvement path of digital literacy of physical education teachers.

2. Digital literacy for physical education teachers in vocational undergraduate institutions

2.1. Definition of core concepts

2.1.1. Digital literacy. In order to accurately grasp the connotation of digital literacy, its relationship with related concepts such as information literacy, media literacy, computer literacy and network literacy needs to be systematically sorted out [19]. Observing the historical process, the development of digital literacy can be traced from computer literacy, network literacy, media literacy and information literacy, gradually evolving to today's digital literacy. Computer literacy, which mainly involves the mastery of computer knowledge and the skillful use of computers and software, is the narrowest concept and forms the basis of the concept of digital literacy. Cyber literacy, on the other hand, has evolved with the emergence of the Internet, emphasizing the basic ability to analyze, interpret, and evaluate online information, as well as the acquisition, processing, and application of information via the Internet. Information literacy encompasses the skills to utilize information-rich tools and resources to work effectively and solve problems. Media literacy is the ability to select, understand, question, and evaluate media messages as well as the ability to produce and produce media messages. Digital literacy focuses on the ability to collect, analyze, apply, and disseminate data information in a reasonable and legal manner and the process of following data ethics and norms, with an emphasis on data information processing. Together, these concepts build an intricate framework of literacy, of which digital literacy is considered the most comprehensive category, reflecting the need for a new type of literacy in the digital age. Computer literacy and cyber literacy are the elements that build the foundation and core of digital literacy, while information literacy and media literacy respond to the particular skills needed in a given digital context. Digital literacy, on the other hand, is considered to be the basic requirement for an individual's ability to handle data in the era of big data.

By sorting out and analyzing the relationships between the above concepts, as shown in Figure 1, this study adopts “digital literacy” as the core concept, which is a comprehensive concept that integrates media literacy, computer literacy, information literacy, and network literacy, and embodies an individual's ability to cope with, analyze, evaluate, and innovate in the digital environment. The concept transcends the narrow perspective of technological manipulation and emphasizes the cross-cutting skill sets that individuals must possess in the digital age in order to adapt to and navigate the rapidly changing technological and social environments.

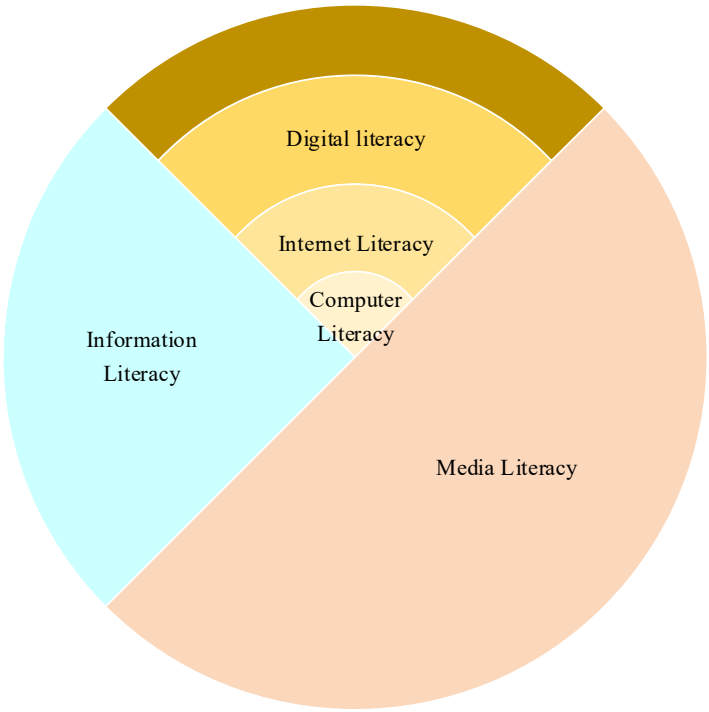

Fig. 1. Digital literacy and other related concepts

2.1.2. Digital literacy for vocational undergraduate teachers. Much of the research on teachers' digital literacy has been proposed on the basis of digital literacy, and compared to the digital literacy of students or citizens, teachers' digital literacy competencies are generally more complex, not only to reflect their identity as digital citizens, but also to highlight their key role in fostering future digital citizens. As mentors and collaborators in the students' learning process, teachers' digital literacy levels have a direct impact on the formation of students' digital literacy. Therefore, while mastering basic civic digital literacy, teachers also need to commit themselves to improving their cognitive skills, critical thinking, and problem-solving abilities in complex digital environments according to their own growth needs and those of their students.

In the context of the development of the digital age, teachers' digital literacy shows a more comprehensive and systematic trend of progress. This not only covers the enhancement of teachers' skills in teaching with digital technologies, but also includes the enhancement of teachers' abilities in digital cognition, digital security and problem solving skills. In China's education system, secondary schools are an important part, and these schools educate students in high school cultural knowledge while implementing targeted vocational knowledge education and vocational skills training according to the requirements of vocational positions. As a result, vocational undergraduate colleges and universities are focusing on cultivating technical and skilled talents and creating a “dual-teacher” teaching force. In view of such talent cultivation goals and teacher training needs, the digital literacy of vocational undergraduate physical education teachers is inevitably different from that of ordinary primary and secondary school teachers or college teachers. The digital literacy of ordinary teachers is mainly reflected in their use of digital teaching tools and resources for general education, as well as their ability to build and guide students' digital learning environment, which is not so demanding for teachers' own digital literacy level, and they only need to master basic digital knowledge and use basic digital tools. On the other hand, the digital literacy of vocational undergraduate physical education teachers is more comprehensive and systematic, because they not only need to master the digital technology required for teaching, but also need to have deeper digital cognition, digital security and problem solving skills. First of all, the digital literacy of vocational undergraduate physical education teachers needs to emphasize more on the integration and application of

vocational skills, and vocational undergraduate physical education teachers pay more attention to the integration of teaching content and vocational practice than ordinary teachers. Therefore, their digital literacy not only includes the use of instructional technology, but also requires in-depth understanding and application skills in specific occupational areas. For example, in the process of cultivating technical skill talents, vocational undergraduate physical education teachers need to master the latest technological dynamics of the relevant industry and be able to integrate them into teaching practice so that students can grasp the industry trend and have practical operation ability in time. Secondly, the digital literacy of vocational undergraduate physical education teachers also needs to emphasize the cultivation of dual-teacher teachers. With the development of society and the continuous updating of modern professional requirements, vocational undergraduate physical education teachers need to have both solid professional knowledge and good teaching ability. Therefore, vocational undergraduate colleges and universities are focusing on cultivating dual-teacher teachers, i.e., teacher talents who know both technology and education, and who are able to combine the two organically. This requires vocational undergraduate physical education teachers to have not only technical skills in digital literacy, but also education and teaching theory and practical experience, in order to better guide students to master vocational skills and cultivate high-quality technical talents to meet the needs of society.

2.2. Connotations of digital literacy

2.2.1. Digital technology cognitive skills. Digital technology cognitive ability is the basis for vocational undergraduate physical education teachers to understand modern information technology, covering a wide range of knowledge from basic data processing to complex system operation [20]. In vocational undergraduate programs, teachers need to have a deep knowledge of digital technology in order to effectively integrate various digital resources in the teaching and learning process and improve the efficiency of teaching and learning. This ability requires teachers to have a high level of proficiency in software and hardware, and to be able to accurately predict trends in educational technology, so that the teaching content can be synchronized with technological development. Enhancing the cognitive ability of digital technology provides technical support for teachers' teaching innovation in the era of informationization, strengthens the diversity of education, and greatly enriches teachers' teaching methods. The cultivation of digital technology cognitive ability also has a positive impact on teachers' personal career development, helping them to maintain their competitiveness in the rapid change of educational technology.

2.2.2. Digital technology application capacity. Competence in the application of digital technology refers to the ability to effectively utilize digital tools in teaching and learning, including the implementation of technology-based teaching strategies and the selection of appropriate digital tools to enhance educational effectiveness. Vocational undergraduate teachers can enhance students' learning motivation by utilizing various modern information technology tools to create attractive learning environments in accordance with students' needs in their teaching activities. Teachers' application of digital technology has a direct impact on the improvement of education quality and the innovation of teaching methods. Enhanced ability in the application of digital technology helps teachers to take the initiative in the digital transformation, keep the foresight of educational practice, and provide students with a broader learning horizon.

2.2.3. Capacity to integrate data resources. Data resource integration covers the whole process of screening, evaluating and synthesizing information from multiple sources to practical application. Data resource integration requires teachers to have advanced information retrieval techniques and to use advanced database management systems and network resource management tools to quickly and accurately obtain the data needed for teaching. Teachers transform data resources into teaching

knowledge in course implementation, which in turn improves students' learning effectiveness. In the context of digital education, the ability to integrate data resources supports teachers to make innovations in teaching strategies and helps build a more personalized learning environment. The effective integration of educational resources in vocational undergraduate programs enables teachers to play a greater role in the process of educational informatization, optimize the allocation of educational resources, and promote the overall improvement of educational quality.

2.2.4. Correct digital values. Proper digital values refer to the maintenance of high standards of ethics and morality in the digital environment, emphasizing the need for teachers to comply with data protection regulations, respect students' right to privacy, and make fair use of information resources when using digital technologies. Such values are manifested in vocational undergraduate teachers' adherence to the principle of authenticity of information when introducing digital resources. The cultivation of correct digital values plays an indispensable role in improving the quality of education and building a healthy educational information environment. Teachers with correct digital values can help students understand the authenticity of digital media information, cultivate students' critical thinking, and guide them to make morally correct judgments in the digital era.

2.3. Digital Literacy Enhancement Strategies for Physical Education Teachers in Vocational Undergraduate Colleges and Universities

2.3.1. Enhance teachers' digital awareness and technology application capabilities. Enhancing the digital awareness of vocational undergraduate teachers is the key to educational innovation. Teachers' digital awareness is related to the ability to effectively integrate existing digital resources to enrich teaching content. This requires vocational undergraduates to invest in new technological equipment and emphasize teachers' proficiency in the use of digital tools to enhance their digital awareness. Teachers' ability to use technology has been enhanced so that they can skillfully utilize digital tools in instructional design. This increased competence helps teachers to better adapt to the rapid changes in educational technology and improves the interactivity of teaching and learning activities.

2.3.2. Enhancement of technical training for teachers to improve the efficiency and quality of teaching and learning. Strengthening technology training for vocational undergraduate teachers is an effective strategy for improving teaching efficiency and quality. Teachers' mastery of advanced teaching methods in systematic technology training can enhance the attractiveness of teaching content and students' learning engagement. Training can include the latest information technology, the use of instructional software, and how to integrate these technologies into course design. Technology training should also focus on the depth of teachers' understanding of educational technology and help them recognize the potential of technology to promote critical thinking among students. Increased technological proficiency of teachers can effectively streamline the teaching process and improve the quality of teaching, thus making educational activities more efficient.

2.3.3. Improve the teacher assessment mechanism and optimize the assessment of digital skills. Improving the teacher assessment mechanism is one of the key strategies to enhance the digital literacy of vocational undergraduate teachers. Establishing a systematic appraisal mechanism can accurately assess and continuously improve teachers' digital skills. Such assessment involves the application of technology in teachers' daily teaching activities and the integration of digital tools and resources into course design. An effective assessment mechanism should include regular self-assessment, peer review and student feedback, so that teachers can have a multi-dimensional understanding of their room for improvement in digital teaching and learning.

2.4. Methods and Results of Measuring Digital Literacy Levels of Physical Education Teachers in Vocational Undergraduate Colleges and Universities

2.4.1. Measurement methods. The entropy method determines the indicator weights according to the size of the degree of variability of the evaluation indicators, and the greater the degree of variability of the indicators, the more information is provided, and the smaller the information entropy is instead [21].

First, the positive and negative indicators are polarized separately.

The positive indicator is calculated by the formula:

$$x_{ij}^{*} = \frac{x_{ij} - \min x_{ij}}{\max x_{ij} - \min x_{ij}} \tag{1}$$

The negative indicator is calculated by the formula:

$$x_{ij}^{-} = \frac{\max x_{j} - x_{ij}}{\max x_{j} - \min x_{j}} \tag{2}$$

where x_{ij} is the value of the j rd indicator for the i nd province and city, $\max$ and $\min$ represent the maximum and minimum values respectively. Only the quantitative indicator of digital administrative capacity is negative, while the rest of the indicators are all positive. In order to avoid the appearance of 0, which makes it impossible to take logarithmic values subsequently, a decimal 10^{-8} is added after each indicator.

Next, the weight and entropy value of the indicators are calculated. The weight formula is:

$$p_{ij} = \frac{x_{ij}^{d}}{\sum_{i=1}^{N} x_{ij}^{d}} \tag{3}$$

The entropy formula is:

$$\varphi_{j} = -k \sum_{i=1}^{N} p_{ij} \ln\left(p_{ij}\right) \tag{4}$$

where, N is the number of samples, d indicates + or - for positive or negative indicators, k is a constant greater than 0, and $-k$ is to ensure that the entropy value is non-negative. If all the values of the indicators are equal, it means that the degree of variation between the indicators is very small, $p_{ij} = 1/N$, at this time, the entropy value φ_{j} to take the maximum value of 1, so generally set $k = -1/\ln N$, making $\varphi_{j} \in (0,1)$.

Finally, determine the weights. Entropy value is a measure of uncertainty, the greater the amount of information, the smaller the uncertainty, the smaller the entropy value, the greater the weight at this time. The formula for calculating the weights of the indicators is:

$$w_{j} = \frac{\left(1 \cdot \varphi_{j}\right)}{\sum_{j=1}^{j} \left(1 \cdot \varphi_{j}\right)} \tag{5}$$

where J is the number of indicators.

2.4.2. Measurement results:

1) Subjects of the survey. This survey mainly selects the physical education teachers of SX vocational undergraduates, and the selected physical education teachers are mainly concentrated in the areas of

HZ city, AK city, XY city, XA city, YA city and YL city. The selected physical education teachers are distributed in the central part of SX province, and this sample can fully represent the characteristics of physical education teachers in SX province as a whole, which is very representative. This study relied on the connections of mentors, friends and relatives to finally identify some math teachers from schools in the above areas to participate in this research. When determining the survey respondents, the special circumstances of the province were taken into account as much as possible, and the impact of various factors on the sample of this study was fully considered to ensure that the survey data obtained in the study were typical and representative.

2) Research on secondary dimensions. In this section, the scores obtained by teachers for each question item in the questionnaire will be counted and organized to obtain the scores obtained by each teacher in each secondary dimension. This is done by averaging the scores of all the questions included in each secondary dimension, and using this average to represent the score obtained by each teacher in the secondary dimension of teachers' digital literacy. The scores of each teacher in the second-level dimension were mainly analyzed, and by analyzing the distribution of the scores obtained by vocational undergraduate physical education teachers in each second-level dimension, it is possible to objectively, concretely, and comprehensively understand the actual situation of digital literacy of SX vocational undergraduate physical education teachers.

Table 1 shows the results of the secondary dimension research, which includes three secondary dimensions of digital awareness dimension, digital awareness, digital willingness and digital will. From the mean value, the highest mean value of digital willingness reaches 4.4269, the lowest mean value of digital awareness is 4.3484, and digital will is in the middle at 4.3748, indicating that vocational undergraduate physical education teachers in SX province have a high willingness to learn and use digital technological resources, and a strong initiative to carry out the practice of digitalization of education, exploration and innovation. In contrast, the level of this aspect of digital awareness is relatively weak, and teachers' competence in this area needs to be strengthened. The mean and median of the three secondary dimensions of digital awareness are large, at 4 or above, indicating that vocational undergraduate physical education teachers in SX province are performing very well overall on all three dimensions. In terms of the variance value, the largest variance value is 0.4369 on digital will, the median variance value of digital awareness is 0.3678, and the smallest variance value of digital willingness is 0.3518, which indicates that in this aspect of digital willingness the performance of these teachers is not uniform, and the data are more volatile. And considering that the mean value of digital will is large, it indicates that the teachers recognize this dimension very highly. Although the mean value of each specific dimension is relatively high, but from the most value, there are still some teachers in these three dimensions scored low as 2 and below 3, this part of the teachers do not have a clear and explicit cognition of the value of the use of digital technology, and the willingness and will to use it is not firm enough. Therefore, it is necessary to think about how to improve the level of these teachers in these three secondary dimensions.

Table 1. Secondary dimensional research results

First-order dimension	Secondary dimension	Maximum value	Minimum value	Mean value	Median	Variance
Digital consciousness	Digital recognition	5	2.3248	4.3484	4.3188	0.3678
	Digital will	5	2	4.4269	4.5296	0.3518
	Digital will	5	2	4.3748	4	0.4369
Digital technical knowledge and skills	Digital technical knowledge	5	2	4.1685	4	0.6588
	Digital skills	5	2	4.1899	4	0.4639
	Digital teaching design	5	2.2415	4.1725	4	0.4756
Digital application	Digital teaching implementation	5	2	4.2158	4	0.4496
	Digital evaluation	5	2.2415	4.2188	4	0.4758
	Digital collaborative education	5	2.5	4.1985	4	0.4526
Digital social responsibility	Moral code of the rule of law	5	2	4.4236	4	0.2948
	Digital security	5	3	4.3185	4.3998	0.3548
Professional development	Digital learning and research	5	2.648	4.3099	4	0.3548
	Digital teaching research and innovation	5	2	4.2689	4	0.4295

3) Level 1 dimensions and overall research situation. In response to the industry standard “Digital Literacy for Teachers” issued by the Chinese Ministry of Education, the digital literacy of teachers is categorized into five Level 1 dimensions. In this section, we will analyze the scores of the teacher group in these five Level 1 dimensions. The data comes from averaging the total scores of all the questions included in each Level 1 dimension for each teacher, and using this average score to represent the scores obtained by each teacher in each Level 1 dimension, the scores obtained by all the teachers in each Level 1 dimension are statistically analyzed and sorted out, resulting in the first five rows of data shown in Table 2, which provides the data for Level 1 dimensions and the overall research. Finally, the scores obtained by each teacher in the specific questions of all dimensions were averaged, and this average was used to represent the total digital literacy score of each teacher, and the total digital literacy score of each teacher was statistically analyzed to obtain the overall digital literacy scores of vocational undergraduate physical education teachers in SX Province, as shown in the sixth row of data in Table 2 below. By statistically analyzing the scores of each level of dimension and the overall digital literacy, it is possible to fully grasp the situation of vocational undergraduate physical education teachers in SX province in each specific aspect of digital literacy and overall digital literacy.

It can be seen that the digital literacy of vocational undergraduate physical education teachers in SX province has a mean score of 4 or above in all dimensions, and the mean value of the overall score of digital literacy is 4.2158, which indicates that the level of digital literacy of vocational undergraduate physical education teachers in SX province is better as a whole. The mean scores of the dimensions at each level are, in descending order, digital awareness, digital social responsibility professional development, digital application and digital technology knowledge and skills, and the corresponding mean scores are, in descending order, 4.3598, 4.3158, 4.2699, 4.2569 and 4.1685, and the mean scores of the dimensions of digital social responsibility, digital awareness and professional development are higher than the overall digital literacy The average scores indicate that vocational undergraduate physical education teachers in SX province generally pay more attention to their own moral cultivation and behavioral norms in digital activities, have a clearer and clearer understanding of digital-related activities, and are able to use digital technology resources to enhance their own and the community's professional development. The average scores of the dimensions of digital application and digital technology knowledge and skills are low, indicating that the teachers' ability

to apply digitalization and their mastery of digital technology knowledge and skills are relatively poor, so it is necessary to strengthen the teachers' ability in digital instructional design, digital instructional implementation, digital academic evaluation, and digital collaborative education, and it is also necessary to provide training to guide the teachers to master the relevant knowledge and skills of digital technology. Skills. In terms of variance, the relatively large variance values of digital technology knowledge and skills and digital applications indicate that the dispersion of teachers' scores on these two dimensions is large, and that there is greater variability in teachers' competencies. On the other hand, the smallest value of variance for Digital Social Responsibility indicates that teachers were more consistent in their choices on this dimension and generally believed that they were able to have better ethics and behaviors in their digital activities. In terms of the maximum value, the maximum value of the scores of all five dimensions is 5. In terms of the minimum value, the minimum value of the scores of digital technical knowledge and skills is 2. The minimum value of the scores of the remaining dimensions, except for the minimum value of the dimension of digital social responsibility, which is 3, is greater than 2 but below 3, which indicates that despite the overall high level of digital literacy of the teachers, there are still some teachers who have a poor level of digital literacy, and this also indicates that the vocational undergraduate degree of the province of SX Physical education teachers' digital literacy level needs to be improved in some specific dimensions despite the overall better level.

Table 2. Primary dimension and overall survey

Variable name	Sample size	Maximum value	Minimum value	Mean value	Median	Variance
Digital consciousness	110	5	2.8565	4.3598	4.4185	0.2985
Digital technical knowledge and skills	110	5	2	4.1685	4	0.4285
Digital application	110	5	2.0685	4.2569	4.1659	0.4179
Digital social responsibility	110	5	3	4.3158	4.2615	0.2763
Professional development	110	5	2.6785	4.2699	4	0.3752
Digital literacy	110	5	2.4658	4.2158	4.1355	0.2935

3. Digital literacy enhancement path for physical education teachers based on multiple linear regression modeling

3.1. Correlation analysis

3.1.1. Pearson correlation analysis of teachers' digital literacy and influencing factors. In order to further explore the correlation between each influence factor of the independent variable and the dependent variable of teachers' digital literacy, this study used SPSS software to conduct Pearson correlation analysis to determine the strength of the correlation between the variables through the correlation coefficient, r. Table 3 shows the results of the Pearson correlation analysis between teachers' digital literacy and the influencing factors. The correlation coefficients between teachers' digital literacy and the influencing factors of self-efficacy, existing experience with digital technology, intrinsic drive, organizational support from the school, training in digital technology, open learning, self-correcting, and interpersonal communication are all greater than 0.6, and the p-values are all 0.000<0.01, which means that the study's All independent variables (influencing factors) have a significant positive correlation with the dependent variable (teachers' digital literacy). Among them, the correlation coefficient r between the influence factor existing digital technology experience and teachers' digital literacy was the highest at 0.7815, indicating that the higher the perceived usefulness, enjoyment, and sense of accomplishment that teachers have gained from using digital technology in the past, the higher the level of teachers' digital literacy. However, relying only on the

results obtained by conducting Pearson correlation analysis is not enough to support proving that the hypothesis of this study is valid, and only through further regression analysis can we verify the causal relationship between the independent variables and the dependent variable.

Table 3. The results of the results of the teachers' digital literacy and influence factors

/	DL	TS	TE	TM	ES	ET	OL	SC	IC
DL	1								
TS	0.7215**	1							
TE	**0.7815****	0.8215**	1						
TM	0.6728**	0.7369**	0.7718**	1					
ES	0.6915**	0.6648**	0.7158**	0.6518**	1				
ET	0.7398**	0.7584**	0.7569**	0.7158**	0.7489**	1			
OL	0.6215**	0.6945**	0.6858**	0.6728**	0.6728**	0.7155**	1		
SC	0.6125**	0.6158**	0.6085**	0.5936**	0.6452**	0.7056**	0.7755**	1	
IC	0.6285**	0.5896**	0.6288**	0.5438**	0.6425**	0.6525**	0.7136**	0.7369**	1

Note: **indicates a significant correlation at level 0.01 (double-tailed).

DL=Digital literacy for teachers,TS=Self-efficacy,TE=Existing digital technology experience,TM=Intrinsic Drive,ES=Organizational support of the school,ET=Digital Technology Training,OL=Open Learning,SC=Self-correction,IC=Interpersonal Communication.

3.1.2. Correlation analysis between the dimensions of teachers' digital literacy and influencing factors. Pearson correlation analysis was conducted between the five dimensions of teachers' digital literacy and eight influential factors, and the results are shown in Table 4 below. As can be seen from the table, the correlation coefficients between the dimensions of digital literacy and the influencing factors: self-efficacy, existing experience with digital technology, intrinsic drive, organizational support of the school, training in digital technology, openness to learning, self-correction, and interpersonal communication are roughly located in the range of 0.4 to 0.7, with only a few of them outside of this range (0.3925, 0.7065, and 0.7244),. and the p-values are all <0.01, indicating that there is a significant positive correlation between all of them. Specifically, digital awareness has the highest correlation with intrinsic drive and the lowest correlation with interpersonal communication. Digital technology knowledge and skills had the highest correlation with pre-existing digital technology experience and self-efficacy, and the lowest correlation with interpersonal communication. Digital adoption had the highest correlation with pre-existing digital technology experience, organizational support at school, and self-efficacy, and the lowest correlation with self-correction. Digital social responsibility correlated strongly with pre-existing digital technology experiences, digital technology training, self-efficacy, and intrinsic drive, and weakly with self-correction and interpersonal communication. Professional development had strong correlations with pre-existing digital technology experience, self-efficacy, and weak correlations with intrinsic drive and self-correction.

Table 4. The results of the analysis of the factors of the teachers' digital literacy

/	DC	DK	DA	DS	PD
TS	0.5526**	0.6518**	0.6215**	0.6812**	0.7244**
TE	0.5532**	0.6636**	0.6569**	0.6858**	0.7065**
TM	0.5636**	0.5715**	0.5296**	0.6318**	0.5759**
ES	0.4054**	0.5536**	0.6315**	0.5369**	0.6853**
ET	0.5266**	0.6055**	0.6136**	0.6318**	0.6815**
OL	0.4825**	0.5636**	0.5369**	0.5596**	0.6036**
SC	0.4469**	0.5136**	0.5162**	0.4823**	0.5698**
IC	0.3925**	0.5065**	0.5636**	0.4269**	0.6418**

Note: ** indicates a significant correlation at level 0.01 (double-tailed).

DC=digital Awareness, DK=Digital Technology knowledge and Skills, DA=Digital Application, DS=Digital Social Responsibility, PD=Professional Development, TS=Self-efficacy, TE=Existing digital technology experience, TM=Intrinsic drive, ES=Organizational support of the school, ET=Digital Technology Training, OL=Open Learning,SC=Self-correction,IC=Interpersonal communication.

3.2. Regression analysis

3.2.1. Regression analysis of each influencing factor with the overall digital literacy of teachers. Table 5 shows the regression analysis of teachers' digital literacy from the dimensions of influencing factors, and it can be seen from the data in the table that the five significant variables entering the regression equation model are: existing digital technology experience, self-efficacy, school organizational support, interpersonal communication, and digital technology training. Firstly, from the overall perspective, the multivariate correlation coefficient R is 0.8399, and the judgment coefficient R^2 is 0.6948, indicating that these five variables can jointly explain 69.48% of the variation of teachers' digital literacy. The Durbin-Watson value is 1.9815, which is very close to 2, indicating that the sample is more independent, and the VIF value is 3.8244<5, indicating that there is no multicollinearity problem. After the last regression, the F-value was 196.484 ($P<0.05$), indicating that the model achieved significant regression effect. From an individual point of view, the "existing digital technology experience" variable was the first to enter the regression model, with a variation of 61.23%, the second was the "self-efficacy" variable, with an explanation value of 66.33%, the third was the "school organizational support" variable, with an explanation value of 68.52%, the fourth was the "interpersonal communication" variable, with an explanation value of 69.36%, and the fifth was the "digital technology training" variable, with an explanation value of 69.18%. At the same time, the standardized coefficients of the five variables in the model were β 0.2956, 0.3096, 0.1389, 0.1153 and 0.098, respectively, indicating that these five factors had a significant positive impact on teachers' digital literacy.

Table 5. Regression analysis

Entry order of the argument	R	R^2	After adjustment R^2	F	P	Normalization factor β	VIF
TE	0.7823	0.6125	0.6123	674.166***	0.000	0.2956	3.7186
TS	0.8166	0.6636	0.6633	423.645***	0.000	0.3096	3.2648
ES	0.8296	0.6815	0.6852	313.157***	0.003	0.1389	2.1456
IC	0.8315	0.6933	0.6936	243.945***	0.002	0.1153	1.9155
ET	0.8399	0.6948	0.6918	196.484***	0.048	0.098	3.8244

Note: ***indicates a significant correlation at level 0.001 (double-tailed).

TS=Self-efficacy, TE=Existing digital technology experience, TM=Intrinsic drive, ES=Organizational support of the school, ET=Digital Technology Training, OL=Open

Learning,SC=Self-correction,IC=Interpersonal communication.

3.2.2. Regression analysis of each influential factor with each dimension of teachers' digital literacy. The eight influencing factors as independent variables were regressed with the five dimensions of teachers' digital literacy dependent variables, i.e., digital awareness, digital application, digital technology knowledge and skills, professional development, and digital social responsibility, and the results are shown in Table 6 below. The significance probability values of all F-values are <0.05, VIF <5, and R^2 are located between 0 and 1, indicating that the regression effect of each regression model is significant, so based on the data, it can be concluded that intrinsic drive, self-efficacy, pre-existing digital technology experience, and self-correction positively affect teachers' digital awareness. Pre-existing digital technology experience, self-efficacy, and open learning positively affect teachers' digital technology knowledge and skills. Pre-existing digital technology experiences, organizational support in school, interpersonal communication, and self-efficacy will positively influence teachers' digital adoption. Pre-existing digital technology experiences, self-efficacy, intrinsic drive, and digital technology training will positively influence teachers' digital social responsibility. Self-efficacy, interpersonal communication, organizational support from the school, and pre-existing digital technology experience will positively influence teachers' professional development.

Table 6. The influence factors are analyzed in each dimension of the teachers' digital literacy

Dependent variable Digital consciousness							
Entry order of the argument	R	R^2	After adjustment R^2	F	P	Normalization factor β	VIF
TM	0.5615	0.3185	0.3188	197.645***	0.000	0.2798	2.8563
TS	0.5939	0.3596	0.3596	119.544***	0.005	0.2098	3.4855
TE	0.6036	0.3648	0.3648	81.569***	0.029	0.1798	4.1983
SC	0.6078	0.3678	0.3634	62.198***	0.024	0.1288	1.9755
Dependent variable Digital technology knowledge and skills							
TE	0.6678	0.4496	0.4469	346.485***	0.000	0.3491	3.3158
TS	0.6948	0.4836	0.4836	200.485***	0.000	0.2815	3.4399
OL	0.7035	0.4928	0.4897	138.184***	0.000	0.1399	2.0786
Dependent variable Digital application							
TE	0.6548	0.4369	0.4325	328.185***	0.000	0.2548	3.7158
ES	0.7069	0.4923	0.4936	208.668***	0.000	0.2579	2.4099
IC	0.7185	0.5069	0.5048	145.658***	0.000	0.1469	1.9158
TS	0.7198	0.5149	0.5098	113.247***	0.000	0.1658	3.2158
Dependent variable Digital social responsibility							
TE	0.6815	0.4718	0.4632	380.915***	0.000	0.2691	4.3485
TS	0.7158	0.5199	0.5123	226.756***	0.000	0.2944	3.5488
TM	0.7285	0.5216	0.5299	159.156***	0.018	0.1469	2.9536
ET	0.7298	0.5399	0.5267	120.688***	0.019	0.1699	3.5569
Dependent variable Professional development							
TS	0.7269	0.5212	0.5215	472.689***	0.000	0.3648	3.4155
IC	0.7769	0.5593	0.5936	318.148***	0.000	0.2269	1.9452
ES	0.7925	0.6258	0.6248	243.259***	0.000	0.2499	2.4966
TE	0.7988	0.6636	0.6069	184.598***	0.003	0.1798	4.2684

3.3. Path analysis

Path analysis can determine whether the influence relationship between the variables is as expected. The results of the model path analysis are shown in Table 7, which yields parameters such as P-value

and standardized coefficients for the corresponding paths.

The path coefficients, C.R values and the significance (P-value) of each path are given in the table. Based on the values of each coefficient, the influence relationship between the variables is specifically analyzed.

In the path "TS→DA", the standard path coefficient is 0.0533, which does not reach the significance level (P>0.05), indicating that the path has no significant impact, in the path "TE→DA", the standard path coefficient is 0.0796, which does not reach the significance level (P>0.05), indicating that the path has no significant impact, and in the path "TM→DA", the standard path coefficient is 0.0789, which does not reach the significance level (P>0.05). Indicates that this path has no significant impact. The other pathways all reached the significance level (P<0.05), indicating that there was a significant positive impact.

Table 7. Path analysis

Path	Standard path coefficient	Non-standard path coefficient	S.E.	C.R.	P
TS→DC	0.3415	0.2945	0.0458	6.1035	***
TE→DC	0.3395	0.3423	0.0596	6.0355	***
TM→DC	0.2766	0.2496	0.0489	5.0425	***
TS→DA	0.0533	0.0536	0.0533	0.9185	0.3548
TE→DA	0.0796	0.0896	0.0658	1.3699	0.1855
TM→DA	0.0789	0.0785	0.0575	1.3845	0.1699
ES→DC	0.3015	0.3152	0.0766	4.3299	***
ES→DA	0.1966	0.2069	0.0579	3.6158	***

Note: ***indicates a significant correlation at level 0.001 (double-tailed).

TS=Self-efficacy, TE=Existing digital technology experience, TM=Intrinsic drive, ES=Organizational support of the school, DC=digital Awareness, DA=Digital Application.

4. Conclusion

This paper defines the core concepts of digital literacy and digital literacy of vocational undergraduate teachers, and proposes the connotation of digital literacy. Based on the connotation of digital literacy, the digital literacy improvement strategy of vocational undergraduate physical education teachers is analyzed. The entropy value method is utilized to measure the level of digital literacy evaluation indexes of physical education teachers in vocational undergraduate colleges. The measurement results show that:

1) In the digital awareness dimension, the mean value of digital willingness is the highest at 4.4269, the mean value of digital awareness is the lowest at 4.3484, and digital will is in the middle at 4.3748, indicating that the subject vocational undergraduate physical education teachers have a high willingness to learn and use digital technological resources to carry out the educational digital practice, exploration, and innovation of a high degree of motivation.

2) Pearson correlation analysis was done between teachers' digital literacy and influencing factors and between dimensions and influencing factors respectively, and the correlation coefficient r between digital technology experience and teachers' digital literacy was the highest at 0.7815, and the higher the perceived usefulness, pleasantness, and sense of accomplishment that teachers have gained from using digital technology in the past, the higher the level of digital literacy of teachers.

3) Regression analysis of the individual influencing factors and teachers' digital literacy as a whole, from the overall point of view, the multivariate correlation coefficient R is 0.8399, and the coefficient of determination R^2 is 0.6948, which indicates that these five variables can jointly explain 69.48% of the variance in teachers' digital literacy.The value of VIF is 3.8244<5, which indicates that there is no multicollinearity, meanwhile, the value of F is 196.484, indicating that the model achieved significant

regression.

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