Research on the Construction of a Digital Competency Maturity Model for Marketing Faculty

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Abstract: The digital economy is reshaping the business landscape at an unprecedented pace, compelling higher vocational education to update its talent cultivation models in tandem. For marketing programs, the high degree of integration between teaching scenarios and industrial scenarios has become a "lifeline," and whether teachers can skillfully leverage data insights, MarTech tools, and algorithm platforms both inside and outside the classroom is the "last mile" that determines whether this integration can be effectively implemented. This study took 30 full-time marketing teachers from five higher vocational colleges (C1–C5) in Changzhou City as the sample and adopted an explanatory sequential mixed research paradigm: first, the "5D-5L" digital competency maturity model was extracted using grounded theory; then, its hierarchical validity was verified using structural equation modeling; finally, retrospective interviews were conducted to explain the quantitative anomalies. The study found that: (1) The model consists of five dimensions: digital teaching beliefs, resource integration, teaching design, teaching implementation, and assessment and reflection. The five maturity levels (initial, reactive, managerial, optimized, and innovative) have clear boundaries and strong operational feasibility; (2) The overall sample is in the transitional phase from the "reactive level" to the "management level," with only 13.3% at the "optimization level" or above. Additionally, the path coefficient of "digital instructional design" on classroom teaching effectiveness is as high as 0.46 ($p < 0.001$); (3) Work experience in enterprises has a significant moderating effect on the "resource integration" and "instructional design" dimensions.

Keywords: Digital Competence; Maturity Model; Higher Vocational Education; Marketing Teachers; Mixed Research

1.Research Background and Problem Statement

Digital transformation has evolved from a macro-level policy slogan to micro-level classroom practice. The Ministry of Education's 2022 Guidelines for the Construction of Digital Campuses in Vocational Education explicitly stipulate that by 2025, the qualified rate of digital teaching capabilities among vocational college teachers must reach 90%. However, the pace of digital updates in marketing programs far exceeds that of other business disciplines: domestic mainstream advertising DMP platforms undergo major version updates twice a year, and the "window period" for live-streaming e-commerce traffic rules is measured in weeks. If vocational college classrooms remain stuck at the "case study screenshots plus PowerPoint presentation" level, graduates will face the awkward reality of "knowledge half-life."

Existing research primarily focuses on basic education or general undergraduate programs, lacking in-depth analysis of the dual context of "vocational education—marketing." Additionally, the "information technology teaching capability" assessment tools commonly used in vocational colleges overly emphasize generic technical operations while neglecting core marketing competencies such as data insights, business ethics, and cross-platform integration. Therefore, this study addresses two core questions:

RQ1: What is the current state of digital competence among marketing faculty at higher vocational colleges in Changzhou?

RQ2: How can a maturity model that balances professional depth and practical applicability be constructed and validated, thereby establishing a sustainable improvement pathway?

2. Literature Review and Theoretical Foundation

2.1 Conceptual Framework and Evolutionary Trajectory of Digital Competency

The United Nations Educational, Scientific and Cultural Organization (UNESCO, 2018) defines digital competence as "the ability to use information technologies confidently, critically, and creatively in work, learning, and social participation" [1]. This definition laid the foundation for global policy frameworks but primarily targeted general citizens, lacking sensitivity to disciplinary and occupational contexts. To address this limitation, the European Commission subsequently introduced the DigComp 2.1 [2] and DigCompEdu frameworks [3]. DigComp 2.1 breaks down the five domains of "information and data literacy," "communication and collaboration," and "digital content creation" into eight proficiency levels, suitable for general self-assessment; DigCompEdu further maps the 22 sub-competencies to six educational contexts such as "professional engagement" and "teaching practice," emphasizing its specificity for teaching. However, these frameworks primarily adopt a "technology-instruction" dual perspective and lack a description of marketing-specific competencies such as data insight, business ethics, and cross-platform integration.

In terms of domestic research, Wang Zhuli (2021) proposed the concept of "digital teaching power," deconstructing it into "data-driven decision-making ability, technology integration and innovation ability, and digital ethics leadership ability" [6], which for the first time incorporated data literacy and ethical dimensions into the scope of teacher competencies; Hu Xiaoyong and Xu Fuyin (2020) drew inspiration from the CMM framework to develop an "Information Technology-Enabled Teaching Capability Maturity Model," categorizing teacher development into four stages: "initial," "development," "integration," and "innovation" [7]. However, these studies remain focused on general information technology and pay insufficient attention to the unique aspects of marketing, such as the MarTech stack, DMP/CDP platform operations, and real-time traffic rule iterations.

2.2 Research Progress on Maturity Models in the Education Field

The concept of maturity originated from the Capability Maturity Model (CMM) in software engineering (Paulk et al., 1993). In the past decade, this concept has been transferred to the educational context, forming tools such as e-Teacher CMM [4], the DELTA framework [5], and TPACK-CMM [8]. Their common logic is to describe teachers' growth trajectories using a three-part chain of "level—behavior description—evidence," accompanied by diagnostic scales and improvement suggestions. For example, Romero et al. (2021) conducted a large-scale validation of teachers in 14 European countries based on DELTA and found that "teaching design optimization" and "learning analytics application" are key bottlenecks for high-level maturity [4]. However, these models mostly focus on general information technology capabilities and lack a description of the characteristics of marketing disciplines, such as "data insight" and "rapid tool iteration," resulting in limited explanatory power in the dual context of "vocational education and marketing."

2.3 Special Requirements of the Marketing Professional Context

Overseas research has summarized marketing teacher competencies as "MarTech teaching conversion capabilities" (Miao & Hoffman, 2022) [5], which includes a four-stage, twelve-item framework comprising "tool master—data narrative—strategy validation—ethical reflection," and emphasizes the importance of a classroom-to-enterprise data feedback loop. Domestically, research remains at the case description stage, primarily focusing on scattered experiences such as "live-streaming e-commerce cases in the classroom" and "TikTok advertising simulations," lacking systematic models and empirical validation.

Notably, vocational colleges and universities adopt a four-pronged approach of "teaching + practical training + competitions + social services," which imposes higher demands on teachers' ability to access real-time data and design cross-platform tasks. For example, in information flow advertising training, teachers need to simultaneously operate multiple platform accounts such as ByteDance's Toutiao, Tencent Ads, and Kuaishou's Magnet Gold Bull, real-time retrieve metrics like ROI, CTR, and CPC, and dynamically adjust task weights based on traffic decay curves. This high-frequency iterative practical scenario represents the "gray area" where existing generic models are lacking.

2.4 Theoretical Foundation

(1) Technology-Pedagogical Content-Pedagogical Knowledge Framework (TPACK): Proposed by Mishra & Koehler (2006), this framework emphasizes the interactive integration of "technology (T)," "pedagogical methods (P)," and "content knowledge (C)" [9]. In this study, the "content knowledge" component of TPACK is further refined into "marketing discipline knowledge + MarTech stack knowledge" to highlight the contextual specificity.

(2) Capability Maturity Model (CMM): Describes the path of capability development through a "level-key practice-evidence" structure, providing a logical prototype for the "5D-5L" matrix in this study.

(3) Data-Driven Instructional Decision-Making Theory: This theory emphasizes that teachers should adjust teaching strategies in real time based on learning analytics and business data, aligning with the advanced requirements of the "digital instructional design" dimension.

3. Research Design

3.1 Research Paradigm and Overall Approach

This study follows Creswell (2015)'s "explanatory sequential mixed methods" design (ESMM), whose logic is as follows:

Table 1. ESMM

Phase I	Qualitative Research	Constructing the "5D-5L" digital competency maturity model from the bottom up based on grounded theory
Phase II	Quantitative research	Developing scales and conducting large-scale surveys, and validating the hierarchical validity of the model using structural equation modeling (SEM)
Phase III	Retrospective interviews	Conduct semi-structured interviews to interpret the meaning of "abnormal data" identified in the quantitative phase.

3.2 Research Sample

A total of 30 valid samples were obtained from full-time marketing faculty members, covering the following dimensions:

① Teaching experience:≤5 years (young teachers) 10 people, 6–15 years (mid-career teachers) 14 people, >15 years (senior teachers) 6 people; ② Corporate internship experience: ≥6 months 9 people (30%), <6 months or none 21 people; ③ Technical background: Computer science or information management minor/second degree 6 people, the remainder with a pure business background; ④ Competition experience: 11 with awards from provincial-level or higher teaching competitions; ⑤ Gender: 12 male, 18 female; ⑥ Professional title: 17 assistant professors/lecturers, 10 associate professors, 3 professors. The sample characteristics exhibit a "small at both ends, large in the middle" distribution of teaching experience, aligning with the actual structure of higher vocational colleges, which primarily consist of young teachers and teachers transitioning from other roles.

3.3 Data Collection

3.3.1 Semi-structured interviews

From November 2024 to June 2025, 30 in-depth interviews were conducted, each lasting 45–70 minutes, with a total of 213,000 words transcribed. During this period, an expert focus group (n=4) developed an interview outline covering four major modules—"technical knowledge—teaching application—situational challenges—growth aspirations"—with 12 core questions.

3.3.2 Classroom Observation

Randomly select 15 teachers, each observing 2 lessons, totaling 30 lessons. Adapt the OTOP scale into the "MarTech Classroom Observation Scale," which includes 14 observation points such as "tool usage frequency," "data task complexity," and "teacher-student interaction patterns."

3.3.3 Questionnaire Survey

Based on qualitative coding results, 34 questions were developed through expert review (n=5), followed by a pilot test (n=46) to remove 6 items, leaving 28 questions. Scoring used a 5-point Likert scale. The electronic questionnaire was distributed to targeted recipients, with 30 valid responses collected, achieving a 100% response rate. Questionnaire reliability and validity: Cronbach's α = 0.92, KMO = 0.88, Bartlett's sphericity test $p < 0.001$.

3.3.4 Work analysis

Two student training reports and three teacher teaching design plans were randomly selected from each course, totaling 60 student training reports and 30 teacher teaching design plans, for triangular verification to examine the consistency between teachers' self-reported teaching behaviors and actual teaching practices.

4. Research Results

4.1 Qualitative Research Results: The "5D-5L" Digital Competency Maturity Model

4.1.1 Model Structure

Through grounded theory coding, the following five main categories (Dimensions, D1-D5) were identified. Each dimension is vertically divided into five levels (Levels, L1-L5), forming a "5D-5L" matrix (see Table 1 for an example).

Table 2. 5D Matrix Model

D1	Digital Teaching Beliefs	From "Technology Anxiety" to "Data-Driven Educational Transformation"
D2	Resource Integration	From "Single-Point Tools" to "Cross-Platform Data Warehouses"
D3	Digital Instructional Design	From "Case Studies" to "Classroom-to-Enterprise Data Loop"
D4	Teaching Implementation	From "rote instruction" to "real-time algorithm parameter tuning"
D5	Assessment and Reflection	From "Outcome-Based Testing" to "ROI Multi-Dimensional Assessment"

Table 3. 5L Matrix Model

L1	Initial	Only uses short videos as an introduction, with no data tasks
L2	Response	Assign "watch-discuss" tasks, but not linked to KPIs
L3	Management	Design an "advertising A/B testing" task sheet and clearly define the data collection dimensions
L4	Optimize	Dynamically adjust task weights based on real-time data
L5	Innovation	Students propose hypotheses, teachers provide API interfaces for verification, forming a classroom-to-industry data feedback loop

This matrix was evaluated by an expert panel (n=6) with a Content Validity Index (CVI) of 0.93.

4.1.2 Key findings

Qualitative evidence indicates that teachers' primary challenge is not "inability to use the tools," but rather "lack of knowledge on how to convert business data into educational data"; Enterprise-based teachers consistently mentioned that "the version of the DMP platform purchased by the school differs from the version actually used by the company," leading to outdated classroom cases; Young teachers are more proficient in "technology experimentation" but have blind spots in the "ethics and compliance" dimension.

4.2 Quantitative Research Results

4.3.1 Measurement Model Validation

Reliability: Cronbach's α ranged from 0.83 to 0.91; composite reliability CR ranged from 0.85 to 0.93; Convergent validity: AVE values ranged from 0.51 to 0.67, factor loadings ranged from 0.63 to 0.89, all meeting the Fornell-Larcker criteria; Discrimination validity: HTMT ratios were all<0.85; Model fit: χ^2/df=1.93, CFI=0.94, TLI=0.93, RMSEA=0.049, SRMR=0.038, indicating good model fit.

4.3.2 Structural equation modeling results

Using teaching effectiveness (student satisfaction + learning outcomes) as the outcome variable, a structural model was constructed:

Digital instructional design → Teaching effectiveness: β=0.46, $p<0.001$, with the highest explanatory power;

Digital Teaching Implementation → Teaching Effectiveness: β=0.28, $p<0.05$;

Digital assessment and reflection → Teaching effectiveness: β=0.31, $p<0.01$;

Overall explanatory power of the model: R^2 = 0.54;

All dimension VIF values <3, excluding severe multicollinearity.

4.3.3 Differences and Moderating Effects

Enterprise internship experience: In the "resource integration" dimension, the internship group scored significantly higher than the non-internship group (M=3.82 vs 3.17, t=2.97, $p<0.01$); Similarly significant in the "teaching design" dimension ($M=3.95$ vs 3.28, $t=2.83$, $p<0.01$); The Process macro analysis revealed that on-the-job training experience exerted a significant chained mediating effect through the pathway "resource integration → instructional design → teaching effectiveness" (Effect = 0.12, 95% CI = [0.03, 0.24]). Age main effect: $F=3.47$, $p<0.05$. Young teachers (≤5 years) scored significantly higher than senior teachers (>15 years) in the "resource integration" dimension, which may be related to their inherent digital native characteristics. No significant differences were found in gender, professional title, or competition award experience.

4.3 Retrospective Interview Results

To explain the anomaly of "high resource integration but low teaching design" observed in the quantitative phase, retrospective interviews were conducted with six teachers.

Teacher T12: "The school purchased DataFocus and organized two training sessions, but the training content focused primarily on 'drag-and-drop charts,' lacking alignment with course objectives. This resulted in us only being able to display charts in class and unable to design data tasks."

Teacher T07: "My internship at a company exposed me to the latest DMP version, but the school's computer lab is still using an older version, so students cannot replicate my examples."

Teacher T23: "I am familiar with the Jutian Qianchuan backend, but I am concerned that students might accidentally incur real costs, so I dare not open real accounts."

Interview results reveal that tool version discrepancies, training content mismatches, and insufficient access to real-world data are the three key obstacles hindering teachers from advancing to higher levels of proficiency.

5. Discussion

5.1 Theoretical Contributions

This study is the first to embed the CMM framework into a higher vocational marketing context, addressing the research gap between "discipline" and "context." It also reveals the leverage effect of "digital instructional design" on teaching effectiveness, providing precise targets for teacher professional development.

5.2 Practical Implications

5.2.1 Individual level:

Teachers are advised to use the "5D-5L" radar chart as a reference and prioritize improving D3. Young teachers can leverage the "Rising Talent Program" to collaborate with enterprises on micro-courses; senior teachers can address data deficiencies through a "corporate mentor + reverse job shadowing" approach.

5.2.2 Institutional Level:

Establish a closed-loop system of "diagnosis—training—certification—incentives." The diagnosis phase uses the scales from this study to generate individual reports each semester; the training phase is tiered by maturity level: introductory level focuses on tool operation, while management level and above emphasize course redesign; the certification phase collaborates with Alibaba and ByteDance to develop a "MarTech Teaching Competency" certificate; the incentive phase links the certificate to title promotions and performance bonuses.

5.2.3 Policy level: Changzhou Science and Education City can establish a "Marketing Digital Teaching Resource Sharing Repository" and open API access and industry datasets to the five universities; the Municipal Education Bureau should allocate special funds to support teachers in participating in "Digital Marketing 1+X Certificate" instructor training.

5.3 Research Limitations and Outlook

The sample is limited to Changzhou, with potential for expansion to the Yangtze River Delta vocational education cluster; cross-sectional data was used, and future studies could conduct a two-year longitudinal follow-up to validate the maturity enhancement mechanism; simultaneously, learning analytics technology could be introduced to enable dynamic real-time assessment.

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