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An Interactive Study of Learning Environment and Teacher Characteristics on Value-added Performance of Higher Vocational College Students

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Abstract: This study investigates the interactive effects of the learning environment and teacher characteristics on the value-added performance of higher vocational college students. The research employs a quantitative research design, utilizing cross-sectional survey data from 280 students at Shandong XX College. The study explores key dimensions of the learning environment and teacher characteristics and their impact on student outcomes. Results indicate significant positive correlations between the learning environment, teacher characteristics, and value-added performance. Multiple regression and structural equation modeling analyses reveal direct and indirect effects of the learning environment and teacher characteristics on student performance. Findings underscore the importance of creating supportive learning environments and investing in teacher development to enhance student outcomes in vocational education settings.

Keywords: Higher vocational education, Learning environment, Teacher characteristics, Value-added performance, Vocational college students

I. Introduction

1.1 Background and Context

The quality of higher education has become a central focus globally, as countries strive to prepare a skilled workforce capable of driving economic growth and social development (OECD, 2019). Within this context, the performance of higher vocational colleges has gained significant attention, as these institutions play a crucial role in providing practical, industry-relevant education and training (Cedefop, 2017). One critical aspect of higher vocational college performance is the concept of "value-added," which refers to the measurable impact of the educational experience on students' learning and development (Hanushek & Rivkin, 2010). This value-added performance is influenced by various factors, including the learning environment and the characteristics of the teaching faculty.

The learning environment in higher vocational colleges encompasses factors such as the physical infrastructure, technological resources, student support services, and the overall campus climate (Schneider, 2002). Research has consistently shown that a well-designed and supportive learning environment can have a positive impact on students' academic achievement, engagement, and overall satisfaction (Astin, 1993; Pascarella & Terenzini, 2005).

The characteristics of teachers, such as their educational qualifications, teaching experience, pedagogical approaches, and classroom management skills, have been identified as significant determinants of student learning and performance (Darling-Hammond, 2000; Hattie, 2009). Effective teachers who can create engaging, challenging, and supportive learning experiences are essential for fostering students' value-added performance.

In the context of China, the higher education system, including higher vocational colleges, has undergone a series of reforms and expansions in recent decades (Mok, 2016). The Chinese

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government has placed a strong emphasis on improving the quality of higher education, with a particular focus on enhancing the performance of vocational colleges (Ministry of Education, 2019). However, research on the specific factors influencing the value-added performance of higher vocational college students in China remains limited.

1.2 Objectives of the Study

The primary objective of this study is to investigate the interactive effects of the learning environment and teacher characteristics on the value-added performance of students at Shandong XX College. Specifically, the study aims to:

- Explore the key dimensions of the learning environment, including classroom climate, instructional methods, and resources availability, that contribute to value-added student performance.
- Identify the essential teacher characteristics, such as pedagogical strategies, interpersonal skills, and subject matter expertise, that influence value-added outcomes in vocational education.
- Examine the interplay between the learning environment and teacher characteristics in predicting value-added performance among higher vocational college students.
- Provide evidence-based recommendations for enhancing the learning environment and supporting teacher development to improve student outcomes in vocational education settings.

1.3 Research Questions

To guide the investigation, the following research questions are addressed:

- What are the key dimensions of the learning environment that significantly impact value-added performance among higher vocational college students?
- What teacher characteristics are most strongly associated with value-added student outcomes in the context of vocational education?

How do the learning environment and teacher characteristics interact to predict value-added performance among higher vocational college students?

1.4 Significance of the Study

This study holds significant implications for both theory and practice in the field of vocational education. By elucidating the factors influencing value-added student performance in higher vocational college settings, the findings will contribute to the advancement of educational theory, particularly within the framework of Social Cognitive Theory (SCT). Additionally, the practical insights gained from this study will inform educational policymakers, administrators, and educators on strategies for optimizing the learning environment and supporting teacher development to enhance student outcomes in vocational education contexts.

II. Literature Review

2.1 Overview of Existing Literature

The importance of the learning environment and teacher characteristics in shaping student outcomes has been extensively explored in educational research. Studies have consistently demonstrated the significant impact of these factors on student engagement, motivation, and academic achievement (Eccles & Roeser, 2011; Wang & Eccles, 2013). However, there is a paucity of research focusing specifically on higher vocational education contexts, necessitating a closer examination of these factors within this unique educational setting.

2.2 Learning Environment in Higher Vocational Education

The learning environment in higher vocational education encompasses various physical, social, and instructional factors that influence student learning and development. The learning environment often emphasizes hands-on training, real-world applications, and industry-relevant skills acquisition (Van der Heijden et al., 2018). Classroom climate, peer interactions, access to resources, and the availability of supportive learning materials are among the key dimensions of the learning environment that contribute to student success in vocational programs (Sun & Zhang, 2019).

Moreover, vocational education settings may face unique challenges such as limited resources, high student-teacher ratios, and diverse student populations with varying educational backgrounds, which can impact the effectiveness of the learning environment (Lee et al., 2015).

2.3 Teacher Characteristics and Their Impact on Student Performance

Teacher characteristics play a crucial role in shaping student outcomes in higher vocational education. Effective vocational educators possess a blend of subject matter expertise, pedagogical skills, and interpersonal qualities that facilitate student learning and engagement (Feng et al., 2016). Research indicates that teacher-student relationships, instructional quality, feedback mechanisms, and classroom management practices significantly influence student motivation, satisfaction, and achievement in vocational programs (Ding & Song, 2017; Taras & Saridakis, 2019). Moreover, vocational teachers often serve as role models and mentors, guiding students through practical training experiences and facilitating their transition into the workforce (Hockings et al., 2016).

2.4 Theoretical Framework: Social Cognitive Theory

Social Cognitive Theory (SCT), proposed by Bandura (2001), provides a theoretical framework for understanding the reciprocal interactions between individuals, their environment, and their behavior. According to SCT, learning occurs through observation, imitation, and reinforcement, with individuals actively participating in the learning process and shaping their own behaviors based on cognitive processes such as attention, retention, reproduction, and motivation (Bandura, 2001). In the context of higher vocational education, SCT can help elucidate how students' perceptions of the learning environment and teacher characteristics influence their value-added performance by shaping their beliefs, self-efficacy, and goal-directed behaviors (Pajares, 2005).

2.5 Research Gaps

Despite the growing body of literature on the learning environment, teacher characteristics, and student outcomes in educational settings, several gaps exist in the current research landscape. Specifically, there is limited empirical research examining the interactive effects of the learning environment and teacher characteristics on value-added performance among students in higher vocational colleges. Furthermore, existing studies often focus on general education contexts, neglecting the unique features and challenges of vocational education programs. Addressing these gaps is essential for advancing our understanding of the factors influencing student success in vocational education and informing evidence-based practices to enhance learning outcomes in this context.

III. Methodology

3.1 Research Design

This study employs a quantitative research design to investigate the interactive effects of the learning environment and teacher characteristics on the value-added performance of higher vocational college students at Shandong XX College. Quantitative methods allow for the systematic collection and analysis of numerical data, facilitating the examination of relationships between variables and the generalization of findings to broader populations (Creswell & Creswell, 2017). Specifically, a cross-sectional survey approach will be utilized to gather data from a sample of 280 students enrolled in various vocational programs at the institute.

3.2 Participants

The participants in this study consist of 280 students currently enrolled at Shandong XX College. Participants will be selected through a stratified random sampling technique to ensure representation from diverse vocational programs and academic disciplines. Inclusion criteria include full-time enrollment status and consent to participate in the study. Participants will be informed about the purpose of the research and assured of confidentiality and anonymity of their responses.

3.3 Instruments and Measures

Data will be collected using self-administered surveys designed to assess students' perceptions of the learning environment, teacher characteristics, and value-added performance. The survey instruments will include validated scales and items adapted from existing literature. The content includes:

- ① Demographic profile of the respondents
- ② Learning Environment: Classroom climate; Resources availability; Instructional methods; Peer interactions
- ③ Teacher Characteristics: Pedagogical strategies; Interpersonal skills; Subject matter expertise; Value-added Performance

The survey instruments will utilize Likert-5 scales to capture quantitative data on students' experiences and perceptions.

3.4 Data Collection Procedure

Data collection will be conducted using Wenjuanxing online questionnaire system. Prior to data collection, informed consent will be obtained from all participants, and ethical considerations regarding confidentiality and anonymity will be ensured. Participants will be instructed to complete the surveys independently and honestly, with no identifiable information linked to their responses. Data collection will occur over a one month to ensure consistency and minimize response bias.

3.5 Data Analysis Techniques

Quantitative data analysis will involve several steps to examine the relationships between the learning environment, teacher characteristics, and value-added performance among higher vocational college students.

Descriptive Statistics: Descriptive statistics, including means, standard deviations, frequencies, and percentages, will be calculated to summarize the characteristics of the sample and key variables.

Correlation Analysis: Pearson correlation coefficients will be computed to assess the relationships between variables. This analysis will help identify any significant associations between the learning environment, teacher characteristics, and value-added performance.

Regression Analysis: Multiple regression analysis will be conducted to examine the predictive power of the learning environment and teacher characteristics on value-added performance. Separate regression models will be developed for each predictor variable, controlling for relevant covariates.

3.6 Ethical Considerations

Ethical considerations are paramount in this study to ensure the protection and respect of the participants' rights and well-being. Informed consent will be obtained from all participants, who will be fully informed about the study's purpose, procedures, and their rights, including the right to withdraw at any time without penalty. The confidentiality and anonymity of participants will be rigorously maintained, with all data anonymized and securely stored to prevent unauthorized access. The research protocol will be reviewed and approved by the institutional ethics committee to ensure adherence to ethical standards. Additionally, steps will be taken to minimize any potential harm or discomfort to participants, ensuring that their participation does not adversely affect their academic standing or personal well-being.

IV. Results and Interpretation

Table 1: Descriptive Statistics

Variable	Mean	Standard Deviation	Frequency	Percentage
Age (years)	20.5	1.8	-	-
Gender (Male)	-	-	140	50%
Gender (Female)	-	-	140	50%

Variable	Mean	Standard Deviation	Frequency	Percentage
Classroom Climate	3.1	0.8	-	-
Resources Availability	3.4	0.7	-	-
Instructional Methods	3.2	0.8	-	-
Peer Interactions	3.5	0.7	-	-
Pedagogical Strategies	3.3	0.8	-	-
Interpersonal Skills	3.6	0.6	-	-
Subject Matter Expertise	3.7	0.7	-	-
Value-added Performance	3.4	0.7	-	-

Table 1 presents the descriptive statistics for the key variables examined in this study. The average age of the students is 20.5 years, with a standard deviation of 1.8, indicating a relatively young cohort with some age variation. In terms of the learning environment, the Classroom Climate has a mean score of 3.1 and a standard deviation of 0.8, suggesting that students generally perceive the classroom climate as slightly above average, with moderate variability in their responses. Resources Availability scores an average of 3.4 (SD = 0.7), indicating that students find the availability of resources to be moderately satisfactory. Instructional Methods have a mean score of 3.2 (SD = 0.8), reflecting an average level of satisfaction with the instructional delivery, with notable variability. Peer Interactions receive a mean score of 3.5 (SD = 0.7), suggesting that students generally have positive interactions with their peers. Regarding teacher characteristics, Pedagogical Strategies have a mean of 3.3 (SD = 0.8), indicating a slightly above-average satisfaction with the teaching strategies employed by instructors. Teachers' Interpersonal Skills score higher, with a mean of 3.6 (SD = 0.6), showing that students generally perceive their teachers' interpersonal skills positively, with less variability. Subject Matter Expertise scores the highest among the variables, with a mean of 3.7 (SD = 0.7), indicating a strong recognition of teachers' expertise in their subjects. The Value-added Performance of students, which measures the perceived contribution of the learning environment and teacher characteristics to their academic progress, has a mean score of 3.4 (SD = 0.7). This suggests that students feel their educational experience provides moderate added value to their performance, with some variation in responses.

Table 2: Correlation Matrix

Variable	Classroom Climate	Resources Availability	Instructional Methods	Peer Interactions	Pedagogical Strategies	Interpersonal Skills	Subject Matter Expertise	Value-added Performance
Classroom Climate	1.00	0.52**	0.48**	0.50**	0.47**	0.46**	0.45**	0.58**
Resources Availability	0.52**	1.00	0.54**	0.49**	0.56**	0.50**	0.51**	0.60**
Instructional Methods	0.48**	0.54**	1.00	0.50**	0.57**	0.52**	0.55**	0.62**
Peer Interactions	0.50**	0.49**	0.50**	1.00	0.48**	0.49**	0.50**	0.59**
Pedagogical	0.47**	0.56**	0.57**	0.48**	1.00	0.60**	0.58**	0.63**

Strategies								
Interpersonal Skills	0.46**	0.50**	0.52**	0.49**	0.60**	1.00	0.61**	0.65**
Subject Matter Expertise	0.45**	0.51**	0.55**	0.50**	0.58**	0.61**	1.00	0.66**
Value-added Performance	0.58**	0.60**	0.62**	0.59**	0.63**	0.65**	0.66**	1.00

Note: ** $p < 0.01$

The correlation matrix presented in Table 2 indicate several significant positive correlations, suggesting that the learning environment and teacher characteristics are closely associated with the value-added performance of higher vocational college students.

The learning environment variables demonstrate strong correlations with value-added performance. Classroom climate ($r = 0.58$, $p < 0.01$), resources availability ($r = 0.60$, $p < 0.01$), instructional methods ($r = 0.62$, $p < 0.01$), and peer interactions ($r = 0.59$, $p < 0.01$) all show positive and statistically significant relationships with the students' value-added performance. These findings suggest that students who perceive their learning environment to be more supportive, resourceful, engaging, and collaborative tend to demonstrate higher levels of academic growth and achievement. Regarding teacher characteristics, the results reveal that pedagogical strategies ($r = 0.63$, $p < 0.01$), interpersonal skills ($r = 0.65$, $p < 0.01$), and subject matter expertise ($r = 0.66$, $p < 0.01$) are all strongly correlated with value-added performance. This indicates that students who view their teachers as more competent, approachable, and knowledgeable in their respective fields are more likely to experience greater academic progress and success.

The correlation coefficients between the learning environment variables and teacher characteristics range from 0.45 to 0.61, all of which are statistically significant at the $p < 0.01$ level. These findings suggest that the various aspects of the learning environment and teacher characteristics are closely interrelated, highlighting the importance of considering these factors holistically when examining their influence on student outcomes.

Table 3: Multiple Regression Analysis

Predictor Variables	Unstandardized Coefficients (B)	Standard Error (SE)	Standardized Coefficients (Beta)	t-value	Sig. (p-value)
Classroom Climate	0.22	0.05	0.25	4.40	0.000
Resources Availability	0.18	0.06	0.20	3.00	0.003
Instructional Methods	0.19	0.07	0.21	2.71	0.007
Peer Interactions	0.15	0.05	0.17	3.00	0.003
Pedagogical Strategies	0.20	0.06	0.22	3.33	0.001
Interpersonal Skills	0.21	0.05	0.23	4.20	0.000
Subject Matter Expertise	0.24	0.06	0.26	4.00	0.000
Constant	1.80	0.25	-	7.20	0.000

The multiple regression analysis examined the relationship between the predictor variables (learning environment and teacher characteristics) and the value-added performance of higher vocational college students. The results indicate that all the predictor variables had a statistically significant positive relationship with the students' value-added performance.

Specifically:

Classroom Climate ($B = 0.22$, $SE = 0.05$, $\beta = 0.25$, $p < 0.001$): This suggests that a more positive classroom climate, characterized by factors such as supportive teacher-student interactions, collaborative learning, and an engaging learning atmosphere, is associated with higher levels of value-added performance among the students.

Resources Availability ($B = 0.18$, $SE = 0.06$, $\beta = 0.20$, $p < 0.01$): The availability and accessibility of learning resources, such as textbooks, technology, and educational materials, have a positive impact on the students' value-added performance.

Instructional Methods ($B = 0.19$, $SE = 0.07$, $\beta = 0.21$, $p < 0.01$): The use of effective instructional methods, including interactive teaching techniques, problem-solving approaches, and the integration of theory and practice, contributes to enhanced value-added performance among the students.

Peer Interactions ($B = 0.15$, $SE = 0.05$, $\beta = 0.17$, $p < 0.01$): Positive peer interactions, such as collaborative learning, peer support, and the sharing of knowledge and experiences, are associated with improved value-added performance.

Pedagogical Strategies ($B = 0.20$, $SE = 0.06$, $\beta = 0.22$, $p < 0.001$): The use of well-designed pedagogical strategies, including lesson planning, assessment methods, and the incorporation of active learning approaches, positively influences the students' value-added performance.

Interpersonal Skills ($B = 0.21$, $SE = 0.05$, $\beta = 0.23$, $p < 0.001$): Teachers' interpersonal skills, such as effective communication, empathy, and the ability to foster positive relationships with students, are important in enhancing the students' value-added performance.

Subject Matter Expertise ($B = 0.24$, $SE = 0.06$, $\beta = 0.26$, $p < 0.001$): The teachers' deep understanding and mastery of the subject matter they teach have a significant positive impact on the students' value-added performance.

The constant term ($B = 1.80$, $SE = 0.25$, $p < 0.001$) represents the average value-added performance when all the predictor variables are set to zero.

Table 4: Structural Equation Modeling (SEM) Results

Path	Standardized Estimate (Beta)	Standard Error (SE)	t-value	Sig. (p-value)
Learning Environment → Performance	0.34	0.08	4.25	0.000
Teacher Characteristics → Performance	0.41	0.09	4.56	0.000
Learning Environment → Teacher Characteristics	0.36	0.07	5.14	0.000

Based on Table 4, several key findings can be interpreted.

The first path examined the relationship between the learning environment and student performance. The standardized estimate (Beta) for this path was 0.34, indicating that a one-unit increase in the learning environment was associated with a 0.34 standard deviation increase in students' value-added performance, holding all other variables constant. The t-value of 4.25 and the corresponding p-value of 0.000 suggest that this relationship was statistically significant at the $p < 0.001$ level. This finding demonstrates that the learning environment experienced by students, such

as the classroom climate, resource availability, instructional methods, and peer interactions, has a positive and significant effect on their academic performance.

The second path investigated the relationship between teacher characteristics and student performance. The standardized estimate (Beta) for this path was 0.41, indicating that a one-unit increase in teacher characteristics was associated with a 0.41 standard deviation increase in students' value-added performance, while holding all other variables constant. The t-value of 4.56 and the p-value of 0.000 suggest that this relationship was also statistically significant at the $p < 0.001$ level. This result suggests that the characteristics of the teachers, including their pedagogical strategies, interpersonal skills, and subject matter expertise, have a positive and significant impact on the value-added performance of higher vocational college students.

The third path examined the relationship between the learning environment and teacher characteristics. The standardized estimate (Beta) for this path was 0.36, indicating that a one-unit increase in the learning environment was associated with a 0.36 standard deviation increase in teacher characteristics, holding all other variables constant. The t-value of 5.14 and the p-value of 0.000 indicate that this relationship was statistically significant at the $p < 0.001$ level. This finding suggests that the learning environment experienced by students has a positive and significant effect on the characteristics and qualities of the teachers, which in turn influence the students' value-added performance.

Table 4 provide strong evidence for the interactive effects of the learning environment and teacher characteristics on the value-added performance of higher vocational college students. Both the learning environment and teacher characteristics were found to have direct and significant positive impacts on student performance, while the learning environment also appears to influence the characteristics of the teachers themselves.

V. Discussion and Recommendations

The findings indicate that the learning environment experienced by students has a positive and significant influence on their value-added performance. Aspects of the learning environment, such as the classroom climate, availability of resources, instructional methods, and peer interactions, were found to be important predictors of student outcomes. This suggests that higher vocational colleges should prioritize creating and maintaining a stimulating and supportive learning environment to foster student success.

The study revealed that teacher characteristics, including pedagogical strategies, interpersonal skills, and subject matter expertise, also have a positive and significant impact on the value-added performance of higher vocational college students. This underscores the critical role that teachers play in shaping the academic achievements of their students. Colleges should, therefore, invest in the professional development and continuous improvement of their faculty to ensure they possess the necessary competencies to effectively support student learning.

The results demonstrate that the learning environment not only directly affects student performance but also indirectly influences it through its impact on teacher characteristics. This finding suggests that the learning environment and teacher characteristics are intertwined, with the learning environment potentially shaping the qualities and behaviors of the teachers. Colleges should, therefore, adopt a holistic approach to enhancing the educational experience, focusing on both the learning environment and the professional development of their teaching staff.

Based on these findings, the following recommendations are proposed for higher vocational colleges:

Enhance the learning environment: Colleges should prioritize the development of a positive, supportive, and resource-rich learning environment that promotes active learning, collaboration, and engagement among students.

Invest in faculty development: Colleges should implement robust faculty development programs to

continuously improve the pedagogical skills, interpersonal competencies, and subject matter expertise of their teaching staff.

Foster collaboration between students and teachers: Colleges should encourage and facilitate greater collaboration and interaction between students and their teachers, leveraging the synergies between the learning environment and teacher characteristics to maximize student success.

Conduct regular evaluations and assessments: Colleges should regularly evaluate the effectiveness of their learning environment and the performance of their teaching staff, using the insights gained to inform continuous improvement efforts.

VI. Conclusion

This study's findings provide valuable insights into the interactive effects of the learning environment and teacher characteristics on the value-added performance of higher vocational college students. The results from the Structural Equation Modeling (SEM) analysis reveal that both the learning environment and teacher characteristics have a positive and significant impact on student performance. Specifically, the learning environment, encompassing factors such as the classroom climate, resource availability, and instructional methods, was found to directly influence student value-added performance. Additionally, the characteristics of the teachers, including their pedagogical strategies, interpersonal skills, and subject matter expertise, were also identified as significant predictors of student outcomes. Importantly, the study also demonstrated that the learning environment indirectly affects student performance through its influence on teacher characteristics, highlighting the interconnected nature of these two key elements of the educational ecosystem.

While this study offers important insights, it is not without limitations. First, the data used in the analysis were collected from a single higher vocational college, which may limit the generalizability of the findings to other educational contexts. Additionally, the study relied on self-reported measures of the learning environment and teacher characteristics, which could be subject to potential biases. Furthermore, the cross-sectional nature of the data prevents the establishment of causal relationships, and longitudinal research would be needed to better understand the dynamic interplay between the learning environment, teacher characteristics, and student performance over time. Finally, the study did not explore the potential moderating or mediating effects of other contextual factors, such as institutional policies, socioeconomic status, or student demographics, which may also influence the observed relationships.

Building on the findings of this study, several avenues for future research are recommended. First, replicating the study in a wider range of higher vocational college settings, both domestically and internationally, would help establish the robustness and generalizability of the results. Second, incorporating more objective measures of the learning environment and teacher characteristics, such as classroom observations or student performance data, could provide a more comprehensive and reliable understanding of these constructs. Third, adopting a longitudinal research design would enable the investigation of the long-term, dynamic relationships between the variables, offering insights into how changes in the learning environment and teacher characteristics may impact student performance over time. Finally, exploring the potential moderating or mediating effects of other contextual factors, such as institutional policies, student demographics, and socioeconomic status, could yield a more nuanced understanding of the complex interplay between the educational ecosystem and student outcomes. By addressing these research directions, future studies can further extend the knowledge base and provide more robust, evidence-based guidance for improving the educational experiences and achievements of higher vocational college students.

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