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Exploration of the "Three Transformations, Four Integrations, Five Expansions" Hybrid Teaching Path in Curriculum and Teaching Innovation Reform: A Case Study of the "Design Drawing A" Course

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Abstract: Using the "Design Drawing A" course as a case study, this paper addresses key challenges encountered in the learning process by adopting a "student-centered" approach rooted in outcome-based education. The course team proposes a blended teaching model defined by "three transformations, four integrations, and five expansions," which places students at the core of the learning experience. Through a comprehensive restructuring of the curriculum and innovative teaching methods, elements of civic education—including national identity, rule of law, scientific inquiry, and philosophical reasoning—are effectively integrated into the classroom. This model broadens the teaching process across multiple dimensions and refines the evaluation approach to be both multi-dimensional and dynamic. As a result, the course's blended teaching approach yields significant, innovative outcomes.

Keywords: Blended learning; Innovative research; Pedagogical innovation

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1. Course teaching "pain point" analysis

1.1. Theory-oriented teaching with limited practical application

In our environmental design program, "Design Drawing A" functions as a "bridge" course, crucial for laying a strong foundation in design drawing theories. It not only strengthens students' theoretical framework but also serves as essential preparation by enhancing their knowledge, skills, and professional literacy. This course supports the core and specialization courses that follow, as shown in **Figure 1**. Therefore, a critical challenge lies in effectively integrating fundamental and specialized courses in a way that aligns with the "dual nature" requirement—balancing both foundational knowledge and specialization. This approach aims

to create a coherent and relevant curriculum that meets the training needs for practical, application-focused competencies in environmental design.

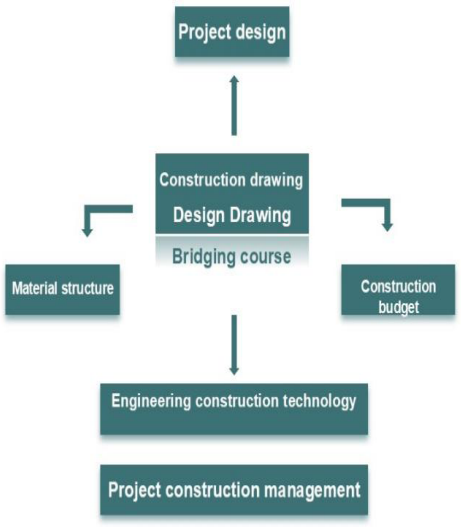

Figure 1. Curriculum bridge relationships

At present, the course's teaching content is heavily weighted toward theoretical aspects, with minimal emphasis on practical and exploratory components. This imbalance leaves the fragmented and often tedious theoretical knowledge of cartography disconnected from core competency training in the field. As a result, students encounter significant gaps in applying theoretical knowledge to professional skills development [1-3]. Thus, it is essential to reconstruct the course content in a "results-oriented" framework that aligns closely with professional courses and key objectives of talent cultivation. Helping students understand why they are learning, how the material applies, and what they can achieve with these skills are three pressing issues that require immediate attention.

1.2. Course ideology and political integration

The integration of ideological and political education within the course is somewhat rigid, which limits its educational effectiveness. The course is highly specialized with complex theoretical knowledge, yet ideological elements fail to blend seamlessly, making it challenging to deeply influence students' values. Innovative approaches are needed to more effectively weave ideological elements into the course, focusing on applied undergraduate education. Highlighting civic values within foundational professional courses and fostering a well-rounded worldview, life perspective, and values system among students are essential to advancing the course's civic education framework.

1.3. Traditional teaching methods and limited student engagement

The course content leans heavily toward theory, with traditional lecture methods and limited teaching tools, which results in a somewhat one-dimensional instructional approach. This approach restricts active student participation, as students often passively receive information with few chances to engage with the material in a way that connects theory to practice. This structure limits the stimulation of students' interest and self-motivation for learning.

Additionally, this course emphasizes students' ability to translate three-dimensional concepts into two-dimensional representations, which presents a unique challenge. Effectively integrating information technology to support students in developing spatial reasoning skills is crucial for improving the course. This shift toward a more dynamic, technology-enabled approach to content delivery and practice is essential for innovating within the curriculum.

1.4. Limited feedback and narrow evaluation approaches

The course assessment consists primarily of process evaluations and a final examination, with the latter accounting for 60% of the total grade. Consequently, the evaluation approach relies heavily on summative assessment, providing students feedback only at the course's conclusion. This delay hinders students from receiving timely insights into their progress throughout the 16-week term and impedes dynamic adjustments to learning objectives. As a result, the course objectives may not be fully realized, highlighting the need for an improved, iterative evaluation approach.

2. Innovative ideas and initiatives for teaching the course

2.1. Inquiry-based learning as a foundation: A three-dimensional reconstruction of teaching content through "three transformations" for a multi-dimensional knowledge structure

Using inquiry-based learning as the foundation, the teaching content is restructured in three dimensions via "three transformations," fostering a multi-dimensional knowledge framework. This approach diversifies content delivery, enhances practical engagement, and integrates core theoretical and professional knowledge pathways, effectively bridging foundational theory with advanced professional coursework and empowering students for continued learning [4].

2.1.1. Diversified time and space in teaching: Creating a multi-dimensional, cross-temporal learning environment

The course content consists of two primary components: basic theoretical knowledge of drawing and engineering-related technical skills in drawing. Theoretical principles form the foundational level, progressing from simpler basics to more advanced concepts. Instruction is layered, with basic principles taught in the "first classroom," which then extends into the "second classroom" where students actively engage as the primary agents of learning. As students reach higher-order skills, these skills feed back into the first classroom, reinforcing and expanding the learning experience.

2.1.2. Practical resource development: Building a scenario-based curriculum through "two databases" for targeted skill training

The construction of the "two databases" centers on our "4321" industry-teaching integration system, emphasizing the development of a teaching case database and a project database. Aligned with the course's "pyramid" teaching goals, these databases are essential for fostering students' ability to apply theoretical cartographic knowledge to real-world industrial challenges. This structure allows students to actively engage in knowledge construction, enhancing both their motivation and professional interest through diverse, practical learning resources.

The teaching case database supports theoretical instruction, featuring cases that relate to everyday

scenarios and professional applications. This helps students deepen their comprehension of theoretical knowledge and facilitates knowledge transfer. Meanwhile, the project database is designed around core skills in map reading and drawing, closely linked to advanced professional courses and industry practices. This enables students to gain hands-on experience, allowing them to "truly learn," "genuinely observe," and "practically apply" their skills, as shown in **Figure 2**.

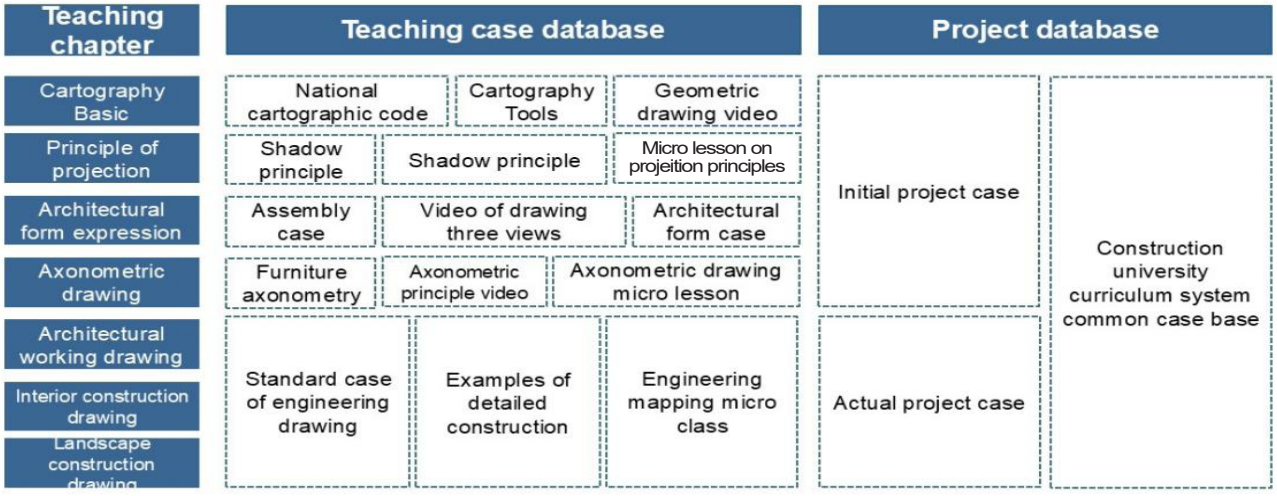

Figure 2. Construction of "two databases" teaching resources

2.1.3. Integrative curriculum design: Building a cohesive system tied to advanced professional courses

Following the OBE (outcome-based education) model, the course content is designed in reverse, beginning with intended outcomes and linking foundational courses like "Design Drawing A" to advanced subjects such as "Landscape Engineering Construction Technology," "Architectural Decoration Engineering Construction Technology," and "Environmental Design Materials and Structures." By tying in engineering and design principles, students develop a clear understanding of their learning objectives and how these skills will apply in their professional future [5]. The curriculum also integrates with program design courses, equipping students with a closed-loop skill set that spans the entire design process from concept to execution.

2.2. Establishing a "four integrations" classroom for talent and character development through value formation, knowledge transfer, and skill cultivation

In addition to teaching specialized knowledge, this course incorporates Civic and Political Education elements to foster a classroom environment that builds character and nurtures talent, as shown in **Figure 3**. By establishing a Civic and Political Element Database alongside an Expansion Database, we aim to inspire students' motivation, cultivate strong moral qualities, and fulfill the mission of "cultivating character and nurturing talent" in modern higher education institutions [6].

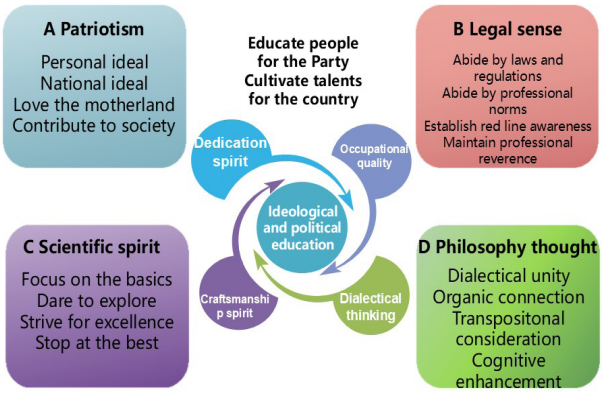

Figure 3. "Four integrations" of course ideological and political

2.2.1. Fostering national sentiment and dedication

Students majoring in environmental design carry the responsibility of advancing art and engineering technology, supplying high-quality applied talent for national development. Therefore, it is essential to align students' personal aspirations with national goals. By blending knowledge with ideologically enriching case studies, students are guided toward a sense of national pride and duty. Documentaries and large-scale national infrastructure projects are highlighted to help students connect deeply with the historical mission of national prosperity and revitalization [7].

2.2.2. Cultivating legal awareness and professionalism

Since the course includes a comprehensive study of national drafting standards and industry regulations, it emphasizes students' legal awareness through case studies, norms, and experiential learning. For instance, in lessons on "fundamentals of drafting and national standards," students experience the necessity of precision and rigorous scientific thinking. National standards and norms underscore the importance of accuracy in design, where even small mistakes can result in significant discrepancies in project outcomes. This focus cultivates in students a high standard of professionalism and a commitment to the rule of law.

2.2.3. Integrating scientific spirit to cultivate artisanal spirit

This course covers fundamental principles in drafting and drawing, which provides an excellent opportunity to instill a scientific spirit of precision and dedication. By emphasizing the value of mastering foundational skills and building knowledge gradually, students learn the significance of persistence—"a journey of a thousand miles begins with a single step." This approach helps students overcome any "fear of difficulty" in their studies, encouraging them to face challenges head-on. This foundation cultivates an artisanal spirit, motivating them to strive for excellence in their work and instilling a commitment to meticulous detail.

2.2.4. Integrating philosophical thought to develop dialectical thinking

As students build practical skills in this course, they are encouraged to engage in philosophical thinking through the method of "observation-analysis-preliminary solution-analysis-final solution." This cyclical thinking framework nurtures their ability to evaluate problems from multiple perspectives and develop logical, dialectical thinking. For example, when explaining the "three-sided projection system," students learn to see how three views form a cohesive representation of an object's shape and size. This exercise

in linking different perspectives helps students strengthen their analytical abilities, fostering a worldview grounded in logical thinking and dialectical analysis. Through this process, students begin to develop a structured, reflective approach to solving complex problems, as shown in **Figure 4**.

Ideological and political elements database			Ideological and political development database	
Teaching contents	Ideological and political elements	Associated instance	Video resources	Book resources
1. Basic knowledge of drawing	B、C	"A tiny difference can lead to a huge loss" guides students to sort out the awareness of observing the norms.	Infrastructure of Great Powers	Thinking, Fast and Slow
2. Basic principles of projection	C	Explain the norms of projections to cultivate students' rigorous craftsmanship.	Building a Great Nation	This is China
3. Architectural form expression	D	Describe the shape of an object from different perspectives, and the multiple views are an organically linked whole, expressing the shape of the object together.	Our Qingming Riverside Drawing	Anteng Tadao on Architecture
4. Axonometric projection	A、C、D	Understand the principle of axonometric projection and guide students to view things from multiple angles. Using the similar axonometric drawing method of "Qingming Riverside Drawing" to arouse students' awe and interest in traditional Chinese art.	I Repair Cultural Relics in the Forbidden City	Lifelong Growth
5. Construction drawings of each project	A、D	Through group work to complete architectural measurements and drawings, students are guided to appreciate the value of communication and collaboration in realizing the vision of self-worth.	DeepMind	

Figure 4. Construction of the "four integrations" civic database

2.3. Based on the "constructivist teaching concept," innovating teaching methods to cultivate higher-order abilities and create a "five expansions" high-performance classroom

The core essence of a constructivist classroom lies in actively engaging students in the learning process, allowing them to take on a more prominent role as learners while the teacher serves as a guide. The following five innovations are implemented to foster higher-order thinking and create a dynamic learning environment [8].

2.3.1. Innovative use of teaching aids to visually extend abstract knowledge

This course involves significant theoretical content, especially in solving the conversion of three-dimensional objects to two-dimensional planes. To help students actively engage with the material, three-dimensional visualization teaching aids are used. These aids bridge the gap between abstract, theoretical knowledge and students' understanding by allowing them to visualize the material in concrete forms. For example, the transition from a three-sided projection system to a three-view diagram can be made clearer through visual aids that show this transformation, allowing students to understand complex concepts more intuitively.

2.3.2. Student-created models to expand understanding of spatial forms

Allowing students to create three-dimensional spatial models by hand serves multiple purposes. It enhances their practical skills, prepares them for future courses like "Model Making," and provides a sense of autonomy, empowering students to explore concepts actively. This hands-on experience helps solve the problem where students may understand theoretical concepts but struggle to visualize or draw them. For example, students building basic shapes reinforces the understanding of "point," "line," "surface," and "body," while also introducing the principles of projection. The results of these hands-on activities not only foster a deeper understanding but also create a collaborative classroom atmosphere, strengthening the student-teacher relationship.

2.3.3. Task-driven teaching: Transforming and expanding theoretical knowledge

Task-driven teaching encourages students to take an active role in solving problems, thereby facilitating the transformation and practical application of theoretical knowledge. For instance, students are given tasks related to the projection principles of "faces," such as deducing and explaining projection characteristics before the class, then drawing the three views of special surface positions during class, and finally practicing drawing lines and points on surfaces afterward. This task-based approach shifts theoretical knowledge into practical skills, significantly boosting students' motivation and interest, while ensuring a more meaningful and engaging learning experience. This method helps seamlessly connect theory with practice and enhances learning outcomes.

2.3.4. Expanding teaching organization forms with information technology: Creating a hybrid online and offline learning environment

The expansion of teaching organization integrates "Internet+" thinking, promoting the seamless fusion of modern information technology with teaching content. This includes the use of smart teaching platforms and virtual simulation software for design and drawing. By integrating the "two databases" of teaching resources into the Superstar smart platform, as well as facilitating interactive teaching and classroom management, a hybrid teaching approach is established that blends online and offline components. This enables multi-dimensional interactions across various learning tasks before, during, and after class. Additionally, virtual simulation software and microcourse resources help link the content to the development of higher-order abilities, fulfilling the goal of an innovative, high-performance classroom [9].

2.3.5. Expanding the teaching environment: Embedding the "constructivist" concept and promoting active knowledge construction

Environmental behavioral psychology suggests that the environment significantly influences human behavior and psychology. Therefore, the implementation of the "constructivist" teaching concept necessitates a reimagining of the teaching environment. The teaching team must innovate and expand the environment to align with the content. This includes using specialized labs, such as architectural decoration materials, construction labs, virtual simulation labs for environmental design, and architectural model mechanisms. A diversified teaching environment encourages students to actively construct their knowledge system, fostering a spirit of innovation and exploration.

2.4. Beyond traditional evaluation: Building a diversified formative assessment system to stimulate student motivation

Traditional single-evaluation methods, which focus solely on knowledge, fail to effectively motivate students and offer limited feedback. A diversified evaluation system, based on multi-dimensional and process-oriented perspectives, is essential [10]. Increasing the proportion of process assessments—such as online previews, classroom task discussions, in-class tests, and after-class homework—should account for 50% of the total grade. This allows real-time feedback, better tracking of student progress, and provides valuable insights into the achievement of learning objectives. Comprehensive, multi-dimensional tracking of student outcomes ensures that students receive the necessary feedback, motivating them and enhancing their learning experience.

3. Curriculum teaching innovation and application

3.1. Innovative achievements

3.1.1. Enhanced student initiative and sense of achievement

Through the reform and innovation of teaching content, methods, and evaluation systems, students' learning initiative has shown significant improvement. In 2022, activities on the students' online teaching platform reached over 6,300 instances, nearly double the number of previous periods. This increase reflects the success of the hybrid online-offline teaching model. Along with increased interactions and diversified feedback, students have reported a heightened sense of acquisition, indicating a positive shift in their learning engagement and satisfaction, as shown in **Figure 5**.

Figure 5. Questionnaire survey of students in grade 2021

3.1.2. Significant improvement in students' practical skills

By exploring blended learning paths and innovating teaching modes, students' spatial thinking skills, ability to convert three-dimensional space to two-dimensional planes, and practical application of cartographic theory have all markedly improved. Upon completion of the course, students are able to establish a comprehensive knowledge and ability system, effectively applying design and drawing techniques to solve real-world problems, thus achieving the course's higher-order objectives.

3.1.3. Continuous improvement in teaching quality

The teaching team's awareness and capacity in curriculum reform and teaching design optimization have grown significantly. The team's collective efforts have led to better understanding and addressing students' needs. The division of labor among team members has enhanced their efficiency in solving various student challenges. In recognition of their contributions, the team has earned multiple accolades, including the second prize at the university-level "Young Teachers' Teaching Skills Competition" and the Outstanding Teacher Instructor Award at the 11th NCDA National Colleges and Universities Digital Art and Design Competition. Additionally, they guided students to win over 20 awards and contributed to the publication of more than 10 research and teaching reform papers.

3.2. Popularization and application

The exploration of the blended teaching model, based on the principles of "three transformations, four integrations, and five expansions," has effectively shifted the focus of the "Design Drawing A" course to center around student engagement, with teachers serving as guides and facilitators in the learning process.

This approach addresses key challenges within the course, such as the overemphasis on theory and the neglect of practical application. Through the "three transformations" in course content reconstruction and the "five expansions" in teaching methods, a stronger connection has been established between theoretical knowledge and the practical skills required for core professional courses, enhancing students' preparation for future academic and career challenges. Additionally, the establishment of a multi-dimensional evaluation system has resolved issues related to weak learning objectives and delayed feedback. This system supports dynamic goal-setting and promotes the timely achievement of course objectives, allowing students to track their progress and make real-time adjustments. The success of these innovations will be expanded into the "Landscape Engineering Construction and Organization" course, which will be introduced to 2022 environmental design students in the upcoming March.

A key achievement of this initiative has been the integration of Civic and Political education into the curriculum through the creation of the Civic and Political Element Database and the Civic and Political Expansion Database. This ensures that Civic and Political education is seamlessly incorporated into classroom activities, overcoming the previous issue of disconnected or superficial coverage. This innovative approach to integrating Civic and Political education has been positively evaluated by the teaching and research team, as well as experts in the field, successfully achieving the goal of making Civic and Political education a pervasive and integral aspect of the course.

Disclosure statement

The authors declare no conflict of interest.

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