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Reconstructing the "Competency-Based—Digitally Empowered" Dual-Wheel-Drive Teaching Model for Vocational Undergraduate Education in the Context of Generative Artificial Intelligence

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Abstract: Vocational undergraduate classrooms have long faced the dual pull of "academic drift" and "vocational narrowness," and the intervention of generative artificial intelligence has further complicated this contradiction: the abundance of technological tools does not automatically translate into a deepening of competency cultivation; on the contrary, it may obscure the "logic of competency" with the "logic of efficiency." Grounded in competency-based education theory and in light of the overlapping "academic" and "vocational" characteristics of vocational undergraduate education, this paper proposes a reconstruction approach for a "competency-based—digitally empowered" dual-wheel-drive teaching model: anchored on a job-competency map, driven by a three-level project chain of "basic functions—compound functions—system integration," closed by an AI-assisted evaluation of "process-based competency evidence," and supported by teacher competency transformation and institutional safeguards, so that the use of digital tools is always subject to the test of whether it has promoted the generation of complex vocational competencies. The study argues that the essence of dual-wheel drive is not a simple superposition of "competency" and "technology," but rather the disciplining of technological logic by competency logic, so as to prevent generative AI from pushing vocational undergraduate teaching into a new trap that "looks efficient but is hollow at its core."

Keywords: Vocational undergraduate education; Competency-based; Generative artificial intelligence; Digital empowerment; Teaching model

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1. Problem statement

The typological exploration of vocational undergraduate education has entered deep water, yet the deeper

contradictions at the classroom level remain far from resolved. A rather representative predicament is the "academic drift" of the curriculum model combined with a "neither-fish-nor-fowl" training objective: students acquire neither the systematic disciplinary training of a regular undergraduate program nor the solid operational skills of a higher vocational college. This predicament points directly to a structural fact: vocational undergraduate education has not yet, for the time being, found an independent logic for its curriculum and teaching model that distinguishes it from either regular undergraduate education or higher vocational education.

The rapid spread of generative artificial intelligence has added a new variable to this predicament and has also brought new cognitive misconceptions. A spreading assumption is that as long as AI tools are introduced into the classroom, personalized learning, precision evaluation, and the cultivation of complex competencies will come about naturally. However, there is no automatic causal relationship between an abundance of technological tools and a deepening of competency cultivation. Without competency-based anchoring, the most likely effect of AI in the vocational undergraduate classroom is precisely "the substitution of efficiency for depth": students use generative tools to complete tasks more quickly, and teachers use intelligent systems to advance processes more "smoothly," yet the abilities that underpin the "academic nature" of vocational undergraduate education—the ability to solve complex engineering problems, to optimize process solutions, and to handle on-site difficulties—may instead be concealed by the appearance of "completion."

In 2026, the "AI + Education" Action Plan issued by the Ministry of Education and four other departments explicitly proposed that, at the vocational education stage, efforts should be made to "promote the intelligent transformation of programs related to traditional industries" and to scientifically design an "AI +" curriculum and teaching system. The policy direction is clear, but the operational logic of "how to transform" remains vague. The core question this paper attempts to answer is: under the condition that generative AI is deeply embedded in the teaching process, what should the classroom teaching model of vocational undergraduate education be "anchored" on in order to be reorganized, so that digital empowerment can truly serve the generation of complex vocational competencies rather than sliding towards technological formalism?

2. How the two wheels mesh: Disciplining technological logic with competency logic

The formulation of a "competency-based—digitally empowered" dual-wheel drive has already been explored in prior research. Wang Yakun et al. constructed a four-tier structure of "objectives—drivers—practice—safeguards" for the software engineering technology program, systematically integrating curriculum optimization, assessment reform, AI assistance, and faculty development into an operational teaching-reform framework. The contribution of this model lies in providing a structured implementation path, but its theoretical premise needs to be clarified more self-consciously: the two "wheels" are not in a relationship of parity. Competency-based education is the driving wheel, and digital empowerment is the driven wheel; the selection, mode of use, and evaluation criteria of technological tools must accept the discipline of competency logic [1].

This judgment has its basis in the typology of education. Jiang Shihui et al. pointed out that one of the core shifts in the paradigm of talent cultivation in vocational undergraduate education in the era of

digital intelligence is the move from "knowledge transmission" to "competency generation." In the context of vocational undergraduate education, so-called "competency generation" encompasses at least three irreplaceable dimensions: the ability to define problems when facing ill-structured real work situations; the ability to weigh and optimize among multiple possible process solutions; and the ability to "land" a technical solution under on-site conditions and to handle unexpected deviations. These competencies are difficult to acquire through the acquisition of information or the imitation of procedures; they are generated within the cycle of "doing" and "reflection" [2].

The value of digital empowerment should be anchored precisely on this "cycle" rather than replacing it. Generative AI can help students quickly obtain background information, generate preliminary solutions, and simulate multiple scenarios, but it cannot make engineering judgments for students, nor can it bear the responsibility for reflection after a solution fails. If the design of the teaching model allows AI to take over the judgment and reflection that should be completed by learners, then "empowerment" turns into its opposite. Therefore, the essence of dual-wheel drive is not the addition of "competency" and "technology," but rather the use of the competency map as a yardstick to functionally delimit the usage scenarios of each digital tool: it should expand the space in which students try and reflect, rather than compress that space.

3. Four fulcrums for reconstructing the teaching model

3.1. The competency map as the "hard boundary" of curriculum reorganization

The deep-seated reason for the "academic drift" of vocational undergraduate curricula lies not in the difficulty of the content but in the logic of organization. Disciplinary logic takes the completeness of a knowledge system as its guiding principle, whereas work logic takes the completeness of task completion as its guiding principle. If digital empowerment merely embeds a few AI tools into disciplinary chapters, it cannot change the nature of the curriculum. The true starting point of reconstruction is to first establish a "competency map" at the program level, and then to cut and reorganize the curriculum content in reverse on that basis [3].

The construction of the competency map needs to start from the typical work tasks of core positions, identify the progressive tiers of "basic engineering operation competency—integrated engineering application competency—innovative engineering practice competency," and map them onto specific course units. The function of this map is not a decorative list of competencies, but to set a "hard boundary" for the use of AI tools: any technical function that cannot point to a certain competency node in the map, no matter how "intelligent" it is, should not enter the priority sequence of curriculum design. For example, in a unit whose competency objective is "process parameter optimization," the role of AI should be to provide simulation results under multiple sets of parameter conditions for students to compare and judge, rather than directly outputting the "optimal solution." The former expands the space for students' decision-making training, while the latter eliminates that space.

3.2. A three-level project chain as the carrier for generating complex competencies

The "academic nature" of vocational undergraduate education is concentrated in the ability to handle complex problems, and complex competencies cannot be acquired through fragmented tasks. A feasible path is to design a three-level progressive project chain of "basic functions—compound functions—system integration" around real products, processes, or service flows. Basic-function projects train the standardized execution of a single skill; compound-function projects require students to combine multiple skills to address

a complete but clearly bounded sub-task; and system-integration projects introduce the resource constraints, time pressures, and unexpected deviations of real production, requiring students to complete solution trade-offs and on-site adaptation.

The ways in which generative AI intervenes in the three levels of projects should be differentiated. At the basic-function stage, AI is mainly used for instant feedback and standards verification, reducing the cognitive load of trial and error; at the compound-function stage, AI is used to provide multi-source information and simulate the consequences of different technical routes, forcing students to compare and argue; at the system-integration stage, the role of AI should be deliberately "weakened"—teachers may consciously set up situations in which AI information is incomplete or mutually contradictory, requiring students to rely on engineering judgment and team negotiation to fill the gaps. This kind of "differentiated technological exposure" is more likely to promote the generation of complex competencies than the uniform use of AI tools.

3.3. Process-based competency evidence in place of completion-based evaluation

Assessment reform is the key interface for whether the two wheels can truly mesh. Traditional assessment focuses on "was it finished" and "does it look right," whereas competency-based assessment needs to answer "in the process of doing it, which competencies were activated, which judgments were made, and on what basis." AI tools provide precisely the technical conditions for this kind of process-based assessment: learning platforms can record students' inputs, revisions, withdrawals, and final choices at each decision node, forming a traceable "chain of competency evidence."

However, technical conditions are not equivalent to assessment validity. If the collection of process data still serves behavioral indicators such as "participation" and "activity level," then no matter how refined the data, it cannot touch competency itself. What needs to be designed is an evidence standard based on competency nodes: at a given project node, did the student identify the key constraints, did they compare at least two feasible solutions, did they make a justified choice among the suggestions offered by AI, and did they reasonably attribute the reasons for the failure of a solution? The collection and analysis of such evidence can rely on AI assistance, but the authority to set the standards must remain in the hands of professional teachers. The digital transformation of assessment is, first of all, a professional judgment about "what deserves to be seen," and only secondarily a matter of technical implementation.

3.4. Teachers as "translators" between the two wheels

The requirements that dual-wheel drive places on teachers go far beyond "being able to use AI tools." Teachers need to complete a competency transformation at three levels: the first is competency translation, turning the job-competency map into a teachable, assessable sequence of classroom tasks; the second is technological discernment, judging whether a given AI function in a specific teaching segment "expands the learning space" or "substitutes for learning responsibility"; and the third is evidence interpretation, identifying genuine signals of competency growth from process data rather than being misled by superficial activity data. None of these three competencies can be acquired through short-term technical training; they need to be generated gradually through joint teaching-research activities between schools and enterprises.

A practical direction worth attention is to transform enterprises' real technical breakthrough projects into teaching cases, so that teachers undergo training in both competency translation and technological discernment within "dual" school-enterprise collaboration. Only when teachers themselves face an

engineering problem with no standard answer are they more likely to understand in which segments AI is a useful assistant and in which segments it is a dangerous crutch.

4. Three pitfalls to guard against

First, the pseudo-empowerment of "tools first." Driven by both policy enthusiasm and technological supply, the deviation most likely to occur is to choose the tool first and then look for an application scenario. The result is that the classroom "looks very intelligent," but the competency objectives have not been seriously interrogated. The design order of dual-wheel drive must be "competency node to learning task to matching of technical function," not the reverse.

Second, the dilution of vocational character by personalization. AI-supported personalized learning paths have undoubted value in the general educational context, but in vocational undergraduate education, personalization must accept the constraints of occupational standards. A student may learn at a different pace, but cannot bypass the operational norms and safety standards that must be met. "Personalization" cannot become an excuse for lowering the competency baseline.

Third, the abundance of data and the poverty of judgment. The great enrichment of process data may create the illusion that "assessment has already become scientific." In reality, the more data there is, the higher the demand on teachers' professional judgment. Without clear competency standards and evidence rules, data will only increase the noise of assessment, not its validity.

5. Conclusion

The "competency-based—digitally empowered" dual-wheel drive for vocational undergraduate education is not an incremental reform that "adds AI" to an existing teaching model, but a stock-based reorganization that rearranges teaching elements according to competency logic. Its success or failure does not depend on how many intelligent systems a school has deployed, but on whether each instance of technological intervention is guided by a clear competency question and whether it has expanded the space for students to judge and reflect in complex situations. At a time when generative artificial intelligence is accelerating changes in knowledge production and work patterns, what vocational undergraduate teaching most needs to guard against is not too little technology, but that when technology becomes abundant, competency quietly withdraws. The real meaning of dual-wheel drive is to let competency logic always sit in the driver's seat.

Disclosure statement

The author declares no conflict of interest.

References

[1] Wang YK, Tang HT, Peng Q, et al., 2026, Construction and Application of a "Competency-Based—Digitally Empowered" Teaching Reform Model for the Software Engineering Technology Program in Vocational Undergraduate Education. Computer Education, 2026(8): 234–239. https://doi.org/10.16512/j.cnki.jsjjy.2026.08.034

[2] Jiang SH, Wang YF, 2026, The Reconstruction Logic and Its Realization of the Talent Cultivation Paradigm in Vocational Undergraduate Education in the Era of Digital Intelligence. Theory and Practice of Education, 46(18): 17–23.

[3] Shi YY, 2025, Construction of the Professional Curriculum System of Vocational Undergraduate Education from the Perspective of Competency-Based Education: Conceptual Interpretation, Practical Dilemmas and Optimization Strategies. University Education, 2025(6): 31–36.

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