ISSN: 2688-8653

Research on Practical Curriculum of Vocational and Technical Education From the Perspective of Science and Technology Integration

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Abstract

Theory is the navigation of practice, and practice is the wing of theory. Modern vocational and technical education is increasingly showing the characteristics of technology penetration, practice traction, system support and so on, and its dependence on the correct path and scientific methods is more prominent. Exploring the integration of theory and practice, and adhering to the combination of theory and technology to design courses have become a new window to break through the traditional curriculum model research and teaching, which has far-reaching significance and value.

Keywords

Integration of science and technology; Independent innovation; Summary; Teaching.

1. Introduction

The Significance and Implementation of Theory-Practice Integration in Vocational Education. In the vocational education system, integrating theoretical and practical components within the curriculum holds substantial significance. The primary objective of vocational education is to cultivate multi-skilled professionals who possess diverse abilities and competencies[1]. By integrating theory and practice in educational settings, students are better equipped to master vocational skills and develop professional qualities that lay a solid foundation for their future careers. For instance, Hebei Vocational College of Transportation has created a “1+3+4” resource pool dedicated to labor education, which enhances resource availability and sharing for practical activities. This approach shifts away from traditional teacher-centered instructional methods, such as rote memorization and passive knowledge transmission, by stimulating student engagement and encouraging a more student-centered learning experience. With a greater emphasis on hands-on learning and active thinking, students are encouraged to develop critical thinking skills and creative problem-solving abilities. Additionally, the implementation of theory-practice integration in practical courses promotes the values of diligence, labor, and craftsmanship. For example, community service experiences guide students to participate in service-oriented projects and social research, fostering a sense of civic responsibility and community engagement. Integrating theory and practice into vocational education also aligns with technological advancements and industrial transformation, reflecting the evolving demands of today’s society. For instance, in the context of New Liberal Arts development, complex interdisciplinary knowledge is essential, and theory-practice integration broadens students' knowledge base while fostering a comprehensive understanding of multiple disciplines.

In summary, integrating theory and practice in vocational education courses is vital for fostering holistic student development, supporting economic and social growth, and enhancing the vocational education framework.

ISSN: 2688-8653

2. Characteristics of Theory-Practice Integration in Practical Courses

The practical courses within vocational education adopt an activity-based approach that emphasizes experiential learning, which is supplemented by modularized theory components. By engaging in activities such as research, analysis, experimentation, design, and community service, students encounter real-world challenges that encourage them to identify and resolve issues firsthand. This experiential approach not only enriches their understanding but also enables them to independently acquire knowledge and subsequently apply it, thereby enhancing both practical and innovative skills[2].

The scope of theory-practice integration extends beyond the conventional boundaries of academic disciplines and classroom settings. Course objectives and content are designed to be open-ended, promoting individual learning processes where students are encouraged to engage in personalized and meaningful learning experiences. Moreover, there is a strong emphasis on knowledge synthesis and reflection, allowing students to assimilate new information and develop a deep understanding of the subject matter.

This type of practical coursework also respects and fosters students' interests, empowering them to take an active role in their own learning. In this context, students become the central figures in the learning process, engaging in self-directed activities under the teacher's guidance. They are encouraged to take initiative, participate in hands-on learning, and reflect on their experiences.

The theory-practice integration approach stems from students' real-life experiences and developmental needs. By identifying problems from everyday situations, these challenges are transformed into theoretical learning opportunities, allowing students to acquire knowledge through inquiry, service, production, and hands-on experiences. This interdisciplinary approach not only builds students' practical capabilities but also fosters their overall development as well-rounded individuals[3].

3. Guiding Principles for Theory-Practice Integration in Course Design

3.1. Relevance Principle

The content of practical education must align closely with theoretical concepts, aiming to deepen understanding of key topics and address core issues within the curriculum. Practical exercises should reinforce the textbook and syllabus content to ensure cohesion and real-world applicability, avoiding arbitrary and irrelevant design.

3.2. Integration of Scientific and Educational Values

Teachers should strive to impart foundational scientific knowledge and skills while embedding ethical, political, and moral education within the curriculum. This ensures that the instruction remains scientifically accurate while also imparting values-based lessons, enhancing both the teacher's professional competence and moral standards.

3.3. Theory-Practice Connection Principle

The instructional strategy should prioritize foundational knowledge, encouraging students to draw connections between theoretical knowledge and its real-world applications. This principle supports the idea of learning through action and understanding by doing, fostering an environment where practical skills and theoretical comprehension develop concurrently.

3.4. Visual Learning Principle

Encouraging students to observe and visualize concepts—whether by direct observation or through descriptive storytelling—helps solidify their understanding. For instance, while

ISSN: 2688-8653

demonstrating equipment operation, teachers should incorporate real-life examples to provide context and improve comprehension[4].

3.5. Stimulating Engagement Principle

Instruction should aim to motivate students and foster a sense of curiosity, encouraging them to engage in critical thinking and exploration. This principle echoes educational philosophies that prioritize encouragement and inquiry-based learning, as exemplified by Confucius' and Socrates' teachings on the importance of student-led discovery.

3.6. Progressive Learning Principle

Teaching should follow the logical sequence of scientific knowledge and the cognitive development of students, enabling them to systematically acquire foundational skills and logical reasoning abilities. This principle aligns with educational concepts that stress gradual learning progression, as reflected in Mencius' philosophy on steady learning and development.

3.7. Student Experience-Centric Approach

Practical courses should center around students' experiences, emphasizing hands-on participation and collaborative learning. By engaging in problem-solving activities that stem from real-world contexts, students gain practical knowledge while developing a comprehensive understanding of how different concepts interrelate within their curriculum[5].

These principles collectively ensure that practical instruction is both effective and targeted, enabling students to better understand and apply their knowledge.

4. Implementing Theory-Practice Integration in Practical Courses

In the preparatory phase, instructors should thoroughly review the curriculum and clearly understand the course's objectives and philosophy. It is essential to align practical activities with the institution's overarching educational goals and students' needs. Teachers can further enrich the curriculum by incorporating local resources, such as cultural and environmental assets, to design activities that are both relevant and educational.

During the teaching phase, theoretical knowledge should be seamlessly interwoven with practical activities. Teachers should facilitate topic selection, project design, group discussions, methodological guidance, and final presentations, supporting students throughout each stage. By encouraging collaborative projects, students gain valuable experience in teamwork and active engagement. Furthermore, teachers should honor and cultivate students' autonomy, enthusiasm, and creativity by allowing them to contribute to the topic selection and problem identification process.

In the assessment phase, practical course evaluation should align with the broader goal of fostering comprehensive skill development. Teachers should encourage students to present their projects or reports, providing opportunities for self-expression. Evaluations should highlight not only technical competence but also the underlying thoughts, creativity, and experiences that shaped the students' work. Skills assessments should be multi-dimensional to ensure that students not only meet technical standards but also retain a solid grasp of fundamental knowledge.

5. Resource Allocation for Theory-Practice Integration in Vocational Education

The allocation of resources for theory-practice integration involves several key steps:Internal Resources: These include faculty, libraries, and laboratories. Teachers should be selected based on their expertise in relation to course objectives, and students should have access to relevant

ISSN: 2688-8653

library materials and lab equipment. External Resources: Community and industry partnerships can offer fieldwork opportunities and project collaborations. Community resources enable real-world applications, while industry connections facilitate internships and cooperative projects.

Leveraging Digital Resources: Using digital tools, such as simulation software, online learning platforms, and virtual labs, enhances efficiency and safety in the practical learning process, allowing students to perform experiments and procedures in a controlled environment.

Equipment Provision: Necessary hardware, such as sensors, controllers, and virtual reality devices, should be allocated based on project requirements to ensure students gain experience with hands-on or simulated operation.

Blended Learning Implementation: Pre-class resources, such as instructional materials and project outlines, can be made available on digital platforms, enabling students to understand project goals, requirements, and safety protocols in advance. Blended learning allows for a combination of in-class theory instruction, hands-on demonstrations, virtual practice, and post-class reflections, where students analyze their experiences and prepare improvement suggestions.

6. Conclusion

By following these steps, vocational education programs can effectively allocate resources to optimize theory-practice integration in practical courses, thereby enhancing both educational outcomes and student engagement.

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