ISSN: 2710-0170

The Impact of Competency-Based Education and Social Constructivism on Vocational Ability Development of Design Students in Hangzhou Vocational Colleges: A Quantitative Study

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Abstract

Vocational ability development is a core objective of higher vocational education, particularly for design majors facing rapid industrial transformation. This study explores how Competency-Based Education (CBE) and social constructivism theories inform vocational ability cultivation among design students in Hangzhou vocational colleges. Using quantitative methods, data from 320 students across three institutions were analyzed to measure the relationship between curriculum alignment with CBE, social interaction in learning (a key tenet of social constructivism), and vocational ability outcomes (operationalized as technical proficiency, problem-solving, and teamwork). Results indicate that CBE-oriented curriculum design ($\beta = 0.38$, $p < 0.001$) and collaborative learning environments ($\beta = 0.29$, $p < 0.001$) significantly predict vocational ability, explaining 47.6% of variance in student performance. These findings highlight the value of integrating educational theories into practice to enhance design students' industry readiness.

Keywords

Vocational ability, Design education, Competency-based education, Social constructivism, Quantitative study.

1. Introduction

1.1. Background

Design industries in the Yangtze River Delta, particularly Hangzhou, demand professionals with both technical skills and adaptive problem-solving abilities (Hangzhou Design Industry Association, 2023) [1]. Vocational colleges, as suppliers of mid-level design talent, face challenges in aligning education with industrial needs (Li & Wang, 2022) [2]. Traditional curriculum models, focused on theoretical knowledge transmission, often fail to develop students' practical competencies (Zhang et al., 2021) [3].

1.2. Theoretical rationale

This study anchors on two foundational educational theories:

Competency-Based Education (CBE): Emphasizes learning outcomes tied to specific, industry-validated competencies rather than time-based instruction (Spady, 1994) [4]. For design majors, this means curricula should prioritize skills like software mastery (e.g., Adobe Creative Suite) and client communication, as defined by industry standards.

Social Constructivism: Posits that knowledge is co-constructed through social interaction, collaboration, and contextual learning (Vygotsky, 1978) [5]. In design education, this translates to project-based group work and mentorship, where students refine abilities through peer and instructor feedback.

ISSN: 2710-0170

1.3. Research gaps and objectives

While CBE and social constructivism are widely cited in vocational education research (e.g., Chen & Liu, 2020; Lave & Wenger, 1991) [6-7], few studies quantify their combined impact on design students' vocational ability in Hangzhou's context. This study addresses:

How CBE-aligned curricula correlate with design students' technical and non-technical vocational abilities.

To what extent social constructivist learning environments (e.g., collaborative projects) predict improvements in these abilities.

The combined explanatory power of these theories in predicting vocational ability outcomes.

2. Literature review

2.1. Competency-based education (CBE) in vocational design education

CBE's roots in vocational training date to the 1960s, with Spady (1994) defining it as "a system of education that bases instructional decisions on student demonstration of mastery of competencies" (p. 4) [4]. For design education, CBE requires identifying "terminal competencies" (e.g., branding design, user experience prototyping) through industry surveys (González & Wagenaar, 2003) [8]. Studies show that CBE implementation in Chinese vocational colleges improves graduate employment rates by 15–20% (Ministry of Education, 2022), but its specific impact on design students' technical skills remains understudied [9].

2.2. Social constructivism and collaborative learning

Vygotsky's (1978) zone of proximal development (ZPD) argues that learning thrives when learners interact with more capable peers or instructors [5]. In design education, this is operationalized through studio-based collaborative projects, where students negotiate ideas and solve complex problems (Dillenbourg, 1999) [10]. Lave and Wenger's (1991) "communities of practice" framework further emphasizes that vocational identity—critical for design professionals—develops through participation in industry-like social contexts [11].

2.3. Vocational ability measurement in design fields

Vocational ability for design majors encompasses:

Technical skills: Proficiency in design software, drafting, and material knowledge (Huang, 2020) [12].

Non-technical skills: Teamwork, client communication, and adaptability to new design tools (Zhou & Chen, 2021) [13]. Measurement tools include rubrics for project evaluation (based on industry standards) and self-assessment scales (Li, 2019) [14].

3. Methodology

3.1. Research design

A cross-sectional quantitative study was conducted, with vocational ability as the dependent variable, and CBE curriculum alignment and social constructivist learning practices as independent variables.

3.2. Participants

Stratified sampling was used to select 320 design students (18–22 years old) from three vocational colleges in Hangzhou: Zhejiang Vocational College of Art, Hangzhou Polytechnic, and Zhejiang Institute of Mechanical & Electrical Engineering. Inclusion criteria: enrollment in graphic design, product design, or interior design programs (years 2–3, to ensure exposure to

ISSN: 2710-0170

core curricula). Demographics: 62% female; 58% graphic design majors; 42% product/interior design majors.

3.3. Instruments

CBE Curriculum Alignment Scale: Adapted from Chen and Liu (2020), 12 items measuring alignment with industry competencies (e.g., "Course projects reflect real client needs"). 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Cronbach's $\alpha = 0.87$.

Social Constructivist Learning Scale: 10 items based on Dillenbourg (1999), assessing collaborative activities (e.g., "I frequently revise designs based on peer feedback"). $\alpha = 0.82$.

Vocational Ability Assessment: A 15-item scale combining technical (e.g., "I can independently complete a brand identity project") and non-technical skills (e.g., "I can resolve conflicts in group design projects"). $\alpha = 0.91$.

3.4. Data collection and analysis

Surveys were distributed online (via Wenjuanxing) from March to April 2024, yielding 302 valid responses (94.4% response rate). Data were analyzed using SPSS 26.0:

Descriptive statistics (means, SD) for all variables.

Pearson correlations to examine bivariate relationships.

Multiple linear regression to test the combined effects of CBE and social constructivism on vocational ability.

4. Results

4.1. Descriptive statistics

We calculated the descriptive statistics for all study variables. Table 1 lists the mean (M) and standard deviation (SD) for each variable.

Table 1. Descriptive statistics of variables

Variable	M	SD
CBE Curriculum Alignment	3.72	0.68
Social Constructivist Learning	3.51	0.72
Vocational Ability	3.65	0.65

Note: All variables measured on 5-point scales.

4.2. Correlation analysis

Significant positive correlations were found: CBE alignment and vocational ability: $r = 0.56$, $p < 0.001$. Social constructivist learning and vocational ability: $r = 0.49$, $p < 0.001$. CBE alignment and social constructivist learning: $r = 0.42$, $p < 0.001$.

4.3. Regression analysis

A multiple linear regression model was fitted with vocational ability as the dependent variable (Table 2):

Table 2. Multiple regression analysis of predictors of vocational ability

Predictor	B	SE	β	t	p
(Constant)	0.52	0.18	-	2.89	0.004
CBE Curriculum Alignment	0.39	0.06	0.38	6.50	<0.001
Social Constructivist Learning	0.31	0.07	0.29	4.43	<0.001

Note: $R^2 = 0.476$, $F(2, 299) = 138.21$, $p < 0.001$

ISSN: 2710-0170

The model explains 47.6% of variance in vocational ability, with both predictors contributing significantly. CBE alignment has a stronger impact (β = 0.38) than social constructivist learning (β = 0.29).

5. Discussion

5.1. Key findings in context of educational theories

CBE's Role: The strong positive correlation (r = 0.56) between CBE-aligned curricula and vocational ability supports Spady's (1994) assertion that competency-focused education directly enhances practical outcomes [4]. For design students, this suggests that curricula mirroring industry projects (e.g., client briefs, deadline-driven tasks) effectively build technical skills.

Social Constructivism's Contribution: The significant effect of collaborative learning (β = 0.29) aligns with Vygotsky's (1978) ZPD theory, as peer feedback and group problem-solving push students to refine abilities beyond individual capacity [5]. This is critical for design, where teamwork and client communication are as vital as technical skill (Zhou & Chen, 2021) [13].

5.2. Practical implications

Curriculum Design: Hangzhou vocational colleges should partner with local design firms (e.g., Alibaba Design Center) to validate competencies, ensuring courses prioritize industry-relevant skills (e.g., UI/UX design for e-commerce).

Pedagogical Practices: Instructors should adopt studio-based learning, where students work in teams on real projects, with regular critiques (Lave & Wenger, 1991) [7].

5.3. Limitations

Cross-sectional design limits causal inference; longitudinal studies could track ability development over time.

Self-report data may introduce response bias; future research could include objective assessments (e.g., portfolio evaluations by industry experts).

6. Conclusion

This study quantifies the impact of CBE and social constructivism on design students' vocational ability in Hangzhou. Results confirm that aligning curricula with industry competencies (CBE) and fostering collaborative learning environments (social constructivism) significantly enhance technical and non-technical skills. These findings advocate for theory-driven reforms in vocational design education to bridge the gap between academia and industry.

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