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The Construction of the New Business Smart Learning Factory Model of "Four Integrations, Four Precisions and Four Constructions" Empowered by Digital Intelligence

Wenjing Hu
Faculty of Management, Hubei Business College, Wuhan, Hubei, China

Abstract: This study explores the changes in the demand for business talent in the digital intelligence era and focuses on educational practice scenarios such as teaching, learning, management, evaluation, and research. By analyzing and utilizing teaching and business data from both teachers and students, the research aims to empower learning analysis, personalized teaching, learning feedback, intelligent early warning, trend forecasting, and decision-making support. Based on these analyses, a collaborative and integrative "Four Integrations, Four Precisions, and Four Constructions" smart learning factory model is proposed. This model includes: Four Integrations: Advancing the integration of theory and practice, industry and education, information and education, as well as learning and innovation. Four Precisions: Designing precise teaching objectives, selecting and delivering precise teaching content, designing precise teaching activities, and evaluating precise teaching behaviors. Four Constructions: Co-constructing platforms for theoretical knowledge, practical training, internship, and entrepreneurship.

Keywords: Smart Learning Factory; Model; Digital Intelligence Empowerment

1. Introduction

With the rise of new technologies such as the Internet, cloud computing, and artificial intelligence, "intelligence, cross-border integration, and sharing" has become the main theme of the digital intelligence era. Training "new business" talents that meet the development needs of this era requires new perspectives and interdisciplinary, comprehensive solutions.[1] The smart learning factory, originating from real-world production and management processes, offers capabilities such as facilitating industry-education collaboration, enabling lifelong learning, connecting with industrial resources, and building simulation scenarios. [2] These characteristics provide educators with methods and ideas to address issues like the "theory-practice gap" and the "disconnect between learning and application" in new business education.

Based on years of teaching practice, extensive prior research, and interviews with teachers and students, several limitations in current new business teaching practices have been identified, indicating they do not fully meet the developmental needs of the digital intelligence era:

Limited Integration of Digital Intelligence Technologies in Teaching:

Digital intelligence technologies have not been fully integrated into course teaching to achieve enhanced effects. Most universities focus on establishing information centers or offering information technology courses but lack deep integration between professional courses and digital intelligence technologies. Talent cultivation plans and course systems based on these technologies remain in the exploratory and developmental stages.

Challenges in smart learning factory Pilot Projects:

In pilot projects for smart learning factories aimed at fostering innovation and promoting the integration of education and industrial elements, several issues persist. These include limited collaboration between enterprises and universities, short-term and unsustainable partnerships, low levels of student engagement, inadequate alignment of training with job roles, and insufficient synchronization of learned skills with the latest industry technologies.[3]

2. Model Construction

This study, leveraging relevant teaching and research projects, takes students from the School of Economics and Management at our university as the research subjects. It conducts practical explorations of the smart learning factory model, aiming to break down barriers of time and space, resolve contradictions between theoretical and practical integration, and overcome the boundaries of disciplines and specialties. By expanding educational dimensions, it seeks to explore and implement a new model of smart education.

Specifically, the model builds on:

- Analyzing teaching data to empower business data
- learning analytics and personalized instruction;
- Analyzing learning data to enhance learning feedback and enable intelligent early warning;
- Analyzing business data to support trend prediction and decision-making.

On this basis, the model collaboratively constructs a smart learning factory characterized by intelligence, cross-disciplinary integration, blending of elements, and shared resources.

For the detailed framework of the model, refer to Figure 1 below.

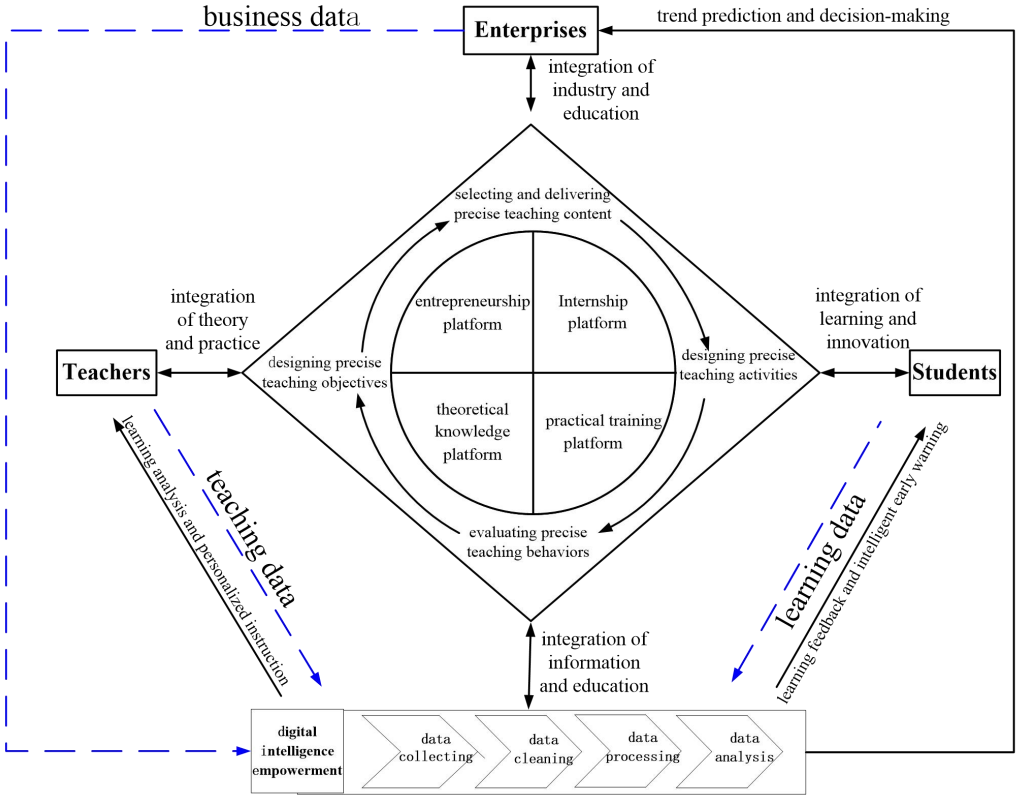

Figure 1. The Smart Learning Factory Model Empowered by "Four Integrations, Four Precisions, and Four Constructions"

2.1 Promoting Four Integrations

Tailored to different endpoints such as teaching, learning, research, and application, the model advances:

1. Integration of theory and practice,
2. Integration of learning and innovation,
3. Integration of information and education,
4. Integration of industry and education.

2.2 Enhancing Teaching Services with Four Precisions

By conducting intelligent analysis and profiling of data related to students, teachers, teaching resources, media, environments, and activities in real learning spaces, the model informs teaching reforms, improves the quality of academic services, and achieves:

1. Precise design of teaching objectives,
2. Precise selection and delivery of teaching content,
3. Precise design of teaching activities,
4. Precise evaluation of teaching behaviors.

2.3 Constructing Four Platforms through Collaborative Efforts

Utilizing technologies such as big data, virtual reality (VR), augmented reality (AR), and

holography, the model creates various realistic learning scenarios to foster natural and authentic learning experiences. These innovations stimulate students' interest and motivation to learn, enabling the collaborative construction of:

1. A theoretical platform,
2. A practical training platform,
3. An internship platform,
4. An entrepreneurship platform.

3. Teaching Reform Practice

3.1 Actively Promoting Four Integrations

3.1.1 Analysis based on actor-network theory (ANT)

Guided by the Actor-Network Theory (ANT), which includes the elements of actors, heterogeneous networks, and translation, this study analyzes the actors involved in constructing the smart learning factory. It identifies the issues faced by each actor and consolidates these into Obligatory Passage Points (OPPs), [4] as detailed in Table 1.

Table 1. Actors and Obligatory Passage Points in the Construction of the Smart Learning Factory

Actors	School, Teachers	Students	Enterprises	Digital Intelligence Technology Owners
OPPs/ Barriers and Issues	Difficulty meeting modern talent development demands	Low alignment with employment needs and satisfaction	Lack of versatile talents with broad, specialized, and multi-skilled expertise	Insufficient utilization and inadequate data mining

3.1.2 Addressing barriers and promoting deep integration

The construction of the smart learning factory must prioritize resolving the aforementioned barriers and issues. Corresponding to various endpoints such as teaching, learning, research, and application, it promotes the deep integration of: Theoretical teaching and practical teaching, Professional learning and entrepreneurial practice, Information technology and teaching research, Industrial practice and teaching application.

3.2 Enhancing Teaching Services with Four Precisions

1. Teaching objectives are precisely designed from the perspectives of teachers, students, and teaching activities, as shown in Figure 2.

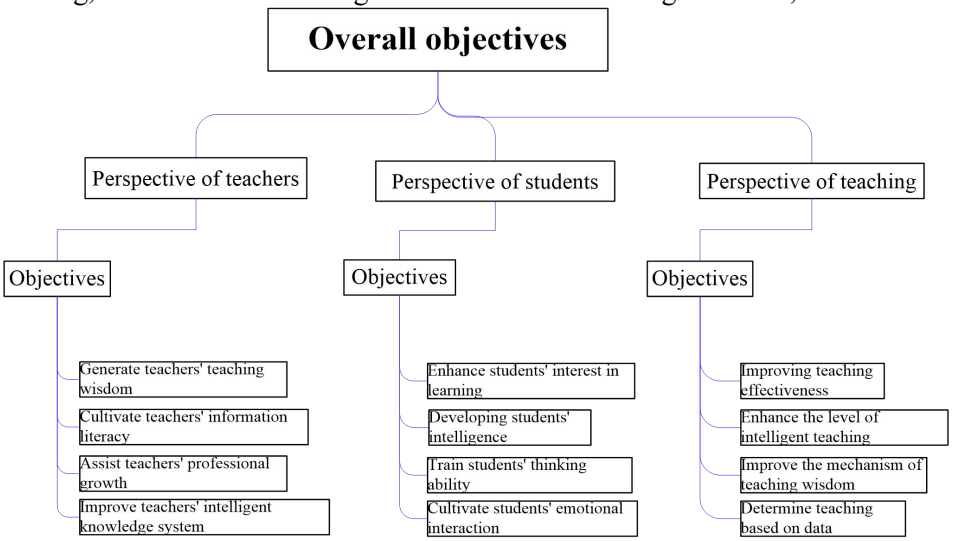

Figure 2. Precise Design of Teaching Objectives

2. By mining data from smart teaching platforms such as Superstar Learning, MOOC, Lanmo Cloud, and WeAssistant, insights are obtained regarding students' learning perceptions and behavioral patterns. These data are used for summative assessments and learning diagnostics, enabling the precise delivery of suitable learning resources.

3. Targeting courses such as E-Commerce, Market Research and Forecasting, and New Media Operations, smart teaching reform is explored through the precise design of teaching activities. Relying on the "One Cloud, Three Terminals" model (cloud platform, student terminal, teacher terminal, and classroom terminal) and the BOPPPS teaching

model, the three major teaching phases—pre-class, in-class, and post-class—are designed. Participatory and interactive teaching methods are employed, incorporating tools like surveys, polls, student selection, Q&A, and discussions to conduct teaching practices that aim to promote students' intellectual development.

4. Comprehensive evaluation methods — including observation, questionnaires, empirical analysis, psychological measurement, video analysis, behavior analysis, and emotion recognition—are employed to analyze and assess the outcomes of teaching reforms, enabling precise evaluation of teaching behaviors.

3.3 Construction of the Factory around Four Collaborative Platforms

3.3.1 Theoretical platform: creating a learning "ecosystem"

The theoretical platform focuses on reconstructing a rigorous yet open, fragmented yet systematic, digitally smart learning resource library. This supports students in active exploration and meaningful knowledge construction, fostering an open and shared learning ecosystem.

By leveraging the updated hardware in smart classrooms and cloud platforms like Superstar Learning, the latest learning resources are distributed, allowing students to personalize their learning content, schedule, methods, and collaboration partners. This creates a digitally supported ubiquitous learning ecosystem. [5]

High-interaction online learning communities are built, such as topic discussion groups and public accounts on Superstar Learning, enabling blended online and offline learning, collaborative inquiry, and shared group wisdom.

3.3.2 Practical training platform: building a growth "ecosystem"

The practical training platform focuses on transferring enterprise operational workflows into the smart learning factory. By simulating operational environments and utilizing real enterprise data, it establishes a practical training process that closely aligns with enterprise operations. This integration helps students apply theoretical knowledge in practical contexts, enhancing their individual business capabilities. [6]

Simultaneously, a "knowledge co-creation" model is adopted to integrate the knowledge and potential of both educators and learners, reducing the dominance of teachers. A collaborative development platform is created involving enterprises, alumni, faculty, and students. Industry professionals with extensive experience and marketing expertise—such as senior executives or department managers in real estate and retail sectors—or successful alumni are invited as guest lecturers or honorary professors. These experts regularly visit the campus to deliver lectures, engage in discussions with students and faculty, and explore real-world challenges, problems, and solutions faced by enterprises. This approach encourages students to actively reflect, discuss, and practice, fostering a more dynamic and effective ecosystem for personal and professional growth. [7]

3.3.3 Internship platform: developing a resource "ecosystem"

The internship platform provides opportunities both on-campus and off-campus.

- **On-Campus Internship Platform**: Operated by the school, it connects with industry partners to simulate real enterprise projects, combining teaching, research, and service functions.[8]
- **Off-Campus Internship Base**: Employs a dual-mentor system involving both academic faculty and enterprise experts. Industry partners contribute teaching suggestions, business scenarios, and anonymized data to support real-world project work. [9] Long-term collaborations with companies such as Huawei, JD.com, and Yum! Brands ensure rich internship and employment opportunities.

3.3.4 Entrepreneurship platform: enabling an employment "ecosystem"

By establishing an "integrated learning and entrepreneurship" platform, the college provides entrepreneurial spaces and other support to help students launch and manage their entrepreneurial activities. At the same time, the platform integrates resources from partner enterprises, technological assets, and the school’s research achievements. [10]This approach ensures the fusion of entrepreneurial practice with the curriculum, as well as the integration of classrooms, training rooms, and workspaces. It also merges the roles of teachers and students with entrepreneurial roles, combines teaching resource

development with the entrepreneurial process, and aligns teaching assessments with entrepreneurial performance. This creates an employment "ecosystem" that meets the needs of students for industry-academic integration and real-world project experience, fostering students' awareness, thinking, and qualities of innovation and entrepreneurship.

4. Conclusion

4.1 Significant Talent Development Achievements

Since the implementation of teaching reforms, the effectiveness of talent cultivation has been remarkable, and the overall quality of student training has significantly improved. Students have demonstrated notable enhancements in self-directed learning abilities, practical skills, innovation capabilities, and comprehensive qualities. The number of students awarded national motivational scholarships and those winning national and provincial awards in professional competitions such as the Challenge Cup and Internet+ competitions has steadily increased. A group of exemplary individuals has emerged, including the Ninth "Yangtze River Student" and Hubei Province's "College Student Self-improvement Star."

Additionally, many model collectives have been recognized, such as the "Dynamic League Branch" of Hubei Province's 100 Talents Forum and the "Outstanding Teams for Summer Social Practice" under the Three Trips to the Countryside program. The proportion of classes with excellent academic atmospheres exceeds 90%, showcasing a phenomenon of "clusters of outstanding groups."

Graduate employment quality has also improved significantly. In the past two years, employer evaluations of graduates' competency indicators have shown higher satisfaction rates. Indicators such as student employment rates, job satisfaction, alignment of employment with academic majors, and consistency with career expectations have all seen notable increases.

4.2 Outstanding Research and Teaching Outcomes

Since June 2022, our academic and research team has consistently promoted and implemented the educational reform practice of the "Four-integration, Four-precision, Four-building" model for new business education in the smart learning factory. The outcomes of our research have been outstanding. We have received approval for Hubei Province's first-class undergraduate program construction points, and four courses—"Entrepreneurship Fundamentals: Entrepreneurial Cognition and Practice," "E-commerce Operations: Immersive E-commerce Practice," among others—were approved as first-class undergraduate courses in Hubei Province.

Team members have been involved in 18 projects funded by the Ministry of Education's industry-education cooperation, demand-supply matching projects, Hubei Provincial Education Science Planning projects, Hubei Provincial higher education teaching reform research projects, and Hubei Provincial Higher Education Innovation Team for Young and Middle-Aged Scientists. Additionally, we have published over 20 academic and research papers.

4.3 Leading and Demonstrative Role

The series of teaching reform practices focused on the construction of the smart learning factory model have been recognized by the university, providing decision-making reference for relevant teaching management departments in formulating policies and regulations to support teaching reforms. At the same time, the teaching reforms have gained some social influence. We have hosted visits and exchange sessions with several institutions, including Wuhan University of Business, Zhengzhou University of Business, Guangzhou University of Business, and Zhongyuan University of Technology. During these visits, we provided on-site demonstrations, explanations, and reports, playing a leading and exemplary role for domestic peers in the cultivation of new business talents and the development of academic programs.

Acknowledgements

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