AN IN-DEPTH ANALYSIS ON THE DIGITAL COMPETENCES IN HIGHER VOCATIONAL EDUCATION AND TRAINING

Jiali Dai[12]
[1]**Universiti Teknologi Malaysia.School of Education**
[2]**Wenzhou Polytechnic**
E-mail: jialidai2022@163.com

Abstract

As the working world becomes increasingly digital, structural changes are occurring at an ever-increasing pace. For occupational training, this means a shift in qualification profiles, which presents new problems for education and training. Students' digital competence (DC) is a critical aspect in the successful integration of technology into education, and it is influenced by personal and contextual variables. DC may be measured using a variety of frameworks and equipment. However, there is currently a lack of study on digital competency in Vocational education and training (VET). Students at Chinese universities were tested for their digital literacy in this study. To begin, information on the pupils is gathered and a survey is created. Based on the framework for digital competency, the study's hypothesis is constructed. Confirmatory Factor Analyses (CFA) & Pearson Chi-Squared Tests (PCST) are used for data analysis. University students' age and digital proficiency varied significantly, according to chi-squared analysis. There is a substantial gap between the academic programmes and digital proficiency levels of university students. The lack of ICT equipment, limited skills and knowledge, data difficulties and bad internet access were all challenges experienced by students.

Keywords: *Vocational education and training (VET), digital competence (DC), Confirmatory Factor Analysis (CFA), Pearson Chi-Squared Test (PCST)*

DOI Number: 10.14704/nq.2022.20.7.NQ33002 NeuroQuantology2022; 20(7):23-34

I. INTRODUCTION

A digital competence is the ability to use information and communications technologies (ICT) to fulfil goals work related, employment, education, leisure, inclusiveness, and social participation. In the Chinese Committee's project on Digital Competence (DIGCOMP), which was launched in order to better understand & develop Digital Competence in China, states that digital competence would include not only basic technical skill, but also the development of new skills to (1) browse, evaluate and manage information; (2) communicate and collaborate; (3) generate digital content; (4) preserve safety; and (5) solve problems in formal, non-formal, and inter - disciplinary contexts [1].One definition for the term "digital competence" is "the confident, critical & responsible use of information society technologies for employment, pleasure and education," with the ability to utilise technology to improve one's everyday life. While it's been extensively debated in academic circles, it has also been linked to digital literacy throughout the previous couple

decades [2].Technology-based education has a particular advantage in integrating digital competences with professional ones. Teachers and students alike should be assessed to see if they are willing to adopt and perceive this sort of training, as well as the usefulness of the virtual environment in identifying and expanding the most efficient resources [3].The first step toward "advanced" digital competences is to learn how to use and manage fundamental digital tools and platforms. With digital competence, the growth of the instrumental skills to become more productive, communicative and critical and strategic should be considered as continuing [4]. The general framework for digital competence is shown in fig.1.

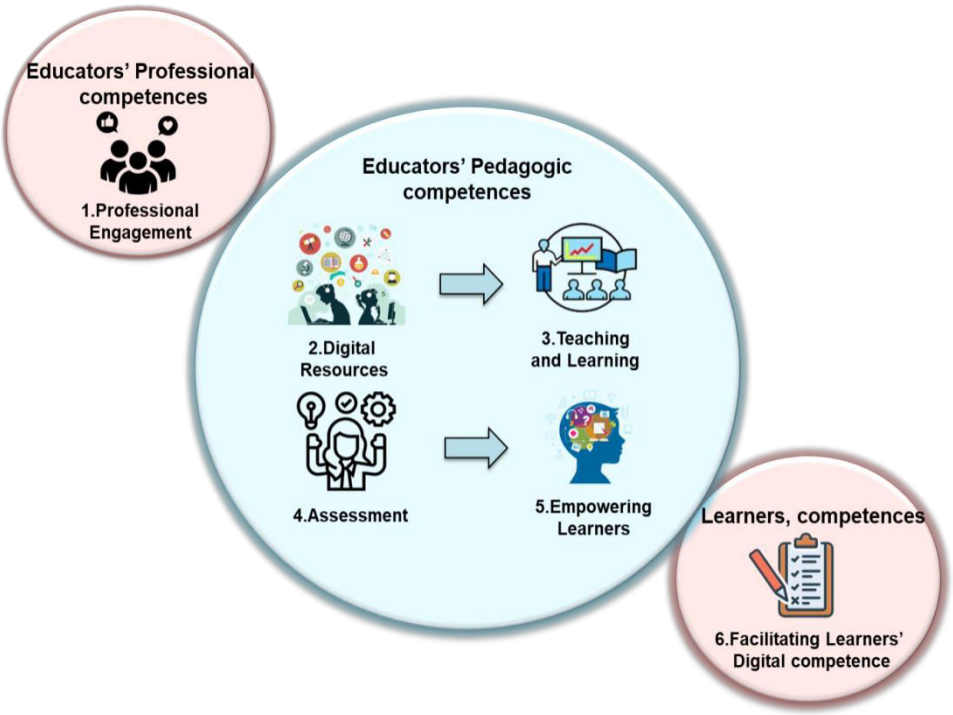

Figure 1. Digital competences framework for educators

The notion of digital competency has been more popular in the recent decade. A variety of fields have adopted the term "digital competence" to characterize the skills needed in today's digital world. This study, on the other hand, focuses on the pedagogical aspects of digital competence because of its emphasis on educational settings. It appears that, despite a substantial amount of research on the topic of digital competence through educational contexts, there is a gap between what is required for particular actors working in students and school settings in terms of digital competence and what the average citizen knows about digital competence [5].

II. RELATED WORKS

In [6] the author is to examine the impact of cultural variations on digital informal learning (DIL) among university students from various cultural backgrounds and the implications of digital competence and technological expectation. The entire sample size is 335 Chinese and 197 Belgians, based on a survey performed in both countries.

The study's goals were to look at how Permanent Education teachers' digital competency is developing and what variables influence that growth. Because of this, a quantitative technique was adopted, in which a representative sample of Andalusia's Permanent Education instructors were asked

to complete a survey on digital competency [7].

In [8] the author determined the level of preparedness of Indonesian instructors and students for digital learning. The research sample consisted of 233 students from vocational high schools. A person's level of maturity is included in the low group. Digital technology mastery abilities may be strengthened through a variety of training and learning methods.

The findings of a case study involving 160 Moroccan English instructors and an adaption of the Competence Framework for the Digital Competence of Educators are presented in this article [9].

In [10] the author provides an overview of educational reform in Europe, with a focus on Ukraine and Poland's efforts to build a digital society. Students demonstrated a high degree of interest in the provided educational trends, indicating the necessity of improving students' digital competency.

In [11] the author demonstrated that the pupils' digital competency and academic achievement were correlated with informal digital learning. 319 Iranian students from Shiraz University were surveyed for this study.

In [12] many of the disorders have multiple odontogenickeratocysts. A 12-year-old female youngster had several odonotogenickeratocysts. The studies found no other anomalies indicative of a condition.

In [13], personalized medicine employs fine-grained data to identify specific deviations from normal. These developing data-driven health care methods were conceptually and ethically investigated using 'Digital Twins' within engineering. Physical artifacts were coupled using digital techniques which continuously represent their state. Moral differences can be observed based on data structures and interpretations imposed on them. Digital Twins' ethical & sociological ramifications are examined. Healthcare system has become increasingly data-driven. This technique could be a social equalizer through providing for efficient equalizing enhancing strategies.

In [14], allergic rhinitis would be a long-standing worldwide epidemic. Taiwanese doctors commonly treat it with either traditional Chinese or Chinese–Western drugs. Outpatient traditional Chinese medicine therapy of respiratory illnesses was dominated by allergic rhinitis. They compare traditional Chinese medicine with western medical therapies treating allergic rhinitis throughout Taiwan.

In [15] the usage of high-dose-rate (HDR) brachytherapy avoids radioactivity, allowing for outpatient therapy, and reduces diagnosis timeframes.A single-stepping source could also enhance dosage dispersion by adjusting latency at every dwell location. The shorter processing intervals need not permit any error checking, and inaccuracies could injure individuals, hence HDR brachytherapy therapies should be performed properly.

In [16], this study presented a treatment as well as technology of domestic sewage to improve therural surroundings

In [17], soil samples from chosen vegetable farms throughout Zamfara State, Nigeria have been tested for physicochemical &organochlorine pesticides. Testing procedure and data were analyzed using QuEChERS with GC-MS.

Problem statement

As part of life as well as employment for students and faculty, digital competences have been feature of vocational school curriculum at different levels. For this reason, vocational institutions are increasingly being forced to confront the issues raised by digital media and their impact on education and training. Standard teaching methods are considered as a major impediment to development. Not only do technological requirements matter, but so does the willingness of teachers to experiment with novel methods. Traditional teaching methods have dominated school routine so far. Project

forms with wikis or weblogs, for example, can only be partially incorporated.

III. METHODOLOGY USED

This part explains the flow of the suggested methodology. The schematic representation of the suggested technique includes the processes like data collection, questionnaire, hypothesis testing, confirmatory factor analysis, person chi-squared test analysis on the digital competences in higher vocational education and training. The present study structure is depicted in fig.2.

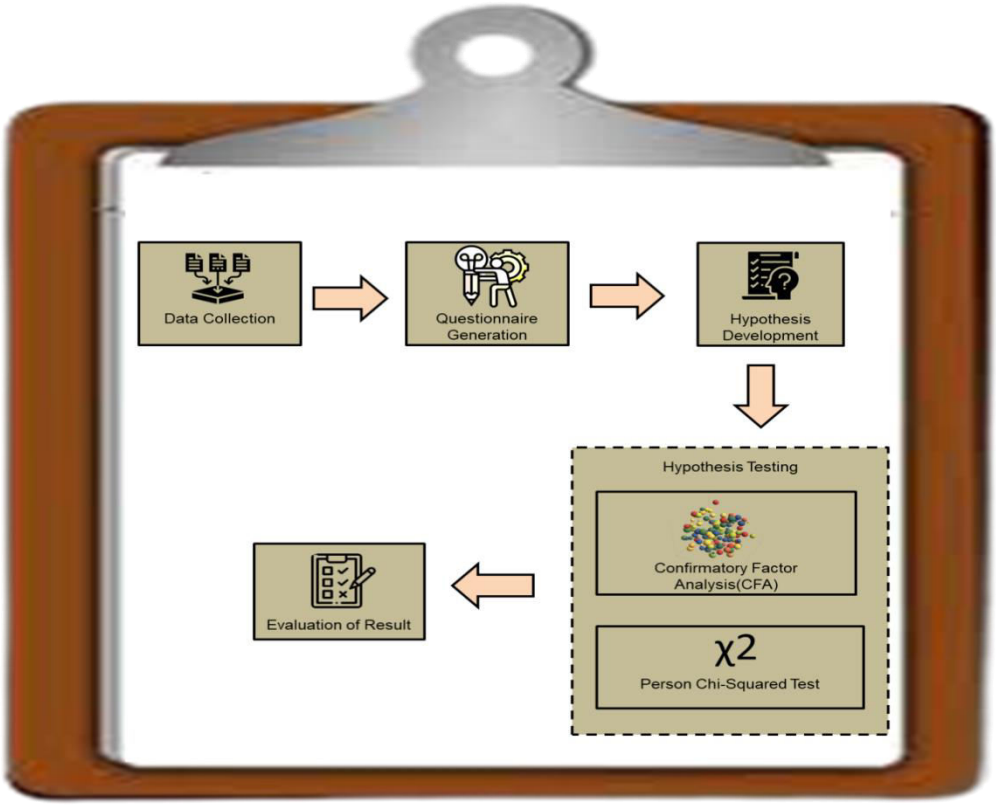

Figure 2.Flow of the suggested methodology

A) Data set

It is possible to receive a vocational education and training in China at four different levels: lower secondary schools (which are a small and declining sector); upper secondary schools (in various educational institutions); tertiary schools (mostly 3-year vocational colleges); and adult education and work experience There are governmental and private vocational schools in China (See Table 1). In 2009, of the 1181 vocational schools, 272 or 23% were private, while the rest were public. There were 635 government-owned institutions, 84 state-owned firms, 173 industrial organisations, and 17 other public entities in the public sector [18].

Table 1.Various Forms of Vocational colleges (2009)

Sector		2009	
		No of Institutions	percentage
public	Government	635	53.77%
	State-owned Enterprises	84	7.11%
	Industries	173	14.65%

	Others	17	1.44%
Private	Indivdiual or Social Organization	272	23.03%
	Total	1181	100%

Source:Vocational Higher Education Institutions Talent Development Data Collection Platform from the MOE in 2009.

B) Questionnaire generation

a) What levels of digital competence do university students report across china countries?

There are several studies out there that claim that digital competence should include a wide range of abilities and resources that may be used at various levels of accessing information as well as evaluating and addressing social issues. Digital competence is primarily based on the ability to use Google to search and find data, use email to communicate such as through video conference and instant messengers, and configure privacy settings to protect their personal information, according to an investigation of university students' ICT use and the impact it has on digital competence.For a variety of reasons, such as individual preferences, the availability of devices, and local connection it appears that the digital proficiency levels of various age groups varies. According to research, pupils' digital abilities have not been quantified.

b) What are the university students' barriers to the effective use of ICTs as an education tool?

The students who are enrolled in higher education (HE) must learn digital competencies in order to succeed in today's digital world and keep up with the times. Attitudes and behaviours needed while using ICTs and digital media to complete tasks; solve issues; communicate effectively; manage information; behave ethically; collaborate with others and produce and share material and knowledge for work, pleasure; participate in and learn. The term "digital literacy" has been used in a variety of ways to describe a person's knowledge of digital technology, media, and media literacy, as well as e-literacy and other related terms.A total of 100 university students from four Chinese countries were involved in this study, according to the findings. In order to gather information, the DigComp competency framework was utilised as a data gathering tool. The questionnaire was created using a Google Form. Students' views of ICT obstacles were also elicited by the instrument in open-ended replies.

Because of the extensive use of e-Learning & other modern information and communication technologies (ICTs), student's digital competence is more important than ever in the twenty-first century. Because of this, digital competency skills, knowledge, and resources are critical to helping students succeed in today's rapidly shifting professional landscape. College students in China are being studied for their digital competency, which is becoming increasingly vital for lifetime learning and employment due to the worldwide pandemic and shutdown. However, no actual research has been done on the level of digital competence among students.

C) Hypothesis testing

a) Confirmatory factor analyses

Measurement models, such as the relationships between actual measures and latent variables and factors, are the primary focus of confirmatory factor analysis (CFA), a kind of structural equation modelling. The identification and quantification of latent variables can be used to explain the variance and covariation of a set of indicators (i.e., component analysis).There is an unobservable variable called a factor that affects more than

one measured value and is responsible for the correlations between those measured values. As a result, all observed measures have intercorrelations because they are impacted by one and the same latent construct. If the latent construct was partially excluded, the intercorrelations among the observed measures would be zero. As a result, the covariation among a group of indicators may be better understood when using a measurement model like CFA, because the number of factors is lower than the number of measured variables.

b) Pearson chi-squared test

The pearson chi-square test is used to determine how probable a given distribution is attributable to chance. The Chi-square test is a categorical data analysis tool. This indicates that the data has been tallied and categorised. To examine categorical data, a pearson chi-square test is used.

To test the hypothesis that the multinomial observations$(o_1, \dots, o_q)$ is satisfy

$$(o_1, \dots, o_q) \sim Nv(o; \theta_1, \dots, \theta_q) \quad (1)$$

Where,$\theta_q=\theta_{q,o}$*(k=1,…Q)* are prespecified probabilities, Pearson proposed a test statistic of the form

$$y^2 = \sum_{k=1}^{Q} \frac{(O_k - o\theta_k)^2}{o\theta_k} = \sum_{k=1}^{Q} \frac{o(\hat{\theta}_k - \theta_q)^2}{\theta_k}, \hat{\theta}_k = \frac{O_k}{o} \quad (2)$$

$$\{(O_k - o\theta_k)/(o\theta_k)^{1/2}, k = 1, \dots . q\} \Longrightarrow O(0, \Sigma) \quad (3)$$

IV. RESULTS AND DISCUSSION

In this section we discuss the findings during the entire analysis. The hypothesis findings imply the following.

HO1: The age of pupils and their digital competency levels varied significantly.

Table 2.Pearson Chi-Squared test on age and digital competence levels

	Value	df	Asymp. sig. (2-sided)
Pearson Chi-Square	239.009[a]	97	.000
N of Valid Cases	100		

The chi-square test result is 239.009, with 97 degrees of freedom (df) and a p-value of.000.As a result, the p-value is less than 0.005, indicating that there is a significant difference in age & digital competence levels among university students. This means that the age of university students has a direct impact on their digital competence.

HO2: The curricula of study and levels of digital competence among university students range significantly.

Table 3. Chi-Squared test on programs of study and digital competence levels

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	509.447[a]	193	.000
N of Valid Cases	100		

The chi-square test statistic is 509.447[a], with 193 degrees of freedom (df) and a p-value of.000. Because the p-value is less than 0.005, there is clear evidence of a substantial difference between university students' programmes of study and their digital competence levels. By implication, students' knowledge and digital capabilities are determined by their university programmes of study.

a) Information and data literacy

This relates to the capacity to communicate information requirements, discover and obtain digital information, data, and content, and evaluate sources & their content for relevance. It also entails comprehending how digital information, data, and content are gathered, controlled, and organised.

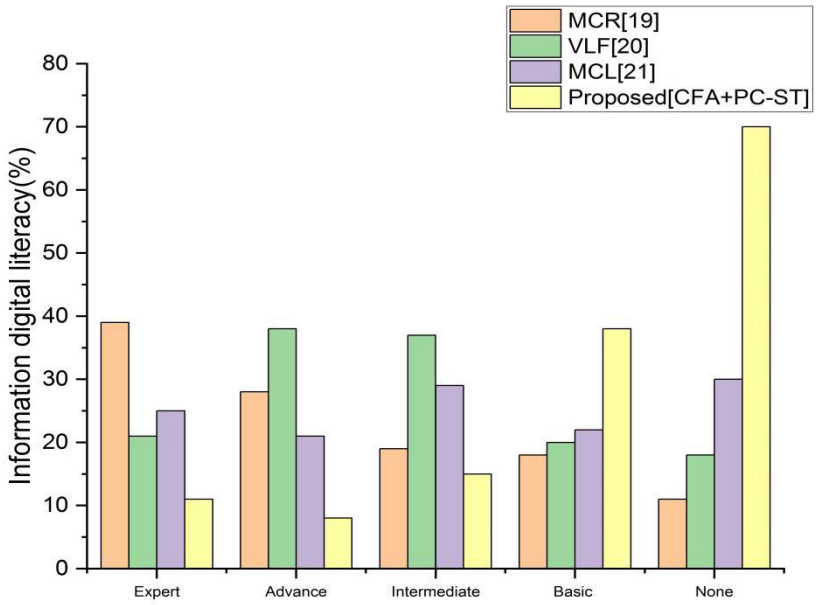

Figure 3.Information digital literacy results

Figure 3 represents the information digital literacy with proposed and existing approaches. From the above diagram, compared to the exisiting methods such as multiple linear regression (MCR), variation inflaction factor (VLF), meta cognitive learning (MCL), the proposed method of confirmatory factory analyses with pearson chi-squared test has high information digital literacy.

b) Communication and collaboration

This requires connecting, engaging,talking, and working with evolving technologies while keeping cultural and generational distinctions in mind. Participating in society via public and private digital networks, as well as the ability to maintain one's digital identity and reputation, are all part of this.

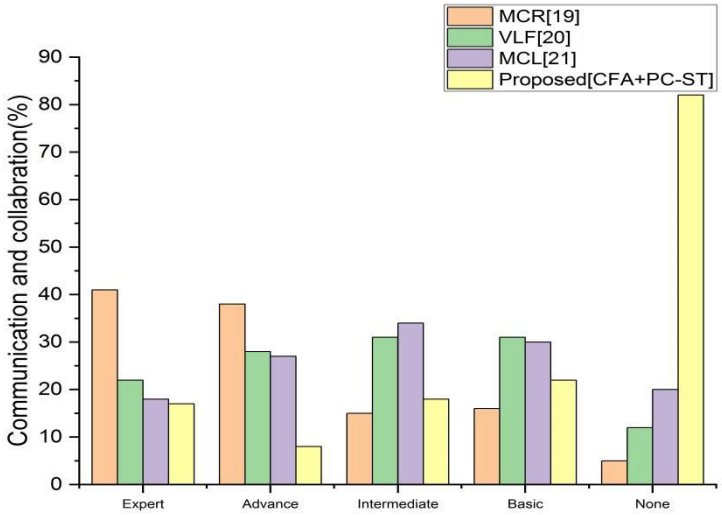

Figure 4.Communication and collaboration results

Figure 4 represents the Communication and collaboration with proposed and existing approaches. From the above diagram, compared to the exisiting methods such as multiple linear regression (MCR), variation inflaction factor (VLF), meta cognitive learning (MCL), the proposed method of confirmatory factory analyses with pearson chi-squared test has high Communication and collaboration.

C) Digital content creation

This includes creating and editing digital content, as well as upgrading and merging content and information into a body of knowledge, as well as understanding how copyright and licencing may be enforced and how to provide computer systems with clear instructions.

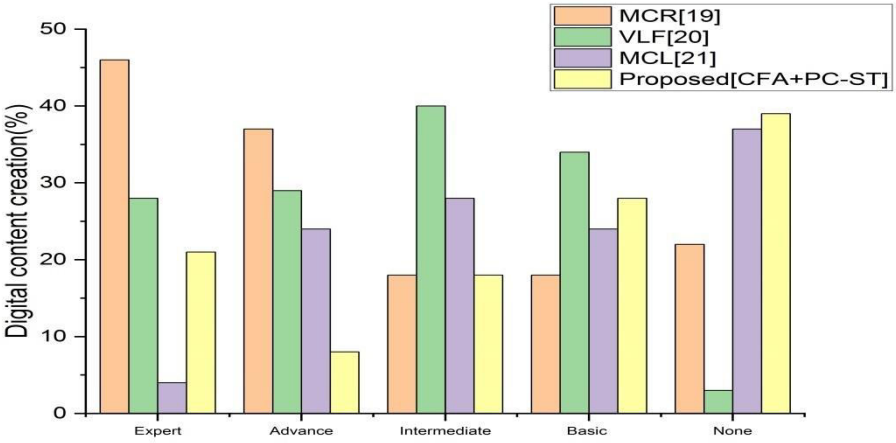

Figure 5.Digital content creation results

Figure 5 represents the digital content creation with proposed and existing approaches. From the above diagram, compared to the exisiting methods such as multiple linear regression (MCR), variation inflaction factor (VLF), meta cognitive learning

(MCL), the proposed method of confirmatory factory analyses with pearson chi-squared test has high digital content creation.

D) Safety

This relates to the protection of computers, contents, personal data,& privacy in the digital environment. It also involves successful consumer security against physical & psychological health hazards, self-awareness of the use of digital technology for social well-being and social inclusion, and understanding of the environmental implications of digital technologies and their use.

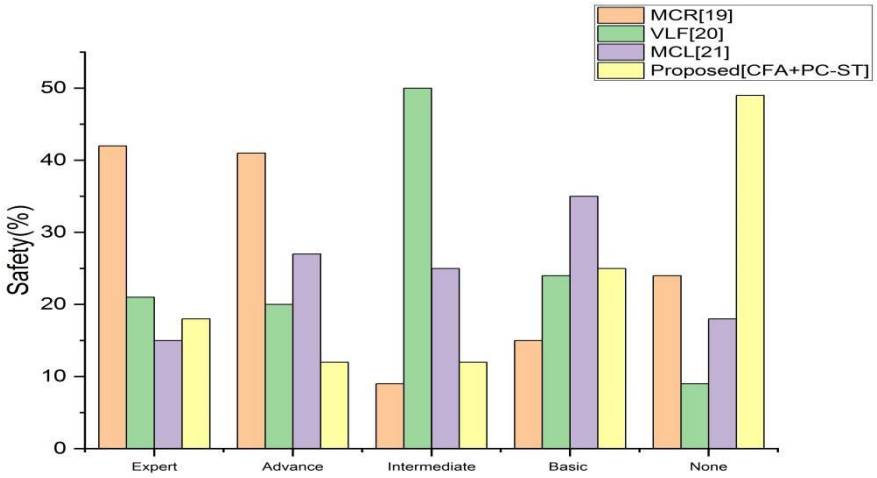

Figure 6.Safety results

Figure 6 represents the safetywith proposed and existing approaches. From the above diagram, compared to the exisiting methods such as multiple linear regression (MCR), variation inflaction factor (VLF), meta cognitive learning (MCL), the proposed method of confirmatory factory analyses with pearson chi-squared test has high safety.

E) Problem solving

In a digital environment, this means understanding and resolving fundamental demands and technological difficulties. Due to the digital revolution, it also requires learning how to utilise digital technology to produce information, innovate procedures, and stay up with self-development.

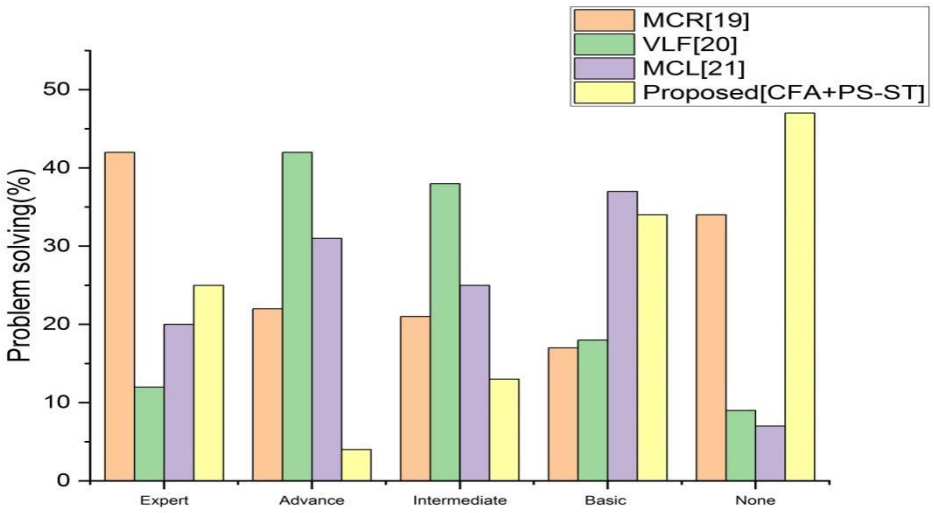

Figure 7.Problem solving results

Figure 7 represents the problem solvingwith proposed and existing approaches. From the above diagram, compared to the exisiting methods such as multiple linear regression (MCR), variation inflaction factor (VLF), meta cognitive learning (MCL), the proposed method of confirmatory factory analyses with pearson chi-squared test has high.

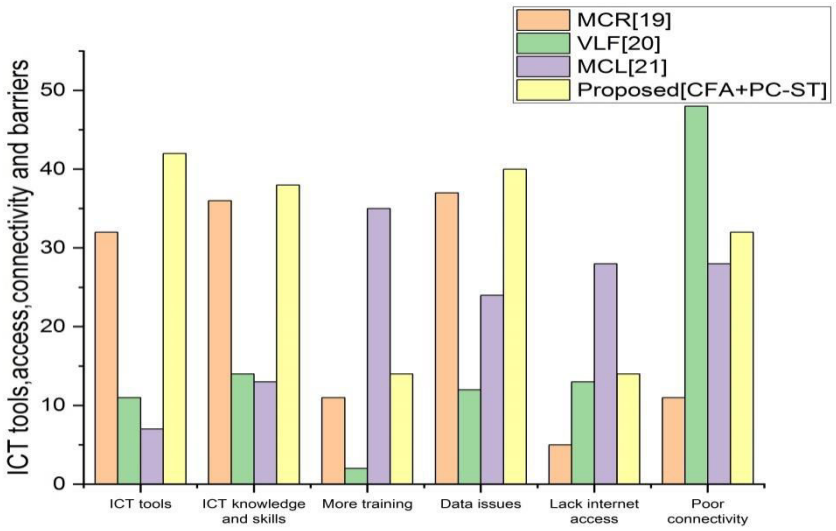

Figure 8. ICT tools, access, connectivity, barriers results

Figure 8 represents the ICT tools, access, connectivity, barriers with proposed and existing approaches. From the above diagram, compared to the exisiting methods such as multiple linear regression (MCR), variation inflaction factor (VLF), meta cognitive learning (MCL), the proposed method of confirmatory factory analyses with pearson chi-squared test has high.

Discussion

UNESCO believes that educating students to gain confidence and generate solutions using new technologies may stimulate 21st-century transformation and equip them with basic & cutting-edge skills as technology advances in China. It is clear from the results of the survey that most university students believe their digital competence is at a very low level compared to their counterparts in other nations' universities. In fact, research shows that university students in china have a larger percentage of expert-level digital competence in all categories. This suggests that students at Chinese institutions may have a greater interest in electronic equipment than their male counterparts.

V. CONCLUSION

Teaching and education growth are intrinsically intertwined. Teacher skill enhancement in digital competency (DC) takes significant educational effort. DC seems to be an individual and contextual requirement for efficient technology education. DC is measured using different methods and devices. But impact of digital competency in VET remains limited. This study tested Chinese university students' digital skills. Primarily, the study questionnaire and student data are collected. The study hypothesis is based on the digital competence framework. We employ CFA and the PCST. Chi-square analysis shows a large age gap between university students and their digital proficiency. The digital competency of university students varies greatly depending on their academic programmes.

REFERENCES

1. NapalFraile, M., Peñalva-Vélez, A. and MendiórozLacambra, A.M., 2018. Development of digital competence in secondary education teachers' training. *Education Sciences*, *8*(3), p.104.

2. Zhao, Y., Llorente, A.M.P. and Gómez, M.C.S., 2021. Digital competence in higher education research: A systematic literature review. Computers & Education, 168, p.104212.

3. Sergeieva, L.M., Stoichyk, T.I., Tarasova, O.V., Sulyma, T.S. and Tarasiuk, I.V., 2021. Development of the modern educational environment of the institution of professional (vocational-technical) education in the digital space.Linguistics and Culture Review, 5(S3), pp.459-475.

4. Kovalchuk, V. and Soroka, V., 2020. Developing digital competency in future masters of vocational training.

5.Pettersson, F., 2018. On the issues of digital competence in educational contexts–a review of literature.Education and information technologies, 23(3), pp.1005-1021.

7.He, T. and Li, S., 2019. A comparative study of digital informal learning: The effects of digital competence and technology expectancy. British Journal of Educational Technology, 50(4), pp.1744-1758.

7. Hinojo-Lucena, F.J., Aznar-Diaz, I., Caceres-Reche, M.P., Trujillo-Torres, J.M. and Romero-Rodriguez, J.M., 2019. Factors influencing the development of digital competence in teachers: Analysis of the teaching staff of permanent education centres. IEEE Access, 7, pp.178744-178752.

8. Astuti, M., Arifin, Z., Mutohhari, F. and Nurtanto, M., 2021. Competency of digital technology: the maturity levels of teachers and students in vocational education in Indonesia. Journal of Education Technology, 5(2), pp.254-262.

9.Benali, M., Kaddouri, M. and Azzimani, T., 2018. Digital competence of Moroccan teachers of English.International Journal of Education and Development using ICT, 14(2).

10. Morze, N., Smyrnova-Trybulska, E. and Boiko, M., 2019. The impact of educational trends on the digital competence of students in Ukraine and Poland.

11.Mehrvarz, M., Heidari, E., Farrokhnia, M. and Noroozi, O., 2021. The mediating role of digital informal learning in the relationship between students' digital competence and

their academic performance.Computers & Education, 167, p.104184.
12. Mody, R. N., and A. R. Bhoosreddy. "Multiple odontogenickeratocysts: a case report." Annals of Dentistry 54.1-2 (1995): 41-43.
13. Garg, Harita. "Digital Twin Technology: Revolutionary to improve personalized healthcare." Science Progress and Research (SPR) 1.1 (2020).
14. Ahmed, Bilal, and Aatiqa Ali. "Usage of Traditional Chinese Medicine, Western Medicine and Integrated Chinese-Western Medicine for the Treatment of Allergic Rhinitis." Official Journal of the Zhende Research Group 1.1 (2020): 1-9.
15. Shahabaz, A., and M. Afzal. "Implementation of High Dose Rate Brachytherapy in Cancer Treatment, SPR, 2021, Volume 1, issue, 3, Page No.: 77-106." DOI: https://doi. org/10 52152.
16. Li, Zihan. "Treatment and Technology of Domestic Sewage for Improvement of Rural Environment in China-Jiangsu: A Research." (2022).
17. 1Salihu, S. O., and Zayyanulyya. "Assessment of Physicochemical parameters and Organochlorine pesticide residues in selected vegetable farmlands soil in Zamfara State, Nigeria." Science Progress and Research (SPR) 2.2 (2022).
18.Po, Y.A.N.G., 2014. Understanding Vocational Education Market in China.
19. Lei, P.W. and Shiverdecker, L.K., 2020. Performance of estimators for confirmatory factor analysis of ordinal variables with missing data. Structural Equation Modeling: A Multidisciplinary Journal, 27(4), pp.584-601. (MLR)
20.Guillén-Gámez, F.D., Mayorga-Fernández, M., Bravo-Agapito, J. and Escribano-Ortiz, D., 2021. Analysis of teachers' pedagogical digital competence: Identification of factors predicting their acquisition. Technology, Knowledge and Learning, 26(3), pp.481-498. (VLF)
21.Heidari, E., Mehrvarz, M., Marzooghi, R. and Stoyanov, S., 2021. The role of digital informal learning in the relationship between students' digital competence and academic engagement during the COVID-19 pandemic.Journal of Computer Assisted Learning, 37(4), pp.1154-1166. (MCL)