

Research on the Practical Application of Integration of Construction Engineering Cost Practice Course Certificates under the 1+X Certificate System

Qi He

*College of Civil Engineering and Architecture, Zhejiang Tongji Vocational College of Science and Technology, Hangzhou, China
1664430469@qq.com*

Keywords: 1+X certificate; combination of courses and certificate; construction cost major

Abstract: Taking the construction engineering cost practice course for example, this paper proposes constructive ideas and implementation strategies for integrating courses under the 1+X certificate system, considering the current situation and challenges faced in course integration. It combines the assessment content and evaluation criteria of the 1+X certificate system to enhance talent development direction, optimize course resources, refine teaching design, improve course assessment and evaluation methods. Furthermore, it summarizes and analyzes the outcomes of these implementations with an aim to enhance teaching effectiveness while providing valuable insights for promoting "1+X" course integration across other professional disciplines.

1. Introduction

On July 24, 2020, the General Office of the Ministry of Housing and Urban-Rural Development issued the Work Plan for Project Cost Reform, which clearly pointed out that "the use of big data, artificial intelligence and other information technologies to provide a basis for the preparation of the preliminary budget, indicating the inevitability of the digital transformation of industry cost. At the same time, for further improving the quality of talent training and deepening the vocational education reform, the CPC Central Committee and the State Council have issued a series of education policy documents by 2022, such as the National Vocational Education Reform Implementation Plan and the Vocational Education Quality Improvement and Training Action Plan (2020-2023), providing various policy support for deepening the integration of industry and education, school-enterprise cooperation, and further promoting the 1+X system. The 2021 National Vocational Education Conference put forward the new requirement of "post-class competition for certificates and comprehensive education" for the first time. In October, the General Office of the Central Committee of the Communist Party of China and The General Office of the State Council issued the Opinions on Promoting the High-quality Development of Modern Vocational Education, which proposed in Article 15: improve the comprehensive education mechanism of "post course competition Certificate", design and develop courses according to the actual production and post needs, develop a modular and systematic practical training course system, and improve students'

practical ability. It shows that at the national level, the exploration of the "post course competition certificate" collaborative education mechanism has been taken as an important starting point to improve the vocational education personnel training mode, restructure the professional group curriculum system, and improve the quality of talent training^[1]. It has put forward new tasks and directions for the education and teaching reform of vocational colleges, and the demand for the integration of the 1+X system is becoming more and more urgent.

2. Implementation status and problems of 1+X system credit accommodation

2.1 The low social recognition of certificates

The 1+X certificate system is currently in the stage of exploration and development, requiring further enhancement of the certification's credibility^[2]. Based on the survey findings, there exists a low level of social recognition for relevant X certificates within industry enterprises, leading to an overall lack of motivation among teachers and students. Particularly, students demonstrate a greater inclination towards pursuing other qualification certificates with higher recognition during their spare time. Teachers possess insufficient understanding regarding the certificate system, perceiving 1+X as merely one option for students to obtain certifications without allocating adequate attention to it. Consequently, they exhibit reluctance in updating course content and designing teaching methods, impeding effective integration between courses and certifications.

2.2 Lack of connection between course and certificate

The current integration of professional guidance, personnel training objectives, the existing curriculum system, and certification is insufficient. The development of the professional curriculum system does not adequately align with the demands of vocational fields. The establishment of professional programs often falls behind enterprise transformation and upgrading, resulting in a mismatch between educational offerings and vocational positions. The existing professional standards do not effectively meet the requirements of vocational skill standards, leading to a lack of alignment between curriculum design and practical industry needs.

2.3 Course resources are not particularly relevant to industry demand

The curriculum setup and development exhibit a limited degree of alignment with the corresponding work tasks of vocational qualification certificates. Evaluation organizations and industry enterprises have not fulfilled their intended role in shaping the professional curriculum structure of higher vocational colleges, resulting in a disconnect between the established courses and the practical demands of industry enterprises within the vocational field. Furthermore, there exists a discrepancy between the content standards of these curricula and the corresponding vocational post standards.

2.4 The limited integration between curriculum assessment and certificate

The limited integration between curriculum assessment and vocational skill requirements associated with vocational qualification certificates is primarily manifested as barriers to integrating curriculum and certificates^[3]. Constraints such as class hours, internship training duration, and space availability result in a low emphasis on vocational skill objectives. Higher vocational colleges predominantly rely on final examinations for curriculum assessment, which do not align with the corresponding skill requirements for qualification certificates. Moreover, there is a lack of diversity

in skill assessment methods. The standardization of curriculum assessment standards lead to a disconnect between curriculum objectives and assessment requirements from vocational job standards during industrial transformation and upgrading processes, resulting in a diminished level of integration between curriculum standards and skill standards within the vocational field.

3. Implementation approaches of the Integration of course and certificate

In the 1+X certificate system, individuals trained under "1" acquire fundamental skills, while "X" necessitates specialized technical expertise for specific positions. To cultivate graduates who are truly competent, it is crucial to enhance the intersection between 1 and X, thereby strengthening the quality and comprehensive capabilities of future talents. This vision serves as the primary objective behind implementing the 1+X certificate. By fostering mutual recognition, connection, and transformation, multidimensional complementarity can be established to facilitate learners' comprehensive and sustainable development. The integration of curriculum and certification can be achieved through aligning two certificates, coordinating curriculum systems with vocational fields, harmonizing curriculum with certification standards and content, aligning assessment criteria with post tasks (as depicted in Figure 1).

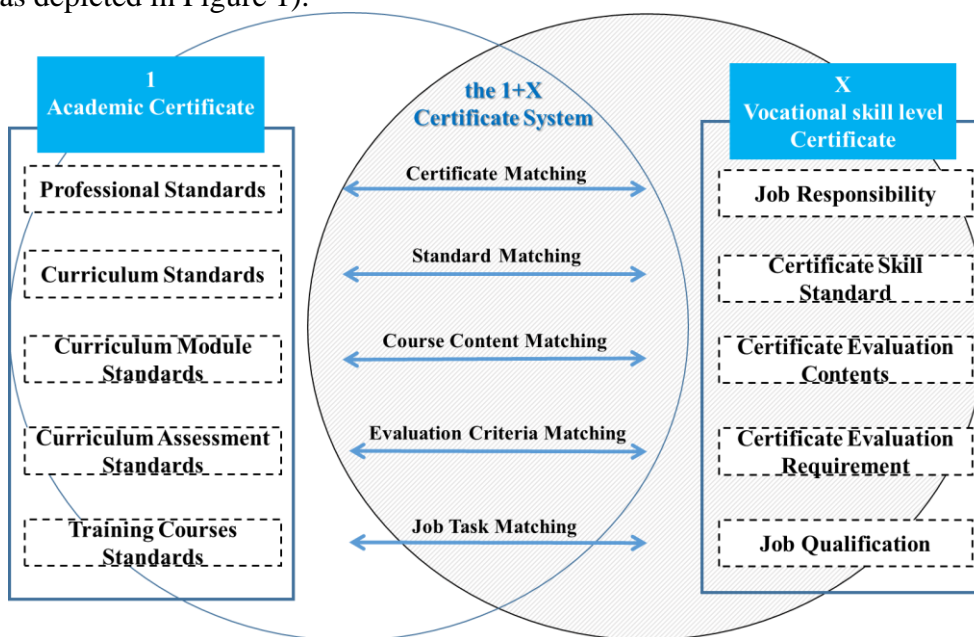


Figure 1: Construction model chart of integration of classes and certificates

Commencing from the top-level design, a systematic revision of professional standards and curriculum development is undertaken in accordance with relevant course standards. This involves extracting specific modules from courses and integrating them into certification standards, while ensuring detailed knowledge and skill objectives are met to achieve modular integration of the curriculum. Simultaneously, reform can also be initiated from the grassroots level by introducing new or revamped courses that adhere to standardized criteria, gradually progressing towards certification targets before extending their influence to other courses, ultimately forming a cohesive cluster-based professional curriculum system.

3.1 Establish explicit integration objectives based on the student situation

Clearly defined training objective is crucial for effective teaching. The 1+X certificate system aims to align the professional abilities taught in schools with industry standards, ensuring that talent

training meets the needs of the industry^[4]. By integrating talent training objectives and skills assessment outlines based on professional situations, colleges strive to meet primary standards while generally reaching intermediate ones and striving for high standards. This comprehensive approach connects professional quality, knowledge requirements, and ability requirements. Curriculum standards are revised or reformed based on industry and enterprise professional standards references, incorporating skill identification requirements into teaching objectives and content while integrating them into the teaching process to improve efficiency.

3.2 Reconstructing Teaching Content

The principle of implementing to alleviate burdens and enhance efficiency, thereby optimizing course content and achieving course objectives more effectively through integration. The implementing approach is taking the 1+X digital cost intermediate certificate as the primary amalgamation certificate, reorganizing curriculum objectives while considering ability requirements of Class2 Cost Engineer to improve certification standards. The reform should be implemented on each curriculum module based on professional skills, and specific demands of X certificates. Original curriculum module objectives will be replaced, added or supplemented if they can't be matched with these skills and demands. By this way, certificate standards will be discreetly integrated into course objectives.

Taking the course "Construction Engineering Cost Practice" and integrating it with the intermediate certificate standards, this study examines three key areas of knowledge and skills: 1) engineering quantity calculation; 2) preparation of engineering quantity lists; and 3) confirmation of engineering costs. By optimizing the course content and implementing a staged training approach for each module, a comprehensive case study is applied throughout the entire course, aligning with the requirements of primary and intermediate examinations for the Digital Application Certificate in Engineering Cost. This integration scheme effectively showcases the certification process.

The integration process permeates the entire training procedure, encompassing core content delivery, classroom instruction, pre-examination review, and post-examination practice. This comprehensive approach significantly enhances students' knowledge reservoir and professional aptitude. The certification attests to their proficiency in the field while the examination process hones their practical skills. Moreover, the review process establishes a systematic knowledge framework that truly embodies the pivotal role of "1+X" certification and showcases its primary advantages.

3.3 Three educational reforms provide a foundation for the integration

The three teaching reforms primarily provide practical support for integrating curriculum and certification, including software and hardware provisions, teacher training, and instructional materials.

The training room has been transformed with comprehensive software and hardware upgrades, becoming a versatile facility that seamlessly integrates teaching, training, practice, and examination activities. This upgraded space serves as a dedicated venue for students to engage in daily learning and pre-examination simulations, effectively mitigating any potential errors from software or hardware issues. Leveraging various platforms to enhance instructional delivery and optimize access to learning resources empowers students in their preparation for the 1+X certificate examination through online certification platforms.

In terms of teachers, it is encouraged for educators to promptly apply for examiner qualifications and train new "double-teacher" instructors in order to ensure effective integration of content implementation^[5]. Regarding teaching methods, schools should implement various measures to

enhance teachers' practical abilities, such as organizing comprehensive arrangements for their participation in enterprise research and technical services. To strengthen the teacher team, a digital application test group specializing in project cost is established with the course leader also serving as its head. This ensures proper alignment between teachers and courses, preventing any issues related to incorrect certifications. This practice not only assists in workload sharing within the college but also facilitates overall management. The course team must regularly engage in teaching and research activities, analyze weaknesses identified during student examinations, and propose improved teaching plans.

In terms of instructional materials, considering the specific characteristics of both teachers and students in our college, we can develop teaching resources by incorporating the structure of project-based or case-based instruction, which are familiar to vocational college educators and learners. This approach will be built upon the foundational elements and basic framework of industry training materials while encompassing content that reflects typical tasks, work processes, and requirements found in leading enterprises' key positions. Additionally, it will incorporate commonly utilized tools, methods, and scenarios encountered in professional settings.

3.4 Diversified collaborative evaluation, innovative incentive system

In terms of evaluation, there are two strategies for achieving the integration of courses and certificates. Firstly, a distinction can be made between teaching and assessment by utilizing formative examination methods. This involves involving industry enterprises in the assessment process, which is combined with identifying key points for skills and divided into stages. Secondly, course and certificate integration can be achieved through credit exchange mechanisms. After completing a course, students must participate in corresponding level certificate assessments. Successful completion of these assessments allows students to obtain partial course evaluation results. As a fundamental component within the major curriculum, this particular course closely aligns with vocational skill standards, making it suitable for this approach.

To facilitate the integration, it is crucial to establish relevant incentive measures. For example, the 1+X certificate should be closely linked with the final examination of the "Practice of Construction Engineering Cost" course for students. Successful completion of this exam would entitle them to receive bonus points and unlock privileges such as access to exceptional instructors and additional bonus points in subsequent courses like core skill training and graduation design. By incentivizing a select group of outstanding students, an atmosphere conducive to learning can be fostered throughout the institution. In terms of teachers, separate subsidies have been implemented for those who participate in the 1+X examination as part of incentive policies by the college. Furthermore, it is essential that training outcomes associated with obtaining the 1+X certificate are incorporated into teaching achievement assessments and duly rewarded.

4. Implementation effects and reflections on integration of course and certification

The curriculum reform has made progress after two rounds of student testing, as outlined in the relevant scheme.

4.1 Quality effectiveness

Following the implementation of relevant policies, students have shown a significant increase in their motivation to learn independently. Their enthusiasm for learning has also risen and there has been a noticeable shift in their attitude towards learning. Many students are now driven by the high number of applicants and pass rates for digital cost certificates in engineering costs, resulting in a

50% increase in certificate applications compared to last year with a pass rate consistently above 95%. Our school is set to become one of the exemplary pilot institutions for 1+X certificates by 2022. Additionally, there has been an approximate 10% rise in the final outstanding rate of construction engineering cost practice course. Obtaining these certificates not only provides students with a sense of accomplishment but also serves as an important incentive.

4.2 Knowledge effectiveness

According to the evaluation of enterprise and student feedback, the majority of students utilize this examination opportunity to engage in a comprehensive review of pertinent knowledge points. The referenced students unanimously opine that their understanding of theoretical knowledge and proficiency in operational skills have significantly improved after undertaking enhanced program courses, thereby reinforcing and expanding the scope of practical coursework.

4.3 Capability effectiveness

Due to the curriculum constraints, two cohorts of reference students have either graduated or are currently in the post-internship and graduation design phase. The feedback from their participation in return visits generally indicates a deeper understanding of their respective professions, with relatively smoother progress in their graduation designs, particularly evident in software proficiency. According to feedback from graduation design instructors, the quality of reference students is significantly higher compared to non-reference students. Collaborating enterprises also note that most reference students require a shorter adaptation period at work and demonstrate greater proficiency in practical skills. Simultaneously, this approach facilitates meeting graduation requirements for students while effectively enhancing the overall graduation rate and alleviating academic burdens.

The integration of curriculum and certification involves the fusion of educators and learners. During implementation, areas of overlap will be identified and enhanced. It is crucial to foster a conducive environment for scholarly inquiry while conducting comprehensive promotion at both the teacher team and student levels. By instilling an ideological perspective that emphasizes the significance of piloting 1+X certification, a favorable atmosphere can facilitate smoother progress in this endeavor. Leveraging exemplary students' demonstration force effectively supports teaching through the 1+X certificate system, allowing teachers to optimize instructional management time while enabling students to achieve systematic staged learning, thereby establishing a virtuous cycle.

5. Conclusions

The integration of curriculum and certificates under the 1+X certificate system serves as a means to an end. In response to evolving industry demands, professional development and curriculum reform have become imperative for educational institutions. The implementation of the 1+X system represents a practical reform initiative aligned with national policies. By integrating curriculum and certificates, it is indeed possible to alleviate burdens, enhance efficiency, strengthen teaching quality, and elevate students' comprehensive professional competence.

Although there is a certain practical basis for integrating the 1+X certification system and curriculum, this paper analyzes the current status of curriculum application and proposes measures such as curriculum teaching reconstruction, resource renewal, and the establishment of a multi-evaluation system. However, with the continuous maturation of the 1+X certification system and sustainable industry development, exploring and implementing an effective, reasonable, and sustainable integration of curriculum and certification still requires collaborative efforts from

multiple stakeholders. Some problems and obstacles in the implementation stage persist, including insufficient understanding of school certification systems and inadequate alignment between curriculum and certification resources.

Acknowledgement

Supported by Three Kinds of Teaching Reform Research Projects of Zhejiang Tongji Vocational College of Science and Technology in 2021: Practical Application of Integration of Construction Engineering Cost Practice Course Certificates under the 1+X Certificate System (kg202109).

References

- [1] Shi, L. (2023). *Exploration and practice of "1+X" BIM certificate accommodation optimization path in vocational colleges*. *Project Management Technique*, 21(07):72-77.
- [2] Liu, W. (2019). *Research on curriculum reform of vocational education under 1+X certificate system*. *Vocational Education Forum*, (07):47-53.
- [3] Wang, H., &He, Q. Q. (2021). *Research on talent training in higher vocational colleges under the background of "1+X" certificate System -- Based on questionnaire survey and analysis of finance and economics majors*. *Career Technology*, 20(12):20-25.
- [4] Zhu, W. (2022). *Construction of quality evaluation system of curriculum certificate accommodation in vocational colleges under 1+X certificate system [J]*. *Education and Careers*, (14):29-35.
- [5] Yang, H. H., &Wang, Y. P., &Lou, F. H. (2019). *Research and Practice on Certificate Accommodation of food physicochemical inspection course in higher vocational Colleges under "1+X" certificate system*. *Chemical Education (Chinese and English)*, 44(02):80-84.