

Research on the Evaluation System of Vocational College Teachers' Teaching Ability in the Digital Economy Era

WenxiaSun¹, YingChen^{2*} FanChen³

Shanghai Urban Construction Vocational College college of business administration, Shanghai,China

Abstract. The era of digital economy promotes the transformation of enterprises and puts forward new requirements for the development of talent ability and higher requirements for the teaching quality of vocational colleges. A scientific and reasonable evaluation system can evaluate the teaching ability of vocational college teachers, accurately locate and solve the problems existing in teaching links, so as to achieve a new leap in the level of vocational college teachers and better meet the needs of the times. Based on the excellent practice achievements of American universities and the iceberg theory model, this paper takes Shanghai Vocational College as an example, and makes a statistical analysis of the data obtained from 208 questionnaires by using analytic hierarchy process, so as to establish a more refined, scientific and timely evaluation system and evaluation rules for teachers' teaching ability in vocational colleges. The evaluation system takes "students" as the evaluation subject, "teachers" as the evaluation basis, and "evaluation questionnaire" as the evaluation form, including 2 first-level indicators, 5 second-level indicators and 24 third-level indicators.

1 Preface

The rapid development of the digital economy has promoted the transformation and upgrading of global economic and social development[1]. The arrival of the digital economy era promotes the transformation and development of enterprises, putting forward higher requirements for the post competence of employees, and then affecting the development of teachers' teaching ability in vocational colleges. In addition, during the COVID-19 epidemic, the mode of "Internet+Education" showed a spurt development in China, which accelerated the pace of the reform of traditional teaching mode in China vocational colleges[2]. In the post-epidemic era, the sudden changes in application scale, popularization speed, technology update and other situational factors put forward new requirements for the teaching development of vocational colleges. As the main body of vocational education, full-time teachers in vocational colleges are the main factors that affect the development of vocational education. The emergence of new background and elements requires vocational college teachers to change their concepts, updating their teaching ability and adapting to the new development[3]. In February 2021, at the press conference of the Ministry of Education, Wu Yan, director of higher education, pointed out that in the future, colleges and universities would vigorously promote the establishment and improvement of an evaluation system that adapted to online teaching and online+offline mixed teaching. It can be seen that it is urgent to establish an evaluation system

for teachers' teaching ability of vocational colleges in the era of digital economy[4]. Therefore, this paper studies the teaching ability of teachers in vocational colleges by using analytic hierarchy process and questionnaire survey, and constructs an evaluation system for the teaching ability of teachers in vocational colleges in the digital economy era, with a view to accurately judging the teaching work of teachers in vocational colleges and truly reflecting the actual teaching level of teachers, so as to better reflect and improve teaching, continuously improving the teaching quality of schools, and then cultivating more talents suitable for the development needs of the times, society and enterprises[5].

2 Literature research

Developed countries such as Europe and America began to evaluate teachers' teaching ability as early as the mid-1920s[6]. China began to evaluate teachers' teaching ability in 1960s, mainly evaluating teachers' professional level and academic ability, and the results served as the basis for teachers' promotion, employment and performance-based salary[7]. At present, most vocational colleges in China are still using traditional methods such as students, peer teachers, department leaders and teaching supervisors to evaluate teachers' teaching ability. This traditional evaluation system can basically reflect the different characteristics and abilities of teachers, but it still has some defects[8]. The traditional teaching evaluation system focuses on the assessment of teachers'

^a724917856@qq.com

*Corresponding author: ^bchenjobying@163.com

classroom skills, but ignores the assessment of teachers' professional ethics, career loyalty, teaching discipline and other hidden basic qualities. In addition, the traditional teaching evaluation system of teachers in vocational colleges still has some disadvantages, such as lack of quantification and refinement[9]. In the era of digital economy, the development of educational technology, the characteristics of digital aborigines of students and the trend of teaching reform in vocational colleges make digital information technology become the focus of current and future teaching research development. Horizon Report of New Media Alliance: 2017 Higher Education Edition clearly pointed out that the best practical experience of online learning and face-to-face learning would become the "new normal" of future education[10]. Therefore, based on the comprehensive influence of digital economy on the development of society, enterprises and education, it is very positive social practical value and significance to establish a more refined, scientific and effective teaching evaluation system for vocational college teachers that adapts to the development of the times.

3 Construction of evaluation system

Based on the existing literature, we can find that there are significant similarities when most universities at home and abroad set up teaching ability evaluation systems.

So based on the teaching ability evaluation system of American colleges and universities, this paper takes 10 vocational colleges such as Shanghai Urban Construction Vocational College as an example, as to obtain relevant data and information through questionnaire survey, and construct a teaching evaluation system for vocational college teachers adapting to the digital economy era.

3.1 Determination of the hierarchy of specific indicators

In order to make the evaluation index system of vocational college teachers' teaching ability in the digital economy era meet the requirements of concreteness, refinement, scientificity and feasibility, this paper strictly follows the principles of systematicness, typicality, dynamics, scientificity and operability in the research process to set up questionnaires and construct indicators.

According to the iceberg theory model of American scholars Lyle M. Spencer, Jr. & Signe M. Spencer[11], the teaching ability of vocational college teachers in the digital economy era is divided into explicit partial quality with benchmark characteristics and implicit partial quality with discriminating characteristics. Among them, the basic skills of explicit quality teaching are in the upper part of the iceberg, and the basic literacy of implicit quality teachers is in the lower part of the iceberg. On this basis, the first-level indicators of the

system are further refined at the second and third levels, so as to reflect the teaching ability of vocational college teachers in the digital economy era more scientifically and comprehensively[12].

In the digital economy era, the evaluation index of teachers' teaching ability in vocational colleges is compared with the iceberg model, as shown in Table 1.

Table 1 Comparison table of evaluation index and iceberg model

iceberg model hierarchy		content	primary index	index refinement	
dominant quality	skill	language expression ability, organizational ability, decision-making ability, etc.	basic teaching ability	unique teaching methods, teaching content riched, teaching effect remarkable .	
	Recessive quality	character	responsibility, honesty, etc.	basic quality of teaching	respect for rules and discipline, loyalty to the cause, dedication, etc.
		self-cognition	optimism, self-confidence, positive ability, etc		
	sense of values	unity and cooperation, etc.			

The iceberg model of teachers' teaching evaluation index in vocational colleges includes the dominant factors mainly referring to teaching technology, teaching methods, teaching content, teaching language expression and so on; The hidden factors are mainly the internal factors such as teachers' quality, self-awareness and values. These factors cannot be directly observed and measured, but they determine the development potential and state of teachers.

3.2 Vocational college teachers' teaching ability evaluation index system

Based on the questionnaire survey of experts, scholars, teaching supervisors, peer teachers, leaders of competent departments and workers in colleges and universities in 10 vocational colleges in Shanghai, an evaluation system of teachers' teaching ability in vocational colleges is established, including two first-class indicators such as basic teaching ability, five second-class indicators such as teaching methods and 24 third-class indicators. After processed the data of the expert scoring table by AHP, the weights of each index of the evaluation system are obtained, and the specific index system is shown in Table 2.

Table 2 Teaching ability evaluation system of vocational college teacher

primary index	secondary index	three-level index
teaching basic skills (0.56)	teaching methods and tools (0.25)	1. problem solving ability (0.060) 2. network technical ability (0.059) 3.ability to use information technology and software(0.044) 4.diversification of methods and technologies (0.036) 5.ability to use teaching instruments(0.051)
	content of teaching (0.16)	6.the content is heavy and difficult. (0.036) 7.effective combination of theory and practice.(0.032) 8. strong social service and application. (0.045) 9.match students' learning ability and needs.(0.044)
	Teaching effect (0.15)	10.improve students' professional theoretical cognition. (0.020) 11.enhance students' practical ability (0.054) 12.improve students' interest in learning (0.040) 13.improve students' learning enthusiasm。 (0.040)
basic quality of teaching (0.44)	teaching and imparting (0.27)	14. teaching content design and courseware development ability . (0.050) 15. organizational teaching ability.(0.051) 16. ability to use teaching means and teaching methods .(0.045) 17. teaching process control ability. (0.043) 18. ability to demonstrate effectively.(0.044) 19. ability to inspire, understand and interact.(0.043)
	Professional ethics (0.17)	20. be patriotic and law-abiding . (0.034) 21.love your job and be dedicated.(0.034) 22.caring for students (0.040) 23. be a model for students.(0.031) 24.lifelong learning.(0.032)

Table 2 includes three-level indicators of teachers' teaching ability in vocational colleges, including two first-level indicators, namely basic teaching skills (0.56) and basic teaching literacy (0.44), and five second-level indicators, including teaching methods and tools (0.25), teaching content (0.16), teaching effect (0.15), teaching imparting (0.27) and professional ethics (0.27). There are 24 three-level indicators, and each three-level indicator is also matched its own weight.

3.2.1 Evaluation form

Based on the evaluation system of teachers' teaching ability in Shanghai Vocational College, a questionnaire is designed to evaluate teachers' teaching ability, and the evaluation subjects are organized to grade the completion of teachers' indicators, and then the grading results are graded according to the scoring standards[13], and then the scoring results are summarized according to the scoring standards, and finally the evaluation results of teachers' teaching ability are obtained. The questionnaire for teaching evaluation is based on 24 three-level indicators of the evaluation system of teachers' teaching ability in vocational colleges, and there are six different grades of A,B,C, D, E, F. The evaluation subject should check the grades of teachers' scoring items with reference to the scoring standards. The rating scales corresponding to the six different grades are: very consistent with the description (10 points), close to the description (8 points), not far from the description (6 points), far from the description (4

points), far from the description (2 points) and uncertain (0 point).

3.2.2 Evaluation scoring system

The evaluation and scoring system of teaching ability in vocational colleges in the era of digital economy includes four parts: three-level index score, two-level index score, one-level index score and comprehensive score.

The scores of the three-level indicators are expressed by H_i , which is determined by the scoring situation of the teaching evaluation questionnaire. The scoring grades A, B, C, D, E and F are 10, 8, 6, 4, 2 and 0 respectively, and the scoring scores of the three-level indicators and the corresponding weight coefficients are recorded. The calculation formula of the three-level index score is:

$$H_i = M_i \times h_i \tag{1}$$

H_i : three-level index score

M_i : three-level index grade score

h_i : weight coefficient of grade score of three-level indicators.

The second-level index score includes five aspects: teaching methods, tools, teaching content, teaching effect, teaching imparting and professional ethics score,

which are represented by $X_{\text{Method, Tool}}$, X_{Content} , X_{effect} , X_{Teaching} , X_{Virtue} respectively.

The formula for calculating the scores of teaching methods and tools is:

$$X_{\text{Method, Tool}} = \sum_{i=1}^5 H_i \quad (2)$$

$X_{\text{Method, Tool}}$: score of teaching methods and tools

H_i : three-level index scores, teaching tools and

methods, including three-level indicators H_1 to H_5 .

The calculation methods of teaching content score X_{Content} , teaching effect score X_{effect} , teaching imparting score X_{Teaching} and teaching ethics score X_{Virtue} are similar to Formula (2).

The first-level index score includes two aspects: the score of teaching basic skills and the score of teaching basic literacy, which are recorded as sum respectively. The formula for calculating the score of basic teaching skills is:

$$Y_1 = \sum_{i=1}^{13} H_i \quad (3)$$

Y_1 :teaching basic skills score;

H_i :three-level indicators score, basic teaching skills

include three indicators H_1 to H_{13} .

The formula for calculating the score of teaching basic literacy is:

$$Y_2 = \sum_{i=14}^{24} H_i \quad (4)$$

Y_2 :teaching basic literacy score

H_i :three-level indicators score, teaching basic

literacy includes three indicators H_{14} to H_{24} .

The comprehensive score of teaching ability evaluation in vocational colleges is recorded Y , and its calculation formula is:

$$Y = Y_1 + Y_2 \quad (5)$$

Y :comprehensive score.

Y_1 :teaching basic skills score.

Y_2 :score of teaching basic literacy.

4 Characteristics of the evaluation system

The evaluation system of teachers' teaching ability in vocational colleges in the era of digital economy established by questionnaire survey and analytic

hierarchy process in this paper is systematic, scientific and timely. The three-level quantitative indicators of teachers' teaching in vocational colleges are detailed and quantitative, and the scientific and reasonable weight makes it more operational and practical in implementation. Specific performance in the following three aspects:

4.1 The evaluation index more detailed

The traditional teaching evaluation index system of teachers in vocational colleges mostly has only two levels of evaluation indicators, and the logical relationship between the indicators is not strong. At the same time, there were too many qualitative indicators, too few quantitative indicators, and lacked clarity in evaluation standards. Based on the iceberg model theory, this paper establishes a three-level index system by questionnaire survey and analytic hierarchy process, and sets scientific weights for each level index and each specific index combined with data, making the evaluation index system more refined and rational. At the same time, the indicator system includes both explicit and implicit indicators of teachers' teaching ability, which not only pay attention to teachers' current ability status and teaching effect, but also pay attention to teachers' future development potential. Therefore, this evaluation index system can evaluate the teaching ability of teachers in vocational colleges more comprehensively and systematically.

4.2 Index weight distribution more scientific and reasonable

In the course of this research, by soliciting opinions and opinions from experts, scholars, teachers and other relevant people at different levels, this paper invites industry experts to grade, improve and optimize the questionnaire setting, and uses analytic hierarchy process to make statistics, calculation and analysis on the data obtained from the questionnaire survey, and finally determines a reasonable and scientific index weight distribution. The traditional evaluation system of teachers' teaching ability in vocational colleges paid little attention to teachers' potential teaching ability and literacy, and lacked evaluation and weight distribution of teachers' potential teaching ability. From the perspective of development, this paper studies the establishment of indicators of teachers' potential and explicit teaching ability in vocational colleges, with scientific weight, This makes this indicator system more scientific and reasonable.

4.3 Teaching evaluation more timely and applicable

Based on the background of the development of digital economy, this paper investigates the teachers of ten typical vocational colleges with different development strengths in Shanghai. Experts, scholars and industry authorities score the teachers' teaching abilities in six

different grades, and then summarizes the scores according to the scoring standards of the evaluation system, and finally gets a systematic quantitative index system of the three-level teachers' teaching ability, which embodies strong timeliness and applicability.

5. Conclusions

Based on the background of digital economy's transformation and development of society and enterprises, this paper focuses on the internal needs of vocational college personnel training to serve the development of society and enterprises, studies the teaching ability of vocational college teachers and establishes a quantitative index system. Through literature research, questionnaire survey and analytic hierarchy process, this paper establishes a teaching evaluation system for teachers in vocational colleges, which includes two primary indicators, five secondary indicators and 24 tertiary quantitative indicators. The research results are timely, scientific and operable.

Acknowledgments

This paper is one of the phased achievement of the 2023 Shanghai Educational Science Research Project 《Vocational Education in China under the Background of Digital Economy》 (project number: C2023177).

References

1. Zhao Huijuan, He Yaoqin. New requirements and new measures for vocational education personnel training in the digital economy era [J]. Journal of Beijing College of Finance and Commerce.2020 (5): 48-50.
2. Li Haifeng, Wang Wei. Collaborative mixed teaching mode driven by digital twins J. Research on Higher Engineering Education, 2021 (5): 194-200.
3. Xie Jialong, Lu Te-ying. Research on the Evaluation System of Full-time Teachers' Competency in Mixed Teaching in Colleges and Universities [J]. Higher Education Forum.2022. (10): 17-19.
4. Liu Xiaoying. Research on the New Career Generation Mechanism in China in the Digital Economy Era J]. Science and Technology and Economy. 2019(06):6-10.
5. Sun Ningyun, Li Jian, Yuan Shuai. Research on the construction of PMPI evaluation system for young teachers' teaching ability in colleges and universities [J]. Journal of Henan University of Science and Technology (Social Science Edition), 2019.039 (010): 38-42.
6. Li Shaohua, Li Hanbang. The development course of American higher education research evaluation and the construction of evaluation system [J]. China Higher Education Research, 2010.(11):54-57.
7. Huang Guangyuan. Construction of the evaluation system of teachers' ability in local universities -- Taking Yangtze University as an example [J]. Management Observation, 2019,000 (032): 114-116.
8. Zhang Wenbo, Liu Jiajia. Construction of teaching ability evaluation system for college teachers [J]. Popular Science and Technology, 2015,17 (189): 130-132.
9. Wu Yaqui. Probe into the evaluation index system of teachers' teaching ability in higher vocational colleges [J]. Research on Continuing Education. 2022,(5):67-69.
10. Adams B. Cummins M, Davis A, et al. Horizon Report of New Media Alliance: 2017 Higher Education Edition [J]. Open Learning Research. 2017(2):1-20,62.
11. Li Youwen, Cai Jixiang, Xue Jiangpeng, Mo Zhixin. Research on the evaluation system of teaching ability of college teachers in southern Xinjiang [J]. Donghua Paper .2022 (01): 143-147.
12. Ma Xiaoxu. Research on the Evaluation and Improvement Strategies of Young and Middle-aged Teachers' Teaching Ability in Colleges and Universities [J]. Journal of Yangzhou University (Higher Education Research Edition) .2022 (6): 52-58.
13. Chen Chunlian, Tang Zhong. Construction and implementation of teacher's teaching evaluation system -- Reform ideas based on "five-dimensional integration" developmental evaluation [J]. China University Science and Technology, 2020 (10): 29-32.