

THEMATIC PAPER: APPRENTICESHIP

Soft inputs matter: How school processes and family emotional support shape core competencies in Chinese vocational students

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ABSTRACT

This study examines the impact of various factors on the core competencies of Chinese higher vocational students in the digital age. With the rapid advancement of technology and increasing automation in industries, the demand for skilled talents with not only professional skills but also core competencies such as communication, problem-solving, and resilience has grown. The research aims to assess the extent to which students acquire these competencies and identify the key factors from family and school inputs that influence their development. The study employs a quantitative approach, using an online questionnaire survey with a large sample size across multiple provinces in China. The findings underscore the significant role of school process inputs and family emotional inputs in shaping students' core competencies, highlighting areas for improvement and resource allocation to better equip students for the future workforce.

Key words: vocational education, core competencies, school process input, parental emotional support

INTRODUCTION

With the rapid advancement of technology and increasing automation across industries, the demand for skilled professionals who possess not only technical expertise but also core competencies such as communication, problem-solving, and resilience has grown. The theory of "Task-biased Technological Change" suggests that technological advancements reshape the nature of work tasks, resulting in the substitution effect for routine tasks and a creation effect for non-routine tasks (Goos *et al.*, 2014). Generally speaking, the work tasks of medium-skilled workers, such as sales personnel, machine operators, *etc.*, often fall into the category of routine tasks, which are highly standardized and can be easily encoded by computers, allowing machines to execute them through automation technologies (Luo & Chen, 2022). As a result, these workers are most impacted by artificial intelligence. Traditional job

positions for vocational college graduates primarily correspond to medium-skilled roles, thus facing significant challenges. While "machines replace humans" the digital economy also creates a number of new job positions such as automation equipment maintenance technicians, mechanical design engineers. These positions see a significant increase in non-routine tasks, requiring workers not only to possess specialized job skills but also to have strong communication and collaboration skills, stress resistance, and problem-solving abilities (Wu & Bai, 2023).

Core competencies, often referred to as core literacies, share substantial conceptual overlap with terms such as key competencies, 21st-century skills, social-emotional skills, and non-cognitive abilities, and are frequently used interchangeably. Early on, German scholars introduced the concept of "key competencies" from the perspective of vocational education, referring to knowledge, abilities,

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and skills not directly tied to specific professional expertise—essentially, the capacity to adapt to unforeseen changes throughout one's career. Core competencies encompass a collection of knowledge, skills, and attitudes essential for personal development, social integration, and job competence (Hozjan, 2009). Scholars have identified three key dimensions of core competencies: emotional management, communication and collaboration, and goal achievement (OECD, 2015). Drawing on the literature related to the core competencies of vocational college students (Kahn *et al.*, 2012; OECD, 2015; Talavera & Pérez-González, 2007), the frequently mentioned variables of resilience, communication and problem-solving were selected as proxies to measure the level of core competencies among vocational college students.

To meet the technological challenges of the digital and intelligent era, students in China's higher vocational education must develop core competencies such as communication and social skills, problem-solving abilities, and digital literacy. A report has pointed out that, influenced by automation, the demand for physical and manual operation skills in China's labour market will decrease by 18% by 2030, while the demand for social and emotional skills as well as technological skills will increase by 18% and 51%, respectively (McKinsey Global Institute, 2021). Research indicates that vocational education graduates often have an early employment advantage, but lack "long-term momentum" in their career development; compared to specialized skills training, general education is more conducive to helping individuals adapt to changes in industry and technology (Hanushek *et al.*, 2017).

The research aims to understand how well students grasp these competencies and what key factors from family and school inputs influence their development. The research questions are: (1) What is the level of core competencies among vocational college students in China, as exemplified by communication skills, problem-solving abilities, and resilience. (2) What key factors in family and school inputs impact the development of these core competencies in vocational education students.

METHODS AND RESEARCH DESIGN

This study evaluates the core competencies of Chinese higher vocational students, employing communication skills, problem-solving abilities, and resilience as proxy variables. School inputs are categorized into process inputteacher-student interaction, teaching enthusiasm, curriculum settings and resource inputsschool nature, student-teacher ratio, per-student expenditure, while family inputs are divided into material and emotional

resources.

A quantitative online survey was conducted among 14,836 students in 35 colleges across 7 provinces in China in December 2022, yielding a final valid sample of 11,597 after data cleaning. The survey collected data on students' personal characteristics, family background, core competencies, perceived curriculum settings, and teacher teaching levels. Statistical analysis involved Coarsened Exact Matching (CEM) to reduce self-selection bias, followed by robust multivariate regression to analyze key input elements and Shapley Value Decomposition to compare their contributions to students' core competencies. Measurement items were derived from large-scale surveys, revised for Chinese students, and validated for reliability and validity.

RESULTS

The level of core competencies of higher vocational students in China

The preliminary statistics indicate that among higher vocational students surveyed, resilience scores were the highest at 3.620, followed by problem-solving ability at 3.504, with communication and social interaction ability being the lowest at 3.414, suggesting that these core competencies are not highly developed and require improvement.

The impact effects of family and school inputs

The CEM method successfully matched 10,893 samples, achieving a 93.93% success rate and significantly improving data balance, as evidenced by the L1 index decreasing from 0.487 to 0.191. This matching process mitigated individual self-selection bias.

The robust multiple regression results indicate that, overall, when controlling for other factors, school process inputs represented by teacher-student interaction behavior, teaching enthusiasm, and course practicality have a significantly positive impact on vocational students' resilience, communication skills and problem-solving abilities. School resource inputs represented by per-student education expenditure, per-student practical training workstations, student-teacher ratio, and school type generally do not have a significant impact on these core competencies. It can be said that school resource inputs do not exert a positive influence. Both family socioeconomic status and parental emotional support have a significant positive impact on all core competencies (Table 1).

Shapley value decomposition further confirmed that school process inputs and family emotional inputs are the most critical factors, collectively contributing 71%-

Table 1: The impact of school and family inputs on the competencies of higher vocational students

Indicator	Resilience	Communication	Problem-solving
Teacher-student interaction behavior	0.171*** (0.022)	0.147*** (0.035)	0.157*** (0.026)
Teacher teaching enthusiasm	0.080*** (0.020)	0.042 (0.032)	0.048** (0.024)
Course practicality	0.347*** (0.012)	0.252*** (0.019)	0.305*** (0.014)
Log of per capita expenditure	0.018 (0.022)	0.017 (0.034)	0.028 (0.025)
Per capita practical teaching workstation number	0.013 (0.030)	0.030 (0.048)	0.035 (0.036)
Student-teacher ratio	-0.001 (0.002)	-0.002 (0.003)	-0.002 (0.003)
School nature (private = 1)	0.014 (0.021)	0.085** (0.033)	0.019 (0.025)
Family socioeconomic status	0.047*** (0.008)	0.089*** (0.012)	0.053*** (0.009)
Parental emotional support	0.238*** (0.011)	0.352*** (0.017)	0.272*** (0.013)
Control variables	Yes	Yes	Yes
R2	0.32	0.15	0.23
N	10,893	10,893	10,893

* $P < 0.1$, ** $P < 0.05$, *** $P < 0.01$. Control variables include grade, gender, household registration type, only child, major category, and school location.

Table 2: Contribution rates of various factors to the differences in dependent variables based on shapley value decomposition

Independent variable	Resilience	Communication	Problem-solving
School process inputs	68.49%	47.89%	62.27%
School resource inputs	1.22%	1.75%	1.19%
Family emotional inputs	22.49%	37.10%	28.04%
Family material inputs	1.87%	4.92%	2.31%
Other	5.93%	8.35%	6.18%

91% to the variance in students' core abilities (Table 2). Specifically, the contribution of school process inputs to the variance in students' resilience, communication skills, and problem-solving abilities reached 68.49%, 47.89%, and 62.27%, respectively. In contrast, the average contribution of school resource inputs did not exceed 2%. The contribution of family emotional investment to the variance in students' core competencies was also significant. For instance, its contribution to the variance in communication skills reached 37.10%, far exceeding that of family material investment 4.92%.

CONCLUSION

The findings provide significant implications for the ongoing development of vocational education. It is essential to broaden the scope of vocational education talent development, building on technical specialization to foster the core competencies needed to adapt to a changing world.

The findings indicate that these intangible, process-oriented, or psychological input factors are crucial elements influencing core competencies. It can be argued that, compared to the material resource investments from schools and families, the "soft inputs" from these sources are more effective in enhancing the

core competencies of vocational students. However, the current investment in vocational education in China predominantly focuses on hardware construction and resource-based inputs, with insufficient attention paid to soft, process-oriented investments. This has certain implications for the current model of vocational education investment.

DECLARATIONS

Secondary publication declaration

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Written informed consent was obtained from the participants for publication.

Conflict of interest

The authors have no conflicts of interest to declare.

Data availability statement

Data used to support the findings of this study are available from the corresponding author upon request.

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