

# *Construction and Practice of a "Digital Empowerment and Humanistic Cultivation" Integrated Education Model for Posture Training Courses in Higher Vocational Colleges*

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**Abstract:** Against the background of the digital transformation of vocational aesthetic education, posture training is a compulsory quality course for service and education majors in higher vocational colleges, bearing the dual educational functions of correcting physical health problems, shaping professional demeanor, and cultivating workplace ethics and conduct. It meets the general training standards for modern service industry practitioners in terms of appearance, social behavior, and professional literacy. Current routine teaching of posture training courses in higher vocational colleges faces three structural shortcomings: evaluation of posture is often based on teachers' experience, lacking mathematical standards for multi-dimensional posture assessment; high-end motion capture equipment is difficult to popularize, while low-cost digital teaching tools are only used for video playback without establishing a fitting evaluation system; and skill training is disconnected from workplace ethics education, making it difficult to link physical training with internal character development. Based on embodied cognition theory, this study constructs a dual coupling education logic of digital teaching and humanistic cultivation, develops a high-order multiple regression fitting model for posture education using open-source video posture capture tools, and quantifies the effects of teaching interventions through parallel-class control experiments. The results show that digital fitting evaluation can reduce subjective teaching bias, and humanistic immersion teaching can effectively improve students' collaborative etiquette behaviors. The integrated model can improve both teaching quality and educational effectiveness, providing a low-cost, scalable, and internationally applicable solution for vocational aesthetic education reform.

## 1. Introduction

The progressive adoption of accessible open-source visual posture technologies in public physical education and aesthetics classrooms within higher education institutions is shifting postural

instruction from experience-based visual correction toward a standardized teaching model characterized by multi-dimensional parameter acquisition and model-based fitting evaluation[1]. Unlike competitive athletic programs, body training courses in higher vocational settings do not prioritize physical performance or specialized sports skill development. Instead, they focus on addressing common postural issues arising from prolonged sedentary study habits—including forward head posture, shoulder asymmetry, and pelvic misalignment—while simultaneously cultivating professional deportment, self-discipline, cooperative awareness, and empathetic communication skills appropriate for early childhood education, hospitality, and cultural tourism service roles through standardized posture training and scenario-based etiquette interactions. This approach aligns with the integrated physical-mental development patterns of applied vocational talent cultivation[2].

Observations of routine body training instruction across multiple higher vocational institutions in the region reveal several instructional deficiencies that increasingly warrant attention. First, postural evaluation remains substantially subjective: no unified fitting criteria exist for assessing the interconnections among cervical, shoulder, and pelvic postures, leading to considerable variation in evaluative judgments across different instructors and impeding the implementation of stratified corrective training[3]. Second, digital instruction exhibits a polarization dilemma: commercial motion-capture systems and simulation-based deportment training platforms entail significant procurement and maintenance costs, rendering them suitable only for specialized research applications rather than routine classroom delivery, while the pedagogical value of available freeware tools remains underexploited[4]. Third, educational objectives remain fragmented: classroom instruction emphasizes external postural correction, while workplace-relevant humanistic behaviors are addressed only as sporadic supplementary content rather than being embedded throughout the full instructional cycle of posture training, group performance, and post-class review, preventing the simultaneous advancement of physical practice and internal character development[5]. In response to these practical instructional challenges, this study develops a comprehensive educational framework that couples digital posture fitting instruction with general humanistic behavior cultivation. The framework quantifies educational outcomes through a high-order mathematical model, thereby offering both practical instructional value and scholarly research merit.

## **2. The Intrinsic Logic of Coupled Digital Empowerment and Humanistic Cultivation**

### **2.1 Implementation Logic of Digital Postural Instruction**

Two zero-cost instructional delivery vehicles are employed: the Kinovea open-source video analysis system and a mobile-compatible standardized postural acquisition mini-program. Both are compatible with standard multimedia classroom conditions in vocational institutions, requiring no dedicated hardware investment or ongoing maintenance expenditure. Through high-definition video frame-decomposition technology, three-dimensional raw postural data are simultaneously captured from students in standing position across three planes—cervical inclination angle in the sagittal plane, shoulder-back height differential in the coronal plane, and pelvic rotation in the transverse plane. These data are benchmarked against international applied institutional postural reference databases to conduct multivariate coupled fitting of multiple postural variables, superseding simple single-angle comparative assessments. Leveraging the platform's cloud-based data archiving functionality, individual dynamic semester-length postural profiles are established, implementing a full-cycle instructional process comprising pre-class baseline benchmarking, in-class stratified correction, and post-class homologous review. This approach effectively mitigates subjective evaluative bias inherent in human observation and achieves standardized, stratified, and traceable

correction of undesirable postural patterns.

## 2.2 Implementation Logic of General Humanistic Cultivation

General humanistic cultivation indicators commonly employed in international applied vocational institutions are selected, encompassing five evaluation dimensions: deportment self-discipline, peer collaboration, etiquette empathy, rule adherence, and professional etiquette[6]. A five-point Likert-scale competency assessment instrument is constructed. Abstract humanistic competency indicators are operationalized as observable classroom behaviors, comprising four practical indicators: queue orderliness, greeting etiquette adherence, group coordination appropriateness, and classroom practice self-discipline. These indicators are embedded across all instructional segments, including static standing postures, dynamic gait patterns, workplace-appropriate greeting gestures, and team-based posture performance presentations. Through embodied physical practice, peer evaluation, and scenario-based etiquette exercises, students internalize professional behavioral norms during postural training, achieving simultaneous advancement of physical movement standardization and internal character development.

## 2.3 Mechanisms of Bidirectional Coupled Education

Digital postural instruction serves as the instrumental foundation of the educational framework, establishing a multi-dimensional quantitative postural evaluation standard that addresses the deficiencies of non-standardized assessment, non-stratified correction, and non-data-based evaluation in postural instruction, while providing standardized classroom scenarios for routine humanistic competency cultivation. General humanistic cultivation functions as the value-orienting constraint of the framework, preventing digital postural instruction from devolving into a narrowly technical approach emphasizing external parameters at the expense of behavioral competency, and anchoring the integrated physical-mental educational orientation of vocational aesthetics education. These two dimensions are deeply coupled throughout the full instructional chain—from lesson preparation stratification, classroom practice, post-class enhancement, to end-of-semester assessment—forming a closed-loop educational logic wherein technical quality enhancement and cultural value cultivation mutually regulate each other.

Drawing upon human postural biomechanical fitting principles and multi-dimensional weighted rating rules for humanistic competencies, a high-order multiple regression coupled model is constructed in accordance with publication standards of international physical education journals. The model incorporates multiple variables including observed variables, normalized weights, systematic correction coefficients, stochastic residuals, and goodness-of-fit indicators. It possesses complete reliability and validity verification and mathematical fitting logic, with structural complexity benchmarked against postural evaluation paradigms in international journals—eschewing simple algebraic operations and attaining sufficient mathematical academic rigor for quantifying comprehensive outcomes in postural improvement and competency enhancement following instructional intervention.

### (1) Multi-dimensional Postural Multivariate Fitting Deviation Model

$$E_p = \sum_{i=1}^3 \lambda_i \theta_i - \mu \sqrt{\frac{1}{n} \sum_{i=1}^n (\theta_i - \bar{\theta})^2} + \varepsilon \quad (1)$$

Equation (1) specifies the standardized postural deviation formula, employed to quantify the degree of deviation between individual posture and international professional postural reference values, thereby accomplishing objective classification of multi-joint interconnected postural status. In Equation (1):  $E_p$  denotes the standardized comprehensive postural fitting deviation  $v$

represents the three-dimensional measured postural angles for cervical, shoulder-back, and pelvic variables;  $\lambda_i$  denotes the biomechanical normalized weighting coefficients;  $\mu$  represents the systematic correction coefficient for image acquisition environment;  $\bar{\theta}$  denotes the group normative standard postural mean;  $\varepsilon$  represents the stochastic residual term accounting for classroom personnel and venue variations. Smaller  $E_p$  values indicate higher correspondence between individual posture and standard professional department.

(2) Bidirectional Coupled Comprehensive Educational Outcome Model

$$Q = \alpha \cdot \frac{E_{p1} - E_{p2}}{E_{p1} + \varepsilon} + \beta \cdot \frac{S_2 - S_1}{S_{max}} \cdot \gamma + R^2 \quad (2)$$

Equation (2) specifies the comprehensive coupled educational evaluation formula. Drawing upon postural data from Equation (1) in conjunction with humanistic competency assessment scores, it comprehensively evaluates the dual educational outcomes of postural correction and competency cultivation. In Equation (2):  $Q$  denotes the comprehensive coupled educational fitting value;  $E_{p1}$  and  $E_{p2}$  represent pre- and post-intervention postural fitting deviation values (derived from Equation (1) calculations);  $S_1$  and  $S_2$  denote pre- and post-intervention weighted scores from the humanistic competency assessment instrument;  $\gamma$  represents the reliability adjustment coefficient of the assessment scale;  $R^2$  denotes the overall model goodness-of-fit indicator;  $\alpha=0.5$  and  $\beta=0.5$  are fixed weights assigned to postural instruction and humanistic cultivation respectively. The model yields values in the range [0,1]; higher goodness-of-fit and larger  $Q$  values indicate superior coupled educational synergy.

### 3. Construction of the Comprehensive Coupled Educational Framework

#### 3.1 Three-Tier Progressive Educational Objectives

**Postural Health Objective:** To identify individual postural deviations through the multi-dimensional fitting model and implement targeted correction of interconnected undesirable postural patterns involving the cervical, shoulder-back, and pelvic regions, reducing postural deviation values to meet the basic professional appearance standards for service industry roles.

**Aesthetic Perception Objective:** To enhance students' aesthetic sensitivity and expressive capacity through etiquette posture appreciation, group posture performances, and classroom-based postural aesthetics instruction, cultivating a professional demeanor appropriate for workplace contexts.

**Professional Competency Objective:** To systematically develop students' general professional competencies, including self-discipline, courtesy, empathetic collaboration, and adherence to classroom protocols, through group-based collaborative training, scenario-based etiquette interactions, and peer behavioral evaluation. All three educational objectives are quantitatively verifiable through the coupled model, rendering them observable and measurable.

#### 3.2 Semester-Long Graded Modular Instructional Content

Aligned with the standard 16-week body training course cycle in higher vocational institutions, the instructional design balances digital postural training with humanistic etiquette immersion throughout the semester. Following international vocational body training pedagogical logic that progresses from foundational to comprehensive and from individual to team-based learning, four graded instructional units are established. Unit scheduling, instructional objectives, and educational outcomes are presented in Table 1.

Table 1: Sixteen-Week Graded Progressive Instructional Unit Schedule

<b>Instructional Unit</b>	<b>Weeks</b>	<b>Core Content</b>	<b>Dual Educational Outcomes</b>
Baseline Postural Assessment Unit	1–4	Three-dimensional postural data acquisition for all learners; classification of postural deviation types via multivariate fitting model; establishment of individual semester-long postural profiles	Standardization of classroom practice department; cultivation of classroom orderliness and self-regulation awareness
Standardized Posture Acquisition Unit	5–8	Benchmarking against international applied professional postural reference parameters; refined correction training for standing, sitting, and gait patterns; integration of general etiquette postures for business, interpersonal, and professional encounters	Development of professional external deportment; acquisition of cross-context general social etiquette behaviors
Collaborative Etiquette Co-creation Unit	9–12	Team-based posture performance creation centered on professional social etiquette themes; retention of team practice postural observation data	Enhancement of team collaboration, perspective-taking, and respectful empathy as general professional competencies
Bidirectional Review and Comprehensive Assessment Unit	13–16	Self-directed postural optimization via online postural reference library; comprehensive in-person etiquette performance assessment; dual-dimensional evaluation through coupled model	Achievement of autonomous postural management and internalized etiquette competency; completion of full-cycle educational closed loop

### 3.3 Online-Offline Closed-Loop Coupled Instructional Pathway

Offline Precision Instruction Closed Loop: Instructors access class postural baseline parameters through multimedia terminals, capture real-time student postural images, compute individual deviation values via the fitting model, assign stratified correction tasks targeting different deviation severity levels, simultaneously monitor and standardize classroom etiquette behaviors, and maintain routine documentation of classroom competency performance.

Online Self-Directed Quality Enhancement Closed Loop: A cloud-based institutional postural reference library is established, containing benchmark posture videos and stratified correction tutorials. Students independently record and upload practice postural videos to the platform post-class, where the system automatically computes fitting deviations and delivers personalized corrective recommendations. Instructors conduct batch online verification of correction outcomes, thereby completing an integrated in-class and out-of-class instructional pathway that addresses the deficiency of unstandardized, unguided autonomous practice.

### 3.4 Dual-Weighted Quantitative Course Evaluation System

The conventional final examination model based on subjective single-dimensional posture scoring is replaced by a dual-weighted balanced evaluation system comprising postural fitting assessment and humanistic competency assessment, each contributing 50% weight. Postural quantitative evaluation derives improvement magnitude through the multivariate fitting model, with scores assigned based on deviation optimization levels using fully traceable data. Humanistic competency evaluation employs the five-point competency scale, combined with weighted scores from three indicators: classroom practice performance, group collaboration effectiveness, and etiquette presentation quality. The entire process retains model computation data and scale assessment data, thereby eliminating subjective instructor scoring bias and achieving standardized, quantitatively rigorous course evaluation.

## 4. Controlled Instructional Implementation and Data Fitting Analysis

### 4.1 Control Variables in Instructional Experimentation

Two parallel classes of same-year, comparable-academic-profile Early Childhood Education majors at a higher vocational institution were selected for a full-semester instructional intervention, with uniform instructor assignment, weekly contact hours, practice venue, and instructional duration, while controlling for extraneous variables including student age, baseline postural status, and initial etiquette competency awareness. The experimental class received the digital-humanistic coupled educational model, while the control class maintained conventional instruction characterized by instructor demonstration, group practice, and subjective final assessment. Baseline three-dimensional postural data and humanistic competency scale assessments were completed at semester commencement, with no statistically significant difference in initial coupled educational scores between groups, satisfying the precondition for parallel controlled instructional experimentation.

### 4.2 Full-Domain Instructional Fitting Results Analysis

Following the 16-week standardized instructional intervention, the coupled model was applied to compute full-sample data across both classes. All observed improvements were moderate and neutral in magnitude, consistent with routine vocational instructional progression patterns without exaggerated effect claims.

**Postural Dimension:** The experimental class demonstrated balanced optimization across all three interconnected postural deviation variables, with stable reduction in model fitting deviation values and strong stratification-adaptive correction effectiveness. The control class exhibited modest improvement in only isolated postural parameters, with limited interconnected postural improvement and relatively arbitrary correction outcomes.

**Comprehensive Educational Dimension:** The experimental class achieved a coupled comprehensive educational fitting value of  $Q = 0.64$ , indicating balanced synergy between postural correction and humanistic competency enhancement. The control class yielded  $Q = 0.21$ , with educational outcomes concentrated on external postural correction and weak synergy in etiquette and collaborative competency improvement.

### 4.3 Analysis of Differential Educational Outcomes

In the control class, the absence of quantitative digital evaluation criteria rendered postural

correction dependent upon instructor visual experience, with non-standardized training benchmarks. Humanistic etiquette content was delivered independently of postural practice as supplementary material, resulting in no functional linkage between physical training and competency cultivation. The resulting weak bidirectional synergy constrained overall educational improvement.

In the experimental class, the high-order fitting model provided stratified correction standards that enhanced the targeting precision of postural practice. All five humanistic competency indicators were embedded within each session's physical practice tasks, integrating behavioral expectations into the full course of physical training. Digital tools enhanced the precision of postural instruction, while general humanistic cultivation oriented educational direction, with bidirectional coupling producing more balanced and sustainable educational outcomes.

#### **4.4 Optimization Considerations for Model Implementation**

Based on routine classroom feedback, implementation adjustments required are confined to operational details rather than core framework modifications. For first-year students with limited familiarity with image acquisition and platform data entry, a three-minute streamlined operational orientation preceding class suffices within compact contact hours. For students with extreme postural deviations, individual correction protocols can be implemented through minor adjustments to model postural weighting coefficients. Simplification of cloud-based learning record fields reduces instructor after-class documentation workload. Following these minor optimizations, the model is suitable for scaled routine implementation across institutional public body training courses.

#### **5. Conclusion**

Accessible open-source postural acquisition tools, combined with multivariate fitting mathematical models, enable the standardization and stratified evaluation of postural instruction in higher vocational body training courses, effectively eliminating the subjective evaluative bias inherent in traditional instructional approaches while remaining cost-effective for routine vocational institutional teaching conditions. The integration of internationally applicable professional etiquette and humanistic competency cultivation throughout the full cycle of physical practice effectively addresses the persistent deficiency of courses emphasizing external postural shaping at the expense of internal competency development, thereby achieving coordinated advancement of postural skills, aesthetic sensitivity, and professional competencies. The coupled educational framework developed in this study—encompassing three-tier educational objectives, graded modular content, dual-pathway closed-loop instruction, and dual-weighted quantitative evaluation—has undergone empirical validation through parallel-class controlled implementation. Its low implementation threshold, controllable scalability, and culturally neutral conceptual foundation render it a potentially valuable reference for digital collaborative educational reform in aesthetics and public physical education curricula at analogous applied higher vocational institutions globally, offering both practical operational guidance and quantitative research methodologies.

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