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The Digital Competence of Chinese University Students: A Survey Study

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Abstract: This article uses the self-assessment tool of the European Union's digital competence framework for citizens，to investigate the level of digital competence of 151 university students in China, and examine the relationship between participants' digital competence and their personal factors. The results show that university students have an intermediate level of digital competence, and their competence level has significant differences in the number of digital tools used, but there is no significant difference in gender, age, region, and participation in the competition. The results of the study can be used as a reference for curriculum and teaching reform.

Keywords: Digital Competence; DigComp; DigCompSat; Self-assessment.

1. Introduction

The acceleration of digital industrialization and the digitization of industries is placing new demands on the knowledge, skills, and competencies possessed by the global workforce, redefining the standards of talent for the 21st century. According to a scientific study by the European Commission, digital competencies are likely to be translated into general skills, as they are applicable to 90% of occupations and are highly valued throughout the European Union. It is estimated that 90% of future jobs will require basic digital competencies [1]. Research on future trends in skills demand shows that the requirement for digital competencies is likely to be found in most industries and academic professions. The development of digital competencies needs to be considered as part of lifelong learning [2].

Digital competence, the skills required to use digital technology, is an evolving concept that develops, updates, and changes as technology evolves. Therefore, there has been a lack of consensus on the definition of the term "digital competence". In order to unify the concept, Ilomäki et al. revised the literature on the definition of digital competence, emphasizing that digital competence includes: (1) technical competence, (2) the ability to use digital technologies in a meaningful way for working, studying and in everyday life, (3) the ability to evaluate digital technologies critically, and (4) motivation to participate and commit in the digital culture[3].

Due to the strong generality of the concept of digital competency and the lack of operability in practice, more and more studies have begun to focus on the construction of a competence framework that can reflect specific indicators of digital competence, and various digital competence frameworks have been proposed by relevant foreign organizations and scholars. In the Digital Competence Framework (DigComp 2.1) developed by the European Commission, digital competence consists of five dimensions. These competencies are information and data literacy, communication and collaboration, digital content creation, problem solving, and security dimensions. According to this framework, individuals with all dimensions and competencies can be defined as digitally competent. Each year Eurostat conducts a survey on the use of ICT skills for computers and networks in educational institutions in 27 European countries to assess and predict digital skills with variables such as age and gender [4-10].

Today's university students are growing up in a modern technological context and are recognized as digital natives. Despite the amount of time, they spend surfing the web, most students do not have the required level of digital competence [11] and have a long way to go [12-14].

In China, the research on digital competence of university students started late and still stays on the research related to information literacy and digital literacy, or the analysis and research on the connotation or framework of digital competence concepts in Europe and America, etc. There are few empirical studies on digital competence of university students. Therefore, this study draws on the framework of digital competence of EU citizens to explore the level of digital competence of university students in China so as to provide reference for the subsequent teaching reform.

Based on the above analysis, the research questions of this study are:

RQ1: What is the level of digital competence of Chinese university students?

RQ2: Are there significant differences in the level of digital competence of college students according to the established variables (gender, age, living area, participation in competitions and number of digital tools used)?

2. Methods

This study used a descriptive quantitative survey type design because this method allows answering questions in descriptive terms and in relation to variables. Likewise, it allows the information collected to be to be generalized to a broader population.

In this study, DigCompSat, an EU citizen digital competence assessment tool, is selected as the survey tool. The European Citizen Digital Competence Framework (DigComp) provides a comprehensive approach to digital competence, which can be applied to many areas of life. The

DigCompSat tool is designed to test the DigComp 2.1 capability set corresponding to levels 1 to 6 (basic, intermediate and advanced) based on experience. The tool can measure the digital capability of each of the five fields of DigComp through the three elements of knowledge, skills and attitude. The tool was tested by people aged 16-65 in Ireland, Latvia and Spain, and has good psychometric characteristics, including the effectiveness and internal consistency of the project [15].

After the localization revision of the tool and the expert review, it is determined that the revised tool consists of 82 questions. Four alternative answers are provided for each question, and 0, 1, 2 and 3 points are given in turn, a total of 246 points.

For example:

I know how to create a profile in digital environments for personal or professional purposes..

I don't know how to do it.

I can do it with help.

I can do it on my own.

I can do it with confidence and, if needed, I can support/guide others

Through the pre-survey, test the overall reliability of the questionnaire and all dimensions of college students' digital competence with Cronbach's Alpha. The test results show that the overall Cronbach's Alpha of the questionnaire is 0.991>0.7 (Table 1), indicating that the questionnaire has high reliability.

Table 1. Reliability indices (Cronbach's Alpha) of the dimensions

Dimension	Cronbach's Alpha	N of Items
Information and Data Literacy (IDL)	0.948	12
Communication and Collaboration (CC)	0.976	23
Digital Content Creation (DCC)	0.954	16
Safety(S)	0.970	16
Problem solving (PS)	0.975	15

Source: Own elaboration.

The items of each measurement sub-dimension of this questionnaire refer to the relevant items of the highly recognized scale in foreign countries, and have high content validity. The exploratory factor analysis method was used to construct the validity of the scale. The analysis showed that the overall KMO of the questionnaire was 0.916>0.7 (Table 2), and the factors were 0.919, 0.938, 0.928, 0.944 and 0.954, respectively, and Sig=0.000, indicating that the questionnaire was suitable for factor analysis and had good validity.

Table 2. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.916
Bartlett's Test of Sphericity	Approx. Chi-Square	17400.275
	df	3321
	Sig.	.000

Source: Own elaboration.

In order to reflect the level of digital competence of university students, this study takes the students of Chinese Language and Literature and English majors in Pingdingshan University as an example, and relies on the student group to conduct an online survey in the form of online distribution. A total of 157 questionnaires were collected, of which 151 were valid. The basic information of the respondents is shown in Table 3, mainly including the respondents' gender, age, region, participation in the competition, and the number of digital tools used.

Table 3. Distribution of the sample

Variable	Items	Frequency	Percent	M ± SD
Gender	Male	26	17%	1.83± 0.38
	Female	125	83%	
Age	19 years old	11	7%	20.46± 0.80
	20 years old	78	52%	
	21 years old	44	29%	
	22 years old	18	12%	
Region	Urban	35	23%	1.77±0.42
	Rural	116	77%	
Participation in the Competition	Participate and win awards	7	5%	2.84± 0.48
	Participate and didn't win awards	10	7%	
	Not participating	134	88%	
the Number of Digital Tools Used	1	7	5%	4.33± 2.06
	2	13	9%	
	3	46	31%	
	4	29	19%	
	5	17	11%	
	6	15	10%	
	7	11	7%	
	8	5	3%	
	9	5	3%	
	10	3	2%	

Source: Own elaboration.

According to the above analysis results, we can see the numerical characteristics of demographic variables, reflecting the distribution of the respondents. The mean value represents the concentration trend. The standard deviation represents the fluctuation. According to the frequency analysis results of each variable, the distribution basically meets the requirements of sampling survey. Among the results of the gender survey, the proportion of men is 17% and that of women is 83%. It can be seen that the results of this survey focus on women.

3. Findings and Discussion

Due to the large amount of data available during the whole research process, the data in this paper is no longer specific to each problem due to the length. The descriptive statistical method is used to analyze the overall digital competence level of the respondents. The analysis results (Table 4) show that the overall digital competence level of university students is at the intermediate level (M=121.82, SD=44.80), which

means that most students are able to complete relevant tasks independently, but there is still a long way to go from the advanced level, and still need to improve their digital competence level through practice.

Table 4. Average analysis of college students' digital competence

Dimension	Essential Factor	M ± SD		Score Range	Level
Information and Data Literacy	Browsing, searching, filtering data, information, and digital content	5.91±2.55	17.83±7.20	0-36	I
	Evaluating data, information, and digital content	6.39±2.64			
	Managing data, information, and digital content	5.52±2.69			
Communication and Collaboration	Interacting through digital technologies	6.57±2.64	35.90± 13.47	0-69	I
	Sharing through digital technologies	6.4±2.58			
	Engaging in citizenship through digital technologies	6.21±2.45			
	Collaborating through digital technologies	4.76±2.02			
	Netiquette	6.3±2.6			
Digital Content Creation	Managing digital identity	5.66±2.41	23.34±9.05	0-48	I
	Developing digital content	6.81±2.6			
	Integrating and re-elaborating digital content	5.99±2.49			
	Copyright and licenses	5.84±2.56			
	Programming	4.69±2.97			
Safety	Protecting devices	5.37±2.56	22.93±9.37	0-48	F
	Protecting personal data and privacy	7.06±3.14			
	Protecting health and well-being	4.4±1.87			
	Protecting the environment	6.1±2.42			
Problem Solving	Solving technical problems	5.78±2.32	21.82±9.02	0-45	I
	Identifying needs and technological responses	6.06±2.55			
	Creatively using digital technologies	4.19±1.97			
	Identifying digital competence gaps	5.79±2.59			
Students' Digital Competence			121.82±44.80	0-246	I

Source: Own elaboration.

The survey results show that on the whole, "Information and Data Literacy" is at the intermediate level, and "Managing data, information, and digital content" is at the basic level. "Communication and Collaboration" is at the intermediate level, and most of the elements are similar, all at the intermediate level. Only "Managing digital identity" is relatively low and at the basic level. "Digital Content Creation" is at the intermediate level, "Programming" is the lowest, and "Developing digital content" is the highest. "Safety" is at the basic level, while "Protecting the environment" is relatively high and at the intermediate level. "Problem Solving" is at the intermediate level, and "Creative using digital technologies" is at the basic level. Therefore, the research results show that there are obvious deficiencies in such unfamiliar or complex fields as "Managing digital identity", "Programming" and "Creatively using digital technologies", which need to be improved. In general, the author believes that the digital competence of university students has barely reached the intermediate level and needs further improvement.

The development of university students' digital competence has its own rules and is also influenced by various factors. These factors include both internal subjective factors and external objective factors. This study focuses on the differential analysis of the subjective factors affecting students' digital competence. The independent sample t-test, one-way analysis of variance (ANOVA), and nonparametric test were used to analyze the differentiation of influencing factors according to the type of variables and data distribution.

Gender: No difference. Through the independent sample T test, the gender difference significance test of each dimension is greater than 0.05. It shows that there are no differences in the competence of students of different genders in various dimensions.

Age: No difference. Through one-way ANOVA, there is no difference in age of each dimension, because the results of significance analysis are greater than 0.05.

Region: No difference. Through the independent sample T test, the regional significance test of each dimension is greater than 0.05. It shows that there are no differences in the abilities of students from different regions in various dimensions.

Participation in the competition: No difference on the whole. Through one-way ANOVA, only the dimension of digital content creation has a certain difference in the participation of the information competition (significance level $P=0.042<0.05$), that is, the students who have participated in the information competition and won awards are higher in the ability of digital content creation than those who have participated in the information competition and have not won awards and have not participated in the information competition. There are no differences in other dimensions.

The number of digital tools used: There are significant differences. Through the nonparametric test, on the whole, there is a significant difference in the number of digital tools used by students, because $P=0.019<0.05$. Among them, there are significant differences in the dimensions of Information and Data Literacy (IDL), Communication and Collaboration (CC) and Problem Solving (PS), because P is 0.04, 0.046 and 0.004 respectively, less than 0.05. There is no significant difference in the dimension of Digital Content Creation (DCC) and Safety (S), because P is 0.080 and 0.082 respectively, greater than 0.05. Meanwhile, in general, with the increase of the number of users, digital competence continues to improve, but to a certain extent, the improvement is no longer significant. The specific demarcation point cannot be determined yet.

4. Conclusion

This study is based on an empirical study of some university students in Pingdingshan University, Henan Province, China, and explores the impact of personal variables on the level of digital Competence.

The results of this study show that the EU Citizen's Digital Competence Assessment Tool has good reliability and validity, and is appropriate for measuring the digital competence of university students in China. At the same time, the results show that the digital competence of Chinese university students has just reached the intermediate level, and is generally consistent in all dimensions, but "Safety" is at the basic level, which is weak. In addition, the influence of personal variables on the level of digital competence was also studied, pointing out the influence of gender gap, age difference, urban-rural difference, participation in competitions, and the number of digital tools used on digital competence. This study can provide reference data for subsequent changes in curriculum instruction.

This study is not without limitations. First, the sample was small in scope and number with students from certain majors at the same university and needs to be expanded. In addition, the measurement of digital ability in this study was based on students' self-perceptions, which is not objective enough and can only reflect students' level of digital ability to a certain extent, and the measurement instrument needs to be further optimized on this basis. Finally, it is suggested that follow-up studies can include more variables to explore the main factors affecting students' digital ability development.

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