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Quantitative Analysis Digital Literacy of Secondary and Higher Vocational School Students in the Digital Economy Background - Preliminary Empirical Research Based on 181 Samples from Zhejiang, China

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Abstract

Improving digital literacy has become one of China's important strategies in the digital economy era, leading to an important mission of vocational education to cultivate digital talents. A quantitative digital literacy survey was conducted among 181 secondary vocational and higher vocational students in Zhejiang, China. Data analysis showed that the self-score of digital literacy among vocational students was relatively high (3.97/5). Differences in digital literacy between secondary vocational and higher vocational students reached the level of significance, but not between students of different genders or different ages. The four dimensions of digital literacy, digital awareness, computational thinking, digital learning and innovation, and digital social responsibility" have significant correlation pair wisely.

Keywords

Vocational education, Digital literacy, Digital transformation, Digital technology, Digital innovation

Introduction

Digital literacy refers to an individual’s ability to acquire, understand, create, and communicate information in a digital environment (Reddy et al., 2023; Tinmaz et al., 2023). It includes a series of qualities and skills (Farias-Gaytan et al., 2023; Reddy et al., 2023; Tinmaz et al., 2023). In the field of education, it has been found that digital literacy is significantly related to student learning outcomes (Ervianti et al., 2023). Researchers also have highlighted the importance of digital innovation and digital literacy in higher education institutions, encouraging both students and teachers to integrate into the digital technology environment (Farias-Gaytan et al., 2023). It has been verified that the use of social media in students’ learning process is conducive to improving digital literacy (Purwanto et al., 2023). Meanwhile, vocational education promotes digital transformation to build green and sustainable development schools, which has a spillover effect on cultivating applied talents with digital literacy (Qiu et al., 2023). Thus, the immediate concern is to investigate the current level of digital literacy among vocational education students and then propose improvements. Previous researchers tend to focus on a specific group of students, such as

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conducting empirical evaluation studies on the digital literacy of junior high school students (Song et al., 2023). Others are designed to investigate the digital literacy of college students (Ervianti et al., 2023; Liu, 2023).

However, investigating and comparing the current levels of digital literacy among vocational education students is still a research gap. Therefore, this study first focuses on exploring and analyzing the digital literacy of the two groups of students, namely, secondary and higher vocational students, which is forward-looking to fill the research gap.

Methodology

Since this is a preliminary empirical investigation, a quantitative analysis method was applied and a survey design of digital literacy among secondary and higher vocational students was used (Zhang & Chen, 2022).

Survey design

1. Basic information: The demographic variables of the research sample mainly include the most basic information such as gender, age, and academic level.
2. Measurement of digital literacy: According to the "The four departments jointly issued the "Key Points to Improve National Digital Literacy and Skills in 2022" and the "The Yangtze River Delta issues a joint action initiative to improve digital literacy and skills for all people" in 2023, mainly refer to the mature questionnaire scale design of Liu (2023) and other researchers, four capabilities were designed from four dimensions: digital consciousness (C), computational thinking (T), digital learning and innovation (I), and digital social responsibility(R) (Netcom Jiangsu, 2023; Xinhua News Agency, 2022). The scale has 6 questions per item, for a total of 24 items. The questionnaire uses a five-point Likert scale, ranging from "completely inconsistent" to "completely consistent" with 1 to 5 points respectively. Higher scores represent greater digital literacy. Among them, the two subtitles C6 and R6 are newly extended.

Table 1. CTIR Student Digital Literacy Questionnaire- Survey Question Framework

Dimension 1	Dimension 2	Correspondence Ability
Digital Consciousness (C)	Ability to skillfully use multiple search engines to obtain network resources (C_1)	Information Search (C_1)
	Know a variety of literature and data retrieval tools (C_2)	Literature search (C_2)
	Able to judge the authenticity of online information and the opinions, tendencies and intentions behind it (C_3)	Information Judgment (C_3)
	Consciously organize and save the searched and useful information content (C_4)	Information organization (C_4)
	Able to communicate and share information using digital media (C_5)	Information exchange (C_5)
	Interested in new digital technologies such as AI artificial intelligence (C_6)	Digital Technology Consciousness (**C_6**)
	When faced with a problem that needs to be solved, be able to quickly understand and express the content of the problem appropriately (T_1)	Comprehension Questions (T_1)

Computational Thinking (T)	Able to gain insight into the hierarchical structure of a problem and discover the key to solving the problem from the structure (T_2)	Insight into structure (T_2)
	Good at using Word, Excel, mind map and other software to express complex information intuitively using graphics, tables, etc. (T_3)	Image thinking (T_3)
	Able to explore the possibility of solving problems from multiple aspects instead of being fixed on one idea (T_4)	Divergent Thinking (T_4)
	Able to flexibly handle unexpected situation changes and solve problems (T_5)	Flexible (T_5)
	After successfully solving a problem, be good at summarizing experience and applying it to solve other problems (T_6)	Summary Application (T_6)
Digital learning and innovation (I)	Under the Internet environment, be able to make full use of digital tools and resources to carry out independent learning (I_1)	Independent learning (I_1)
	Ability to effectively evaluate and rationally select various online learning resources and tools (I_2)	Reasonable selection of tools (I_2)
	For more complex learning tasks, be able to use network tools to quickly search and identify learning resources, and creatively solve problems based on effective management (I_3)	Creative problem solving (I_3)
	Through the utilization and integration of digital resources, you can collaborate with others to complete projects that would otherwise be difficult to complete by yourself (I_4)	Collaboration ability (I_4)
	Propose new ideas by summarizing and organizing the searched information (I_5)	Innovation ability (I_5)
	After having new ideas, they usually put them into practice and implement them (I_6)	Mobility (I_6)
Digital society Responsibility(R)	When communicating online, you will respect others and abide by the rules of online behavior (R_1)	Code of Conduct (R_1)
	Believe you should be responsible for your online behavior (R_2)	Responsibility (R_2)
	Know how to protect personal information and online privacy (R_3)	Self-Privacy Protection (R_3)
	Know how to protect other people's information and privacy (R_4)	Privacy protection of others (R_4)
	Able to timely backup and cloud storage of important data (R_5)	Data Protection (R_5)
	Be willing to share your own digital learning (work) methods and digital tools (R_6)	Responsibility (**R_6**)

Research sample

From Dec. 2023 to Jan. 2024, an online questionnaire survey was conducted out in some secondary and higher vocational schools in Zhejiang, China and a total of 181 valid questionnaires were collected in anonymous form. The sample data showed the gender, age and vocation educational level in a certain proportion, and the distribution of the research objects is reasonable (Table 2).

Table 2. Sample basic information table (N=181)

Variable	Options	sample size	percentage	Average value	standard deviation
Gender	male	84	46.40%	1.54	0.50
	female	97	53.60%		
Age	Under 18 years old	88	48.60%	1.51	0.50
	18-25 years old	93	51.40%		
Vocational Education level	Secondary vocational student	83	45.90%	1.54	0.50
	Higher vocational student	98	54.10%		
	total	181	100.00%		

Results and Discussion

Questionnaire reliability and validity

The Cronbach's alpha coefficient of the total questionnaire was 0.975, and the reliability of each subscale ranged from 0.935 to 0.956, indicating that the scale had high reliability (Table 3) and good internal consistency. In terms of questionnaire validity, the KMO value of the questionnaire was 0.941, indicating that the scale had good construct validity.

Table 3. Questionnaire reliability status table

serial number	variable name	Number of items	Standardized Cronbach's alpha coefficient
1	Digital consciousness (C)	6	0.938
2	Computational Thinking (T)	6	0.947
3	Digital Learning and Innovation (I)	6	0.956
4	Digital Social Responsibility(R)	6	0.935
overall reliability		24	0.975

Through the statistical analysis of the questionnaire (Table 4), it can be seen that the average score of digital literacy of secondary and higher vocational students in school is 3.97. From the perspective of specific dimensions of digital literacy, digital social responsibility scores the highest, with an average score of 4.30, indicating that vocational education students have relatively high abilities to acquire, understand, evaluate and share digital information. The results of this survey are quite different from the data results of Liu's(2023) survey in Hunan Province, but similar to the study results of Zeng & Wu(2023). It may be due to the prosperous digital economic development of Zhejiang Province so that the digital literacy of vocational students is generally high.

Table 4. Statistical results of students' digital literacy (N=181)

variable name	minimum value	maximum value	mean	standard deviation
Digital consciousness (C)	1.00	5.00	3.96	0.81
Computational Thinking (T)	1.67	5.00	3.80	0.80
Digital Learning and Innovation (I)	1.17	5.00	3.82	0.81
Digital Social Responsibility(R)	2.50	5.00	4.30	0.71
Overall average score	1.96	5.00	3.97	0.71

To preliminary explore whether the different levels of vocational education can significantly affect the students' digital literacy, this survey collected and compared the data among secondary and higher vocational students, and analyzed the results by independent sample t-test and ANOVA analysis of sample data. It was concluded that the digital literacy score of higher vocational students (4.087) was higher than that of secondary vocational students (3.842), and reached a significant level (Table 5). It has reached an extremely significant difference level in terms of digital learning and innovation(I). Significant differences were achieved in the two dimensions of digital consciousness(C) and computational thinking(T). Only for digital social responsibility(R) did the difference between the two did not reach a significant level.

Table 5. Analysis of differences in digital literacy between secondary vocational students and higher vocational students

variable name	variable	sample size	average value	standard deviation	*t* value	p-value
Digital consciousness (C)	Secondary vocational student	83	3.8213	0.82137	-2.152	0.033 **
	Higher vocational student	98	4.0782	0.78157		
Computational Thinking (T)	Secondary vocational student	83	3.6542	0.85196	-2.367	0.019 **
	Higher vocational student	98	3.932	0.72733		
Digital Learning and Innovation (I)	Secondary vocational student	83	3.6507	0.85792	-2.683	0.008 ***
	Higher vocational student	98	3.9711	0.74835		
Digital Social Responsibility(R)	Secondary vocational student	83	4.2372	0.74926	-1.173	0.242
	Higher vocational student	98	4.3619	0.67986		
Overall average score	Secondary vocational student	83	3.8416	0.72824	-2.355	0.02 **
	Higher vocational student	98	4.0866	0.67074		

Note: ***, **, * represent respectively 1%, 5%, 10% significance levels

To figure out whether gender or age can be a moderate variable in the digital literacy level of students, a similar analysis was applied. However, there is no significant difference in digital literacy levels between students of different genders or ages.

Correlation analysis of various dimensions of digital literacy

A correlation analysis was conducted on the four dimensions of digital literacy in this survey: digital consciousness (C), computational thinking (T), digital learning and innovation (I), and digital social responsibility (R). The results are as follows.

Table 6. Correlation analysis of dimensions

	Digital consciousness(C)	Computational Thinking(T)	Digital Learning and Innovation (I)	Digital Social Responsibility(R)
Digital consciousness(C)	1.000			
Computational Thinking (T)	.828**	1.000		
Digital Learning and Innovation (I)	.762**	.905**	1.000	
Digital Social Responsibility(R)	.696**	.661**	.672**	1.000

Note: **. The correlation is significant at the 0.01 level (two-tailed). (Spearman Rho)

As shown in Table 6, digital consciousness (C), computational thinking (T), digital learning and innovation (I), and digital social responsibility (R) have significant pairwise correlations, and each dimension has a high mutual influence.

Conclusion

In conclusion, it was found that secondary and higher vocational education students had a relatively high self-scoring of digital literacy based on the preliminary 181 sample survey in Zhejiang, China. The measures include four dimensions: digital consciousness (C), computational thinking (T), digital learning and innovation (I), and digital social responsibility (R), The data analysis results show that there is a significant difference in digital literacy between secondary vocational and higher vocational students, while there is no significant difference between students of different genders and age groups. Therefore, it could be inferenced that higher levels of vocational education tend to be critical in cultivating students' digital literacy. Meanwhile, there is a significant pairwise correlation between the four dimensions of digital literacy. Future research could investigate the connotation and practice of digital literacy to explore improvement strategies and methods for secondary and higher vocational education students, respectively (Istiara & Hastomo, 2023).

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