Education, Language and Sociology Research
ISSN 2690-3644 (Print) ISSN 2690-3652 (Online)
Vol. 6, No. 1, 2025
www.scholink.org/ojs/index.php/elsr

Original Paper

The Impact of Digital Education on Innovation Performance of Postgraduate Students

Mengyuan Su[1] & Yuhan Shen[2]

[1] School of Business Administration, Zhejiang Gongshang University, Hangzhou, 310018, China

[2] Division of Psychology and Language Sciences, University College London, London WC1N 1PF, UK

Received: January 17, 2025 Accepted: February 6, 2025 Online Published: February 25, 2025

doi:10.22158/elsr.v6n1p88 URL: http://dx.doi.org/10.22158/elsr.v6n1p88

Abstract

[Purpose/significance] With the deepening of a new round of scientific and technological revolution and industrial transformation, the higher education has received more and more attention, especially in the context of current digital economy. According to the current development of the management, it is urgent to use the digital education, which is closely connected to digital technology. The study verified the contribution of higher education to the innovative performance of postgraduate students entering the workforce so as to provide a scientific reference for the high education in China.

[Method/process] We collected data 221 graduate postgraduate from Zhejiang Gongshang University in China, then used SPSSAU to test our hypotheses, investigated the relationship among digital education, digital competency and innovation performance.

[Result/conclusion] The results showed that digital education has a significant positive impact on intelligence competence, intelligence competence has also a significant positive impact on innovation performance of postgraduate students just entering the workforce within five years. The conclusion of this article can be apply to both improve the effectiveness of graduate education and the employee innovation performance.

Keywords

digital education, digital competency, innovation performance

1. Introduction

Since 2018, the state has successively issued relevant policies and guidance recommendations to encourage the development of the digital economy, and also encourage enterprises to help industrial upgrading and transformation through digital technology. The report of the 19th National Congress of the Communist Party of China pointed out that we will accelerate the building of a strong manufacturing

country, accelerate the development of advanced manufacturing, promote the deep integration of the Internet, big data, artificial intelligence and the real economy, and foster new growth points and new driving forces in mid-to-high-end consumption, innovation-led, green and low-carbon, sharing economy, modern supply chain, and human capital services. In the report of the Party's 20th National Congress, it was proposed to "accelerate the construction of a network power and a digital China", which pointed out the direction for the development of big data and put forward higher requirements.

"Competency" is a concept proposed by David McCleland. The competency model contains seven elements, namely, behavior-oriented achievement orientation, goal orientation, initiative, self-control, adaptability, interpersonal influence and psychological awareness. Nowadays, digital technology has entered an era of rapid development, providing necessary conditions for Chinese enterprises to improve production relations. With the disappearance of low-cost advantages, how to reshape the core competitiveness of Chinese enterprises has become an important issue in the development of enterprises, and digital operation management talents play an important role in the digital economy. The competence that digital operation management personnel should have can actually be equivalent to digital competence. Some people have built a competency model for digital operation and management talents, which is composed of digital thinking ability, professional knowledge ability, communication and coordination ability, responsibility and innovation ability (Lu & Feng, 2023).

With the advent of the digital age, the importance of digital competence is increasingly recognized by the public. The cultivation of traditional linear thinking is no longer in line with the logic of The Times. The cultivation of digital competency requires network thinking in the digital age. Over the years, a variety of frameworks, models and literacies have been developed to guide teacher educators in their efforts to build digital capabilities in their students, that will support them to use new and emerging technologies in their future classrooms. Generally, these focus on advancing students' skills in using "educational" applications and digitally-sourced information, or understanding effective blends of pedagogical, content and technological knowledge seen as supporting the integration of digital resources into teaching, to enhance subject learning outcomes. Integrating artificial intelligence (AI) topics into the K-12 school curriculum can develop children's agency, understanding, creativity, and moral awareness in the age of AI (Kahila et al., 2024).

With the wide application of information technology, digital materials, media and equipment have become the necessary abilities and tools for teachers in modern education, and digital materials have become the mainstream teaching tools, creating a variety of creative teaching strategies. This teaching strategy or model aims to develop and cultivate students' creativity through various effective ways and methods. (Hu et al., 2016) Used the quasi-experimental research method, where 104 students in two classes in a national university are selected for the experiment, their research results showed that the teaching method using digital technology has strongly promoted the creativity of students.

With the advent of the digital age, the importance of digital competence is increasingly recognized by the public. Digital competence was first proposed for educators and gradually extended to workers in all

industries (Caena & Redecker, 2019). The increasing adoption of digital technologies at the workplace demands lifelong learning for the employees by enhancing their digital competence (DC), impacting their basic psychological needs satisfaction (BPNS). Mungra, Srivastava, Sharma, Banerji, and Gollapudi (2024) assessed the effect of employees' DC on flourishing through BPNS factors among working professionals in service industries by proposing the BPNS framework.

In the context of digital power, the environment is constantly changing, scientific and technological innovation is changing rapidly, and the form and operation mode of organizations have been completely different from the past in many aspects. Adhering to the past rules, systems, norms and procedures is likely to be extremely unfavorable to the development of organizations. As the executor of organizational innovation, employees' "trying" and "optimizing" effective ways and rules in their daily work are important supports for organizations to adapt to uncertain environments (Mertens et al., 2016). This kind of unconventional behavior out of positive intention improves the well-being of the organization or its stakeholders, and is also the ultimate goal of college graduate personnel training.

The purpose of this paper is to explore the impact of the digital education on the digital competency of graduate students, and then how to promote the innovative performance of graduate students after graduation, so as to explore the improvement of graduate talent training system.

2. Research Hypothesis

Since 2018, Zhejiang Gongshang University has fully emphasized the necessity of digital education and conducted digital education from the aspects of curriculum setting, educational philosophy, teaching reform direction guidance, etc. At the same time, for the majority of teachers, lectures on "artificial intelligence + financial development Overview and trend" and "Artificial intelligence Interdisciplinary and Teacher Teaching Innovation" have been held. Teaching reform and innovation and other aspects of experience. In order to verify the effectiveness of digital education and its relationship with graduates' innovation performance, this study constructs the following theoretical research model (See Figure 1).

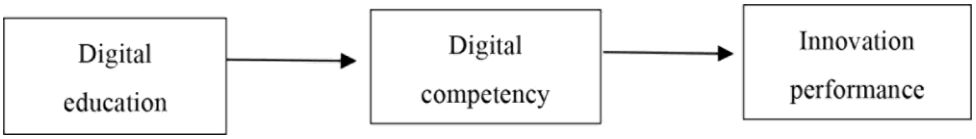

Figure 1. Research Model

While graduate education aims to enhance students' comprehensive abilities, digital education pays more attention to enhancing students' practical experience and creative abilities, such as cross-functional teamwork, communication and coordination, and decision-making management. Digital competence is a comprehensive competence with creation as the core, and digital education can promote the improvement of digital competence. Therefore, the following hypothesis is proposed in this study:

Hypothesis 1: Digital education promotes digital competency among graduate students.

Although there is no direct evidence and research conclusion that digital competence has a positive impact on innovation performance. However, previous studies have shown that: IT capability theory and resource-based view, digital transformation, as a unique resource input, can help enterprises integrate organizational resources and form digital capabilities, thus improving enterprise innovation ability and overall performance (Bharadwaj, 2000). Digital transformation can promote the innovation performance of enterprises (Wang, 2021). Huang et al. (2021) proved that the current digitalization level of Chinese enterprises is positively correlated with enterprise innovation performance, and the enterprises that have set up digital resource information sharing platform have more significant promoting effect. Wang and Du (2021) point out that digital technology has a significant positive impact on enterprise innovation performance, in which employee participation plays an intermediary role. When the enterprise network centrality is high, the positive relationship between digital technology and employee participation will be enhanced, and the indirect effect of digital technology on enterprise innovation performance through employee participation will also be enhanced. The conclusions of these studies can be deduced that digital competence can have a positive impact on employees' innovation performance.

Employee's internal factors are important factors affecting innovation performance. Capability is the origin of all actions. In the context of digital power, most jobs, especially those with obvious innovation (the vast majority of graduate students surveyed in this study belong to this category), are inseparable from the application of digital technology. Digital competency is a key feature that can distinguish employees with excellent innovation performance from those with poor innovation performance. Therefore, the following hypothesis is proposed in this study:

Hypothesis 2: Digital competency of graduate students has a positive impact on innovation performance.

Digital education pays more attention to the improvement of students' practical experience and comprehensive ability, which promotes the improvement of students' innovation ability and can bring about the improvement of innovation performance. However, it also promotes innovation performance partly through the improvement of digital competence. Therefore, the following hypothesis is proposed in this study:

Hypothesis 3: Digital competency mediates the impact of digital education on the innovation performance of graduate students.

3. Empirical Analysis

3.1 Participant

This questionnaire survey is conducted by using offline graduate student resources and online questionnaire distribution. The questionnaire was distributed online through the convenient, fast and efficient "questionnaire star", and a total of 221 questionnaires were collected.

SPSSAU data analysis software was used to extract valid samples from the research data. The gender, working time, salary and other information of graduates are statistically described, as shown in Table 1.

Table 1. Sample Basic Information (N=221)

Variables	Types	Frequency	Proportion (%)
Gender	Male	88	39.8%
	Female	133	60.1%
Age	25 below	11	4.80%
	22-24	28	12.60%
	25-26	37	14.70%
	27-28	97	41.70%
	28 above	18	26.20%
Tenure	1year below	16	7.10%
	1-3year	157	70.20%
	3-4year	30	13.80%
	4year above	20	8.90%
Monthly salary	5000 below	3	1.5%
	5000-8000Yuan	13	5.9%
	8000-12000Yuan	71	32.1%
	12000 above	134	60.5%
Major	Marketing	55	24.7%
	Finance	72	27.6%
	Management	76	29.5%
	Others	19	18.4%
	5000-8000Yuan	13	5.9%
	8000-12000Yuan	71	32.1%
	12000Above	134	60.5%
	Marketing	55	24.7%
	Finance	72	27.6%
	Management	76	29.5%
	Others	19	18.4%

As can be seen from the statistical information in the above table, in terms of gender, there are more women in the study sample, which is consistent with the reality. In recent years, there have been more women graduate students majoring in business at Zhejiang Gongshang University. In terms of salary, most graduate students earn more than 12,000 yuan a month. The liberal arts majors of Zhejiang

Gongshang University mainly focus on marketing, finance and human resources, and the salary of graduate students is also consistent with the reality.

3.2 Measure

The survey and measurement of digital education are carried out from the three levels of curriculum, teachers and educational philosophy. Specific projects include: setting up big data analysis, artificial intelligence and other related courses; Have the opportunity to take courses in other disciplines such as psychology, computer science, and product design; Set up enterprise operation simulation training, ERP, digital marketing, entrepreneurship management and other comprehensive practical training courses; The curriculum emphasizes practice and case studies; The teacher or tutor will make a long-term career plan according to the student's own personality and interests; There are teachers with diverse backgrounds and front-line work experience in enterprises; Invite business executives, industry mentors and other personnel to provide practical and employment guidance to students in the form of lectures and consultations; Teachers use digital education platform, case studies, group discussions, business practice, field trips, project cooperation, discussion guidance and other diversified teaching forms, so that students can directly contact and solve real business problems; Proactively visit enterprises; Professional education adhere to "market-oriented"; The school emphasizes on various occasions that academic should have more practical experience and comprehensive ability; Take interdisciplinary and comprehensive application ability as the training goal; The school advocates project-driven learning to exercise students' ability of cross-functional teamwork, communication and coordination, and decision-making management.

At present, it is a general consensus that innovation performance is divided into three dimensions, namely, the germination of innovative ideas, the promotion of innovative ideas and the realization of innovative ideas. Based on these three dimensions, six item scales are set up for the measurement of innovation performance. This scale has been widely used by scholars for a long period of time, with universality and consensus. This scale is applicable to the measurement of innovation performance of employees (graduate students within five years of graduation).

For the measurement of digital competency, refer to the six dimensions proposed by Xu and Liu (2022). Among them, the digital public service capability is not consistent with the actual situation of business graduate graduates working in the enterprise and commercial background selected in this study, so it is deleted. It retains five dimensions: digital tool operation ability, digital information processing ability, digital communication and collaboration ability, digital security management ability, and digital learning and innovation ability.

3.3 Descriptive Statistics and Correlation Analysis

The descriptive statistics and correlative analysis results of variables in this paper are shown in Table 2. The average value of digital education is 4.43, indicating that a considerable part of graduate students in the sample have realized the dividends brought by such digital education, and they have also felt such discipline construction and reform. The average value of digital competency is 3.11, and the average

value of innovation performance is 3.38. At the same time, the mean value of variance inflation factor (VIF) is 1.310, and the VIF of each variable is far less than the critical value of 10, indicating that there is no serious multicollinearity in this paper, and regression analysis can be performed.

Table 2. Descriptive Statistics for Variables

Variables	N	Minimum	maximum	Mean	Standard Deviation	Median
Sex	271	1.00	2.00	1.70	0.45	2.00
Age	271	1.00	5.00	3.62	1.12	4.00
Working tenure	271	1.00	5.00	2.63	0.71	2.00
Monthly salary	271	1.00	4.00	3.55	0.51	4.00
Digital education	271	1.68	5.00	4.43	0.75	3.53
Digital competency	271	1.65	4.33	3.11	0.52	3.00
Innovation performance	271	1.82	4.93	3.38	0.71	3.41

In addition, the correlation analysis results show (see Table 3) that the correlation value between the independent variable digital education and the dependent variable innovation performance is 0.312, and the significance is 0.01, indicating that there is a significant positive correlation between digital education and innovation performance. The correlation value between digital competency and innovation performance is 0.305, and the significance is 0.01 level, which indicates that there is a significant positive correlation between digital competency and innovation performance. The correlation coefficient between the independent variable digital education and the intermediate variable digital competency is 0.233. It shows that there is a significant positive correlation between digital education and digital competency, and also indicates that digital education initiatives do promote the improvement of digital competency of graduate students.

Table 3. Correlation Analysis Results

	1	2	3
Digital education	1		
Digital competency	0.233**	1	
Innovation performance	0.312**	0.305**	1

* p<0.05 ** p<0.01

4. Conclusion

Based on competency theory and competency-behavior theory, this paper takes Zhejiang Gongshang University graduate students (within 5 years of graduation) as research samples to explore the relationship between digital education, digital competency and employee innovation performance, and draws the following conclusions.

Various initiatives in digital education have promoted the innovative performance of graduate students. Various measures of digital education, including curriculum Settings and teaching methods, have a direct effect on the innovative ability of graduate students. Therefore, on the one hand, various measures of digital education can directly improve employees' innovation performance; on the other hand, digital competency can indirectly promote employees' innovation performance by enhancing graduates' digital competency.

Digital competence can promote employees' innovative performance. Digital competence includes digital tool operation ability, digital information processing ability, digital communication and cooperation ability, digital security management ability, digital learning and innovation ability. In the context of digital China, digital transformation is a top priority for enterprises. Once employees have digital competency, it means that their working ability has been greatly improved, and they can make full use of digital technology and carry out innovation, especially the digital learning innovation ability, which is directly related to innovation performance.

5. Practical Implications

According to the research conclusions, the following practical implications are drawn.

Enterprises should attach importance to improving and cultivating employees' digital competence. Enterprises should pay attention to improving employees' digital competence, fully improve the breadth and depth of digital technology use, and realize the improvement of employees' innovation performance driven by digital technology. For enterprises that have already used digital technology, digital technology should be embedded into products, services and management practices to broaden the breadth of enterprise use of digital technology, strengthen the depth of digital technology application, further improve the digital competency of employees, and thus promote innovation performance. At the same time, enterprises should systematize and professionalize the information resources brought by digital technology, meet the needs of employees to obtain growth and development resources, create incentives and conditions for the improvement of employees' digital competency, and then enable employees to take the initiative in their own jobs to improve innovation performance. For enterprises that have not yet used digital technology, they should change their thinking mode, consciously guide enterprises to learn to use digital technology, seize the opportunities brought by digital dividends, and use digital technology to stimulate and enhance digital competency, thus enhancing innovation performance. In addition, enterprises should exchange experience in the use of digital technology, absorb and utilize it in

combination with their own development needs, so as to improve the innovative performance of employees and even promote the sustainable development of enterprises.

Postgraduate education should focus on digital education. In the future, the research should focus of digital education should mainly focus on innovation and entrepreneurship, digital transformation and other fields, and fully integrate the current digital transformation. In order to adapt to the business environment and the challenges of global competition in the digital age, graduate students, especially those majoring in liberal arts, should take “interdisciplinary comprehensive application ability” as the training goal, such as through the combination of management and technology disciplines, to improve students’ ability to use modern information technology and management theory to solve practical problems. In terms of teaching organization, the teaching forms should be diversified, build a digital education platform, make full use of video courses, e-books, contact question banks and interactive tools, allocate educational resources according to students’ learning progress and needs, and meet the learning needs of students at different levels. Make full use of case discussion, business investigation, enterprise internship or practice, fully let students contact with the actual business environment, smooth the cooperation mechanism between universities and enterprises, provide guidance for students’ internship, graduation design, practical projects, etc., focus on students’ hands-on operation and practical problem solving ability training. Education administration departments, industries, universities and other relevant parties should cooperate in education, jointly build a training system, broaden resources for the cultivation of business graduate talents, enrich students’ learning content and learning methods, and promote the improvement of graduate training quality.

6. Limitation and Future Research

There are some Limitations in this research.

This paper selects graduate students from Zhejiang Gongshang University as research samples. Although differences between schools and majors are controlled, the reference significance for other universities and majors remains to be tested. Samples from different schools can be studied in the future to enhance the universality of research conclusions.

This paper only focuses on the impact of digital education on the innovation performance of graduates who have not graduated for a long time. In the future, we can further explore the impact of digital competency of senior employees on innovation performance, and focus on whether the graduation time weakens or enhances this influencing factor.

This paper only focuses on the mechanism between digital competence and employee innovation performance, but does not consider how digital technology can use external resources to promote enterprise innovation performance. In the future, the role of cross-border search, external environment and other factors can be further expanded.

Acknowledgement

This article was funded by General Philosophy and society Project of Zhejiang Province: Research on the influence mechanism of compensation co-enrichment on innovation performance (No: 24NDJC136YB).

References

Caena, F., & Redecker, C. (2019). Aligning teacher competence frameworks to 21st century challenges: The case for the European Digital Competence Framework for Educators (Digcompedu). *European Journal of Education*, *54*(3), 356-369. https://doi.org/10.1111/ejed.12345

Hu, R., Wu, Y. Y., & Shieh, C. J. (2016). Effects of virtual reality integrated creative thinking instruction on students' creative thinking abilities. *Eurasia Journal of Mathematics, Science and Technology Education*, *12*(3), 477-486. https://doi.org/10.12973/eurasia.2016.1226a

Huang, J. G., Ji, X. X., & Li, Y. X. (2019). Research on the influence of digitization level on enterprise innovation performance: Empirical evidence from Shanghai and Shenzhen A-share listed companies. *Social Sciences of Jiangxi*, *1*(5), 61-72.

Kahila, J., Vartiainen, H., Tedre, M., Arkko, E., Lin, A., Pope, N., … Valtonen, T. (2024). Pedagogical Framework for Cultivating Children's Data Agency and Creative Abilities in the Age of AI. *Informatics in Education*, *23*(2), 323-360. https://doi.org/10.15388/infedu.2024.15

Lu, Y. L., & Feng, J. L. (2023). Research on Competency Model Construction of Enterprise Digital Operation Management Talent from the Perspective of Dynamic Competence. *National Circulation Economy*, *2023*(19), 84-88.

Mertens, W., Recker, J., Kummer, T. F., Kohlborn, T., & Viaene, S. (2016). Constructive deviance as a driver for performance in retail. *Journal of Retailing and Consumer Services*, *30*, 193-203. https://doi.org/10.1016/j.jretconser.2016.01.021

Mungra, Y., Srivastava, R., Sharma, A., Banerji, D., & Gollapudi, N. (2024). Impact of Digital Competence on Employees' Flourishing Through Basic Psychological Needs Satisfaction. *The Journal of Computer Information Systems*, 1-15. https://doi.org/10.1080/08874417.2023.2176948

Wang, C. (n.d.). Research on the mechanism of digital transformation on Enterprise innovation performance. *Contemporary Economic Management*, *43*(3), 344-42.

Wang, H. H., & Du, M. (2021). Digital technology and Employee Participation in Enterprise Innovation Performance. *Research and Development Management*, *3*(1), 138-141.

Xu, X. R., & Liu, D. L. (2022). Construction and Improvement of Civil servants' Digital Competence. *Journal of the Communist Party of China*, *2022*(10), 9-14.