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# Theoretical and practical exploration of work-based learning curriculum with a case study

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**ABSTRACT**

This contribution reviews the development of vocational education and training (VET) curriculum development in the last two decades in China, which is categorised into three models: curriculum with theory and practice in parallel (TPP), curriculum with theory in the service of practice (TSP), and integrated curriculum between theory and practice (ITP). It describes briefly also a VET curriculum reform project that adopts a design-based research approach. The main objective of this project is to explore curriculum models that can more effectively promote the development of learners' holistic professional competences. Result shows that the new work-based curriculum, especially ITP, plays a positive role in promoting the professional action competence of students. The new curriculum also has been welcomed by employers. Difficulties in implementation of new curriculum are teaching capability and work experience defect of teachers, and the lack of self-directed learning competence of some students. The key problem to be solved in the future is how to effectively identify the courses and learning contents through effective qualification research.

**Key words:** work-based learning, curriculum development, vocational education and training, integrated curriculum between theory and practice

## INTRODUCTION

In spite of China's long tradition of handicraft, its productive sector has not given rise to the birth of an institutionalized vocational education and training (VET) approach. The Chinese VET system gradually evolved along the establishment of modern vocational schools during the Self-Strengthening Movement (Westernization Movement, 1861-1894). Today, the predominant element of China's VET system is school-based education, and the learning contents are derived from academic disciplinary knowledge, *e.g.* specialized theory related to an occupation and knowledge of general education. Although VET institutions (vocational schools and colleges) since at the end of last century have begun to pay attention to the training of operational skills, *e.g.* the applicability of learning outcomes to work, which aims to meet the job requirement rather than the cognitive competence as well as the personal development of learners, this type of education can hardly meet the purpose of vocational education fundamentally, namely "learning how to work". Over the past twenty years, promoting the development of a training mode combining theory and practice, enterprise and school, *i.e.* work-based learning Chinese style, with a curriculum concept based on job analysis and working processes, has gradually become a consensus.

## CURRICULUM AND CURRICULUM DEVELOPMENT—DEFINITION

The term curriculum which originates from Latin basically means "the action of running". The curriculum is interpreted from different perspectives. For instance, it was understood as a teaching subject or a learning result;

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affected by the pragmatic theory, it was also explained as the experience gained by learners during the education process and their understanding of such experience.[1] The different interpretations of curriculum show that curriculum is a complicated concept with ambiguous meanings. This directly reflects the complexity of curriculum research and practice. In fact, the birth of every new definition indicates a different development of curriculum research and practice. Since the late twentieth century, the following development trends of vocational education curricula in China have emerged.

### *Competence orientation*

Traditional curriculum in China, especially in the school education system, has been systematically focusing on the knowledge of scientific or technological disciplines, such that the connection between learning and working is not tight. Currently, the development of occupational skills/competence has been regarded as the new orientation of vocational education, even though there are different understandings of competence.

### *Focus on long-term career development*

The curriculum based on job requirements is facing huge challenges due to the changed world of work. Due to the more flexibility of labor market, and with the popularization of the concept of lifelong learning, the promotion of career development has become an important task of modern curriculum development.

### *Focus on the connection between learning and work*

With the introduction of information and communication technology (ICT) and the changing of work organization, the acquisition of work process knowledge has become more important and it can be achieved only through case learning in the workplace and during work process. The work place in frame of modern apprenticeship has become an important venue for learning again.

Vocational education curriculum development is the feasibility study with respect to the objectives, content, structure and evaluation criteria of vocational education. The major questions to be answered here are: What are the requirements for occupational qualification? What kind of curriculum structure can better achieve this goal? Nölker and Schoenfeldt have divided the development process of vocational education curriculum into two interconnected systems: one is the explanation and justification, which is the research on occupational qualification including situation analysis, preconditions analysis, didactic analysis, objectives of learning and training; and the other is the implementation and evaluation, which include organization of learning and training, teaching practice and evaluation.[2] Curriculum is not only the framework of action for teaching and learning, but also the system composed of teachers, students and learning resources in the specific learning situation. Therefore, curriculum development also includes the entire system of learning resources and quality assurance.[3]

## CONVENTIONAL VET CURRICULUM IN CHINA

The traditional curriculum of Chinese VET institutions is composed of two relatively independent didactic parts, *i.e.* theory courses and operational technical skill training. Coordination between the content and time plan of these two parts is not pursued, or cannot be pursued due to organizational difficulties. The theory courses are usually categorized into general courses, basic specialized courses and specialized courses, which explains why it is called a "three-stage curriculum". This type of curriculum has a dominant character of "theory and practice in parallel", which reflects the idea of the "parallel curriculum" advanced by the American educator Foshay, whereby students are expected to explore and solve practical problems in reality at work while acquiring systemic knowledge.

Until now, the "parallel curriculum" has played a main role in Chinese VET practices. Identifying the training contents here relies mainly upon transformation of the discipline-specific knowledge generated from science and technology. The content of teaching is knowledge, with "fact" and "symbol" as the main forms of presentation without direct connection with the world of work. Practical teaching emphasizes operational skills but without incorporating learning in work situations and the work process. Schön criticizes this concept of deriving applied knowledge from science: "This concept of applications leads to a view of professional knowledge as a hierarchy in which general principles occupy the highest level and concrete problem solving the lowest".[4] This kind of "parallel curriculum" can guarantee the logical and systematic nature of the scientific discipline to some extent, but fails to relate to working life. It faces the following problems which are difficult to solve.

The teaching focuses on the transmission of knowledge and the training of skills while neglecting the values of action learning. Without treating "work" as an entity, a holistic understanding and reflection of work cannot be developed, so that eventually the highest level of professional cognitive competence cannot be achieved.

In practice, due to the lack of equipment, facilities and organizational conditions, VET institutions usually focus on theoretical knowledge acquisition or fail to conduct in-depth work practice, thus neglecting the acquisition of experience.

Under the current student admission mechanism, most of the VET students are those who are left behind due to low scores in university admission examinations and high school admission examinations. They are not usually good at the deductive learning approaches based on abstract thinking; they have extreme difficulty in deriving theoretical learning from the work context and are unable to realize the knowledge transfer. Thus, it is difficult to meet the requirements of competence development and to achieve the educational ideal of "self-realization" of the parallel curriculum proposed by Foshay.

Despite the problems, this curriculum is still widely applied in China, probably for two main reasons: on the one hand, the organizers, implementers and researchers of Chinese VET have mostly been trained under the traditional knowledge-based (vocational) educational system and have little understanding of the real world of work in enterprises; on the other hand, "applied knowledge" is a widely accepted concept, VET teachers do not have enough knowledge and sensitivity to understand the difference between "applied knowledge" and the knowledge in use.

## THE CURRICULUM REFORM BASED ON JOB AND OCCUPATION ANALYSIS

VET curriculum development is a process of adapting the curriculum to social, economic and technological development needs by means of necessary review and improvement. Since the beginning of this century, China's VET has focused increasingly on solving outstanding problems with regard to training quality, especially the problem that the classical training program setting and the arrangement of didactic processes are no longer meeting the demand. The Ministry of Education (MoE) and the Ministry of Human Resource and Social Security (MoHRSS) issued many policies for improving the quality of the curriculum, and launched a number of projects to establish key VET institutions. The education model that promotes cooperation between enterprises and schools has become widely accepted. It is of great significance in these measures to institute a better balance between theory and practice at the curriculum level to cater to the trend in demand for work-based learning. In order to improve the quality of the VET, foreign approaches to curriculum development based on job and occupation analysis have been introduced, their application has massively improved the VET curriculum's relevance to practice and its effectiveness.

### *The curriculum with theory in the service of practice (TSP)*

The education and training ideology and concept of the competence-based education (CBE) that originated in North America have been widely applied in China. During the popularization of the CBE concept, many VET institutions implemented the DACUM (Developing a Curriculum) curriculum development method, *i.e.* programd qualification research with the critical element of job and occupational analysis. According to the argument of Norton, "expert workers can describe and define their job/occupation more accurately than anyone else".[5] DACUM decomposes a particular occupation/job into relatively independent duties, each of which is then broken down into several tasks and corresponding skills. Objective deduction from the subjective judgment of expert workers then leads to "objective" courses.

Starting from the job requirements, CBE/DACUM has regarded knowledge learning as the supporting measure for the acquisition of skills and competence development without requirements concerning the quantity and systematization of knowledge, thus forming the curriculum type known as "theory in the service of practice". The widespread slogan "theoretical knowledge should be adequate for application" in China is a vivid portrayal of the pursuit of such curriculum.

Practice has shown that the CBE/DACUM approach, which takes job analysis as a starting point and focuses on the requirements of the labour market, has almost a "revolutionary" significance, compared to the academic paradigm of the past, based on disciplinary knowledge, because the idea of "theory in service of practice" is contradictory to the traditional precept of Confucian culture that "knowledge accumulation is superior to practice". It has fundamentally changed the relationship between theory and practice and thereby determined the new position that "practice is more important than theory" in VET. It has also, indirectly, given an impetus to the Chinese government while shifting its focus from the ideological conflict in the so-called "culture revolution" towards "economic development".

In the discussion among education scientists, the TSP Curriculum has also been criticized especially for ignoring pedagogical aspects and "educational goals".[6] The basic assumption of this concept is that practical knowledge as it appears in professional work is interpreted as being applied scientific knowledge, while the impacts of tacit knowledge on professional competence development are neglected. It regards learning as a simple process between input and output, and competence development as a top-down transfer from teacher to student, emphasizes the enhancement of qualification achieved through the accumulation of scientific knowledge and skills, and focuses on observable changes in behaviour, which is directly related to the behavioral learning paradigm.[7,8] Insufficient attention was paid to professional cognitive competence. The notion of combining single skills into a

competence also ignores the learning situation and holistic qualities of work.

Opposed to the widely held belief in the west that China is a society with centralized planning and decision-making processes, VET institutions enjoy a certain degree of curricular autonomy, especially in the case of new training programs for which no official curriculum yet exists. A number of VET institutions where the Anglo-Saxon culture has more influence use the DACUM. Practice shows, however, that they struggle to provide courses on a sufficiently empirical basis, because there is no established didactic tool for handling identified work tasks in a systematic manner. Instead, the existing curriculum framework was applied, which leads to the establishment of courses that are largely based on the scientific and engineering disciplines. The difference between this curriculum and the curriculum of academic higher education is vague. Deng conducted an analysis on the curricula of this type. After comparing vocational college curricula with undergraduate courses of universities, she came to the following results: out of the 16 courses for the communication technology major of the vocational college, eight courses are exactly the same as those of the university, while six are basically the same, resulting in 87.5% of overlapping courses.[9]

### *The curriculum with integration of theory and practice (ITP)*

The development of ICT and the popularization of new forms of work organization bring forth higher requirements for the professional competence of skilled personals. Since the beginning of this century, both educationalists and VET institutions have recognized that effective learning requires students' cognition and reflection with respect to the tasks, processes and contexts in real work situations. It is necessary to carry out an integrated curriculum designed to allow students not only to acquire knowledge and skills, but also to gain holistic action competence and an occupational identity. At the political level, the MoE launched a pilot program to "Improve the Education Quality to Deal with the Shortage of Skilled Personnel" by developing a new curriculum emphasising the integration of knowledge learning, skills training and experience acquisition in actual work situations.[10] From that time on, VET institutions have done numerous experiments in the area of developing "curriculum with integration of theory and practice" (ITP curriculum). The forms of the new curricula can be categorized into two types. One simplified type is that project teaching has been promoted as a kind of curriculum model[11] and has been implemented especially in south China; the other is the introduction of the learning field curriculum initiated in Germany, and developing and establishing a curriculum type with ITP.

In Germany, vocational schools started to implement the didactic concept of "learning fields" (topic areas) in 1996. A learning field is a specialized teaching unit derived from professional competence in the form of an "action field" by means of instructional design.[12] Chinese educationalists believe that high-qualified skilled workers shall meet the requirements of professional competence, while the purpose of learning fields is to promote the development of professional competence that is mentioned as individuals' reflection in an occupation and in society, and the willingness and capability responsible for the shaping of individuals and society. Thus, the learning field approach should be an optimal type of ITP curriculum that is characterized by "learning situation orientation" and "work process systematic".[13]

In the last two decades, VET institutions have carried out a great number of pilot projects to develop Chinese "learning fields", whose features are highlighted as follows: the training objective is to develop holistic comprehensive professional competence; the learning content is the professional task (which does not correspond to discipline knowledge); the learning process is aligned with the work process, where students can conduct learning and thinking in comprehensive actions.[14] Developing an ITP curriculum requires an occupational analysis method that describes characteristics of modern occupations properly and reflects the rules of competence development. The method of "professional task analysis" (or "BAG" from the German "Berufliche Aufgaben") could be regarded as a further development of DACUM. In comparison to the DACUM approach, BAG identify the "professional tasks" on the theoretical basis of the "developmental logic curricula",[15] and the "expert-novice paradigm"[16] by introducing a new "Expert Worker Workshop" (EXWOWO). In contrast to DACUM's expert workshops, EXWOWO regards "work" as a whole process and distinguishes, filters, analyses and classifies work tasks into different career development stages.[17] The result of the occupation analysis is not a list of competencies, but a number of professional tasks, so as to facilitate the specification of comprehensive learning objectives and learning content.

Chinese VET institutions have carried out a wide range of practices on BAG, and have refined and improved the approach according to the Chinese-specific situation. Different workshop procedures and standards are defined for different types of occupations, particularly to reflect the requirements for the acquisition of work experience and tacit knowledge. It can be said that the BAG approach has helped Chinese VET to realize the transition from the discipline-oriented to a developmental-logic-based and professional-competence-oriented curriculum.

In the relevant practices, ITP curriculum has been divided into two developing levels: the lower level is "the integration of theory and practice teaching", while the higher level is "the integration of work and learning".

In institutions where teaching facilities and equipment are lacking and teachers have little practical experience, an integrated didactic unit of theory explanation and skill training is conducted in one class, which means one step forward as regards the separation of theory and practice. When faculty and organization conditions permit, the learning content of the "integration of work and learning" curriculum focuses on all work-process-related factors including the subject matter of professional work, the tools, methods and organization of skilled work, and the requirements for skilled work.[18]

The curriculum with "integration of work and learning" reflects the concept of constructivism and situated learning theory. It views professional competence as the possibility or potential to complete a certain occupational activity through work-based learning. The work analysis process of developing such courses focuses on the work contents and context, practical community, and experiential learning of implicit knowledge, emphasizing a "deep description"[19] of work actions and the acquisition of implicit knowledge which has special significance for high skilled personnel to complete complex work tasks,[20] reflecting the complex relationship between theory and practice, as summarized by Schön, which includes five characteristics of practice: complexity, uncertainty, instability, uniqueness, and value conflict.[21]

Empirical research shows that the ITP curriculum developed with BAG has achieved positive results. With random selection of similar conditions including students, learning venues and equipment, students in the experimental group following the ITP curriculum generally demonstrate better professional competence than the ordinary group. According to the results of COMET competence diagnostics, the experimental group particularly outperforms the ordinary group on the second level of conceptual-processual competence, *i.e.* "business and work-process orientation", and the third level of holistic shaping competence, *i.e.* "creativity of solution", confirming that the ITP curriculum is a good way to develop students' comprehensive professional competence.[22]

From the pedagogical-didactic point of view, the introduction of an ITP curriculum has played a positive role. The ITP curriculum built a new curricular system according to the competence developmental logic after breaking the discipline-oriented curricular system. This curriculum can better help students to understand the connection between knowledge and work, to obtain the work-process knowledge and context awareness. It has also had an education policy impact. For example, in 2022 the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council have issued the "Opinions on Strengthening the Construction of High skilled Talents in the New Era", which clearly promoted the "promoting of the work-learning integrated curriculum" and the "developing of integrated teaching model".

The implementation of the ITP curriculum implies a series of changes, and poses a great challenge ahead for the current VET management system (*e.g.,* class arrangement, independent theory teaching and practical training). Reforms need to be aware of the following prerequisites: (1) Great changes are needed to commonly held beliefs about teaching and learning and the management and service concepts of VET institutions. The relevant personnel need to change their mindsets so as to align their actions with the new curriculum concepts. (2) Costs for curriculum development, teaching operation and management will greatly increase. (3) The new curriculum requires teachers to have comprehensive competence both in teaching and occupational experience.

The ITP curriculum has, up to now, barely been applied in developed regions and VET institutions with advanced educational ideas. There are still many challenges. In some pilot projects, the curriculum reform tends to show a formal, superficial and conceptual trend. He's survey found that under influence of the previous DACUM concept, many VET institutions regard professional competence as a punctate training output of skills, thus reducing the legitimacy of the "holistic professional-competence-oriented" curriculum.[23] In accordance with the e-learning idea of "micro-courses", teaching units of knowledge and skills are sometimes reconfigured into smaller-scale and standard programs, which hinder students from obtaining a comprehensive understanding of a work process. The current occupational certification examination and learning evaluation contradicts the work-process-oriented curriculum concept, and also affects the implementation of the new curriculum.

## EXAMPLE: CONSTRUCTION OF PROFESSIONAL TASKS BASED CURRICULUM FOR NURSING FURTHER STUDY PROGRAM

### *Background*

Nursing education is an important field in VTE with numerous institutions and students. Traditional nursing education in China often receives critics for being detached from nursing practice. In order to explore

more scientific and efficient nursing training models, the Peking University and Beijing Normal University have collaborated to carry out a curriculum reform project based on work-based learning concept with a design-based research approach.[24] The project is implemented at the School of Distance Learning for Medication Education, Peking University (referred as "PUDM") within the framework of a further study program at bachelor level for nurses with associate college degree.

Originally, PUDM adopted a traditional curriculum mode of nursing education which is prevailing in most Chinese universities, *e.g.* independent two systems for teaching of theory and skill training. The features of this curriculum are: (1) emphasis on completeness and systematics of disciplines and focus on reproduction, understanding, verification and memorizing of knowledge; (2) the content of theoretical learning is the result of didactical reduction which without direct connection with work; (3) the practical teaching emphasizes on operational techniques and skills, and there is a lack of learning and reflexing in real work process.[25] In the practice of implementing this curriculum, following problems were proved: the learning content didn't link directly to real work content; this mode of education didn't go hand in hand with students' future daily work, and their practical capabilities failed to be recognized by their employers at last.

In 2010, PUDM envisioned to construct a more practical and more convenient mode of teaching and learning which caters for distance learning. In partnership with the Institute of Vocational and Adult Education of the Beijing Normal University (BNU), the PUDM initiated a curriculum reform project oriented to the new development of the health care industry according to the traits of adults' part-time learning on the Internet. A scheme of professional competence development from vocational education was introduced based on the concept of typical professional tasks. The project aims to find a solution to the questions: how to cater for the needs and features of adults' learning, and how to make use of technological edges of distance learning to improve their holistic professional competence.

## Guiding principles

Compared with students in full-time study program, adult students in part-time study program have the traits of utilitarianism-oriented learning motivation, clear self-identification, learning readiness being related to their social roles.[26] Their learning activities are oriented to problem solving in practice rather than for theory study and research. According to the reform concept, the new curriculum should focus on the training objectives of holistic professional competence development, comply with the relevant development rules of professional competence "expert-novice paradigm" and establish a course system based on typical professional tasks.[27] Emphasis of the new courses is laid on the work process, working content, working conditions and work requirements of the nursing practice. The learning content highlights students' self-directed learning which based on "Working-learning tasks" and online learning resources. Meanwhile, students can be tutored in their daily practice both by experienced nurses and university teachers. The teaching assessment is based on the assessment content and methods on nursing practice in the clinic.

## Process of the curriculum development

### *Conducting survey and identifying the roadmap of the reform activities*

The project group conducted a one-year survey to identify the basic principles and cultivation objectives of the new study program. (1) According to the literature study and policy analysis, the health care policies and their development orientation became clear. The curriculum reform should be based on work place and work process requirements, meet the national education policies and the development trend of the health care industry. (2) Nurses' professional practice needs holistic capabilities. The objectives of nursing education are to help students acquire the holistic competence for the nursing career, which shall be set as the quality standard of education. (3) According to the survey on work place needs, the fundamental requirements for nursing job are identified. (4) It is need to collect the information about the current situation of nursing education in China and abroad as well as about the different experience of competence-based curriculum development in VTE.

### *Adopting suitable approaches to identify the curriculum system*

Usually, there are two distinct guiding principles in curriculum design in China, thereby formed two different course schemes. One is based on the discipline system which focused on its scientificness, completeness and systematicness; the other is based on occupational requirements and focused on the application of knowledge, which lays an emphasis on the requirements of work place. PUDM has analyzed the work-based curriculum development approach and holds that it is of great importance to the nursing career development. The "Professional Tasks Analysis Approach" (BAG) has been chosen, whose key lies in the EXWOWO on clinic practice.

The PUDM held an Expert Worker Workshop on Clinic Practice. The attendees conducted an analysis about nursing professional tasks based on the concept of

"Developmental tasks".[28] Under the moderator's guidance, experts recalled their history of career development and be categorized several stages. They identified challenging tasks at every stage according to the developmental paradigm "from novice to expert"[29] and then they classified and named those tasks. Finally they summarized a framework of 12 professional task for nursing profession (at the bachelor's level), *i.e.* career awareness, primary clinical nursing, clinical assessment, nursing for common diseases, emergency and intensive nursing, emergency response inside and outside hospital, difficult and complex nursing problems disposal, nursing teaching, organization and management of nursing effort, nursing administration, the doctor-patient relationship coordination, nursing research and monitoring nursing quality. All above lay a basis on the classification and index of study courses at the bachelor level.[30]

### *Setting up the curriculum system, internal and external review of the curriculum*

PUDM invited the experts who attended the EXWOWO to finally identify and review the names and content of the identified professional tasks, basically confirmed the curriculum framework of nursing education. Afterwards, the new curriculum was submitted to an external expert commission. They reached a consensus on the reform thought, the procedure and reasonable results of the construction of the curriculum system. They made also comments on the coverage and difficulty of different courses, qualification needs of teaching staff and feasibility of the new curriculum. They suggested that the new curriculum should be tested by a pilot program firstly.

### *Perfecting the curriculum and determining operation teaching plan*

The project group invited clinic experts to further streamline the new scheme and analyze the content of the professional tasks. They discussed every task's background, significance, working process and content, and finally confirmed the teaching plan. In the meantime, the group members consulted experts from other universities and education research institutions and solicited advice on course design, teaching methodology, assessment mode. Meanwhile, all colleagues of the project group drew up a detailed teaching plan on the course "Coordinate the Nurse-Patient Relationship and Tackle Disputes" together as a model for other courses (Table 1).

The features of the new curriculum can be summarized as: (1) the objective is development of holistic professional competence, where students can obtain the professional cognitive competence, occupation skills and qualification; (2) the learning content is the professional task, which is not (direct) corresponding with discipline knowledge; (3) the learning process is equipped with the work process, where students can conduct learning and thinking in comprehensive actions. Starting from the world of work, the new curriculum helps students to deeply understand the connection between knowledge and work, obtain the work process knowledge and context awareness,[31] it could realize an unification of action, perception and emotion and the return of curriculum from the world of science back to the world of work.[32] From the perspective of learning theory, new curriculum is based on the theory of constructivism, situated learning and action orientation.

### *Development of learning resources and teaching support environment*

Distance education must be supported by online learning platforms. Based on the new curriculum philosophy, big changes take place in the development mode of course resources. The new support platform contributes to teaching design, resource design and learning process, *e.g.* it adds functions like monitoring when students hand in their homework, determining the proportion of test modes and real-time statistics of question and answer (Q & A).[33] Various departments can share information and coordinate on following up learning process and assessment.

### *Pilot on the experiment class and continual improvement*

The new curriculum was implemented in a small scale firstly. Candidates volunteered to apply for the pilot class. They shall be on-the-job nurses who equipped with associate college diplomas of nursing and nurse practitioner certificates. They should be ready for the teaching reform and intensive learning. The following measures was adopted: (1) elaborating design on the teaching process; (2) choosing qualified teachers, ensuring them to understand the teaching-learning reform concept and master the latest instruction methods; (3) enhancing support and tutoring for students, paying special attention to students' individual differences.

Before the new semester began, the PUDM convened all the teachers to discuss the design of courses and hold meetings of preparing teaching plans, so as to make an effort to ensure the teaching reform. During learning processes, the project group timely followed up the teaching to monitor to spur students' learning. At the end of a semester, the PUDM teachers made summary and reflected their teaching activities. The results show that students have finished learning tasks and enhanced their capability of knowledge acquisition. But they had also difficulties to adapt to the new teaching approach, during the first year. That phenomenon requires more guidance for teachers.

**Table 1: Courses before and after the reform**

| Items | Before reform | Reformed |
|---|---|---|
| Courses | Medical Immunology II<br>Pathology<br>Biochemistry II<br>Medical Genetics<br>Preventive medicine<br>Health Statistics I<br>Medical Psychology<br>Clinical Nursing II<br>Nursing management<br>Nursing education<br>Nursing Pharmacology II<br>Fundamentals of Nursing Humanities<br>Nursing research | Career awareness<br>Primary clinical nursing<br>Clinical assessment<br>Nursing for common diseases<br>Coordinate the nurse-patient relationship and tackle disputes<br>Emergency and intensive nursing<br>Organization and management of nursing effort<br>Emergency response inside and outside hospital<br>Difficult and complex nursing problems disposal<br>Monitoring nursing quality<br>Nursing teaching and coach<br>Research on nursing professional issues |
| Characteristic | Discipline-oriented course with a focus on explaining knowledge | Learning field built according to the paradigm from novice to expert |

## *Result*

The implementation of the new curriculum is not long, the whole effect needs to be comprehensively evaluated. According to tracking survey, as a result of the way of action-oriented approach to learn in real work situation, students have to collect data, make and implement working plan and evaluate the learning outcome by themselves after get work and learning tasks form teachers. Compared with traditional discipline-based curriculum, students participate in the real work process deeply and solve the complex professional issues, rather than just reading textbooks and discussing about some cases, which plays a positive role in promoting the professional action competence. Random monitoring on a typical day of students' online learning shows that, compared with those from "normal" classes, students from the pilot class have more participation in learning. Most of them study online during 20:00-23:00 and some still do even at 24:00 (Figure 1). A student commented in the survey: "It doesn't have complicated theories, but rather integrates them into every aspect of clinical work, allowing me to improve my abilities and professional accomplishment through work. This advanced teaching approach deeply attracts me".

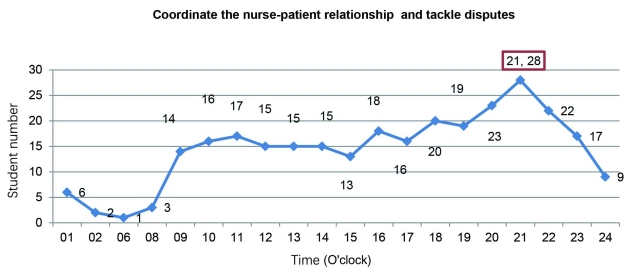


**Figure 1.** Tracking of student online learning situation.

According to the feedback about the first group of graduates, the reformed study program has been welcomed by employers. The head of nursing department of a hospital stated in a survey that "the new courses in the experimental program are developed from beginners to experts, from practice to theory, and then from theory to practice, which are truly close to clinical work, highlighting the training of practical ability, thinking ability, and expression ability...from the perspective of nursing department, I highly recognize this training concept, and recommend that in-service nursing backbone personnel choose this new course". Since the good performance and the reputation of graduates, for example, a famous Sino-foreign joint venture upscale hospital from Shanghai even proposes to cultivate a large number of their nurses in cooperation with PUDM.

The survey found that the competence of teachers is a key factor to the quality of the implementation of the new curriculum. On the one hand, teachers should have the sufficient didactical-methodological competence, and can design suitable learning tasks that reflect the real work requirements; on the other hand, the teachers' working experience have a great impact on the study of students, the degree of professionalization of the guide teachers provide directly affect the depth and breadth of student reflection about the practice.[34] It's still difficult to find enough competent teachers.

In the new curriculum, self-directed, (relatively) independent and out-put-oriented learning approach requires that students use expertise and work experience to solve practical problems. This increases learning pressure for some students who have less learning motivation or competence, and just want to get diploma. Several students have difficulty to study, and are no longer willing to pay so much to learn after a period of study, who ask to resign from the pilot class and return to learn in the traditional "normal" classroom. This is consistent with the results of our other empirical study.[35]

The reform calls for the breakdown of the traditional

curriculum mode and the establishment of a new curriculum concept, it is challenged also by two things: (1) there is a great change in the curriculum concept and philosophy of study administration, study service and instruction before and after the implementation of the reform project. All the participants shall change their mind-set, which faced great problems in the practice; (2) facing query from (part-time) lectures, external experts (*e.g.* professors from traditional scientific disciplines) and students, who needs a lot of explanations.

Practice shows that timely summary is an effective approach for continuous improvement. At the end of every stage of study, teachers shall be convened to summarize and exchange their views on the teaching activities, and seek for further improvement approaches.

## SUMMARY AND PROSPECTS

At present, the practice of VET curriculum development in China can be divided into two categories: the sector analyses organized by governmental authorities, and the job analysis adopted by VET institutions. In many cases, these activities remain a simple process of data collection and processing. For example, the MoE is working on developing "teaching standards" for vocational colleges in an effort that is mainly based on the colleges' involvement. Colleges are called and organized to do enterprise investigation, but corresponding regulation and guidance is not available on what kind of methods to use and how to interpret the gathered data. There is also no appropriate tool that ensures the reliability of the analysis of the work structure and content during the professional task analysis.[36] Without enough preparation in the basic understanding and methods of qualification research, it is difficult to guarantee the quality of the surveys.

The lack of sensitivity to use established research methods may increase the uncertainty of the results of curriculum development. It is of great significance to develop a nationwide "guide book" on conducting qualification research, and to monitor the process of curriculum development. In other words, a whole "toolkit" is necessary for curriculum development, which covers the entire procedure including sector analysis, occupation and job analysis, curriculum design and assessment.[37]

The key problem to be solved is how to effectively identify the courses and learning contents from the results of qualification research. A clever way forward for developing countries is to study the experience from developed countries and to localize the best practices for general promotion. In China, experiential learning from developed countries brings "two-sided" impacts. On the one hand, researchers have gained much inspiration as well as tools to achieve effective results in a short time; on the other hand, different countries have varying concepts, which could cause confusion for practitioners (with a weak theoretical base). For example, the Anglo-Saxon world and Germany have different understandings of "competence".[38] As a result, their curriculum concepts and development methodologies are also different: the former regards skilled workers as a resource that needs effective allocation,[39] while the latter focuses on the development of domain-specific cognitive dispositions.[40] It is nearly impossible to carry out effective cooperation in curriculum research and practice between VET institutions that follow concepts which differ across these lines, which could adversely affect developing countries in their efforts to improve curriculum and practice without a strong theoretical basis.

The advent of the Internet era has promoted the development of the world of work and education. On the one hand, ICT imposes higher requirements upon employees' key competencies, many of which can only be gained in the work process; on the other hand, artificial intelligence is being extended to the entire working environment, which gives birth to the highly flexible, personalized and digital learning mode. The workplace returns to being an important place of learning. Although the features of VET curricula in the Internet era have not been fully grasped, one certainty is that work-based learning will become as important as traditional classroom-based learning, and that both are indispensable parts of any VET curriculum.

Currently, there is still an inadequate understanding of the potential of work-based learning in China, probably because of two reasons. The first relates to the limitations of work-based learning itself, namely the fact that work-based learning depends heavily on the specific tasks and working conditions, that the learning process is relatively casual, and that it costs much more. Furthermore, some workplaces are off limits for learning (the assembly line, for instance). Secondly, the related research is scattered across different disciplines, such as vocational pedagogy or industrial sociology, under different concepts and understandings about the shaping of the learning process. In the future, the focus of VET curriculum research should be on how to design work-based learning tasks for cross-occupational areas supported by ICT, so as to ensure that learners become the main body of the learning process. The key points could be derived in terms of how to transfer a complex work reality into a learning situation with the help of ICT. It is important to define the paradigm of teaching and learning via simulation and the learning platform, and to determine the knowledge elements and learning communication mode contained in this platform. It is also suggested to investigate work-based learning effectiveness across different industries or cultural contexts, and to exam the impact of various teaching strategies on learning outcomes.

## DECLARATIONS

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Zhao ZQ: Conceptualization, Writing—Original draft, Writing—Review and Editing.

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No additional data.

## REFERENCES

1. Hass, G. *Curriculum planning: A new approach*. 5th ed. Boston: Allyn and Bacon; 1987.
2. Nölker H, Schoenfeldt E. *Vocational training: Teaching, curriculum, planning*. Expert; 1980: 92.
3. Zhao Z. Curriculum Research. In: Zhao Z, Rauner F. eds. *Areas of Vocational Education Research*. Springer; 2014: 189-214.
4. Schön AD. *The Reflective Practitioner. How Professionals Think in Action*. New York: Basic Books, 1983: 24.
5. Norton B. *The DACUM Handbook*. The Ohio State University; 1997: 1.
6. Jiang DY, Wu QQ. [*Contemporary Mainstream of the Teaching-learning Theory in German Vocational Education*]. Tsinghua University Press; 2006.
7. Ertl H, Sloane P. [Curricular development work between learning field and functional field]. In: Pätzold G, Rauner F. eds. [*Qualification research and curriculum development*]. Franz Steiner; 2006: 117-127.
8. Hager P. Competency Standards. *Vocat Aspect Educ*. 1995;47(2): 141-151.
9. Deng B. [An empirical study on the teaching management of higher vocational education]. Beijing: Beijing Institute of Technology. 2004. (Thesis)
10. [Circular on the Implementation of Program to Improve the Education Quality to Deal with the Shortage of Skilled Personnel in Construction Sector from the Ministry of education and the Ministry of construction]. Ministry of Education of the People's Republic of China. Updated October 28, 2004. Accessed February 2, 2024 http://www.moe.gov.cn/s78/A07/zcs_left/moe_953/201001/t20100129_9724.html
11. Xu GQ. [*Guidelines for Projects Curriculum Development in Vocational Education*]. East China Normal University Press; 2009.
12. KMK. [*Guidelines for the development of KMK framework curricula for vocational instruction at vocational schools and their coordination with federal training regulations for recognized training occupations*]. KMK; 1996.
13. Jiang D. [*Essentials of Vocational Education*]. Beijing Normal University Press; 2017: 20-22.
14. Zhao ZQ. [*Guidelines for the Integrative Curriculum Development in Vocational Education and Training*]. Tsinghua University Press; 2009: 1-5.
15. Rauner F. [Developmentally structured vocational curricula]. *J Vocat Bus Educ*. 1999;(3):424-446.
16. Dreyfus HL, Dreyfus SE. *Mind over machine: the power of human intuition and expertise in the era of the computer*. Blackwell; 1986.
17. Spöttl G, Loose G. *Conducting Work-process Analyses for the Development of Advanced Detailed Curricula*. In: Bahl A, Dietzen A. eds. *Work-based Learning as a Pathway to Competence-based Education. A UNEVOC Network Contribution*. BIBB; 2019: 128-146.
18. China Technical Guidance Center for Employment Training. *Guiding Handbook for Work-Learning Integrated Curriculum Development*. China Labor and Social Security Publishing House; 2023.
19. Lave J. *Cognition in practice: Mind, mathematics and culture in everyday life*. Cambridge University Press; 1988: 12.
20. Polanyi M. *Personal Knowledge. Towards a Post-Critical Philosophy*. Harper & Row; 1964: 53.
21. Schön D. *The Reflective Practitioner: How Professional Think in Action*. Basic Book; 1983: 16.
22. Zhao ZQ, Lin LS, Zhang ZX. [The Evaluation of Learning Effect of Curriculum Reform in Higher Vocational Education: An Empirical Study]. *J Natl Acad Educ Adm*. 2014;(7):74-79.
23. He X. [*Research on work process-oriented curriculum implementation in vocational colleges. Dissertation*]. Tsinghua University Press; 2021: 120-126.
24. Reimann G. Design-Based Research. In: Schemme D, Novak H, eds. *Gestaltungsorientierte Forschung*. BIBB; 2017: 49-61.
25. Zhao Z, Sun B. *Construction of Professional Tasks Based Curriculum for Applied Further Study program at Bachelor Level—take Nursing Distance Education as an example*. In: Eicker F, Haseloff G, Lennartz B, eds. *Vocational Education and Training in Sub-Saharan Africa—Current Situation and Development*. Bertelsmann; 2017: 145-151.
26. Knowles MS. *The Adult Learner: A Neglected Species*. Gulf Publishing; 1990.
27. Dreyfus HL, Dreyfus SE. *Mind over machine: the power of human intuition and expertise in the era of the computer*. Blackwell; 1986.
28. Havighurst R J. *Developmental task and Education*. Longmans & Green; 1972.
29. Dreyfus HL, Dreyfus SE. *Mind Over Machine: The Power of Human Intuition and Expertise in the Era of the Computer*. Free Press; 1986: 1-40.
30. Sun B□ Liu Z□ Gao S□ Zhao Z. [Research on the Reform of Distant Nursing Education Based on Professional Tasks]. *Chin Nurs Manag*. 2016;16(10):1297-1301.
31. Fischer M. [*From work experience to work process knowledge: Computer-aided work in the context of vocational learning*]. Springer; 2000.
32. Zhao Z. Curriculum Research. In: Zhao Z, Rauner F, eds. *Areas of Vocational Education Research*. Springer, 2014: 189-214.
33. Wang N. [*Study on the Effectiveness of Distant Learning the "Moodle Platform"*]. Nanjing: Nanjing Normal University. 2011. (Thesis)
34. Zhang Z, Tian J, Zhao Z,*et al*. Factors influencing vocational education and training teachers' professional competence based on a large-scale diagnostic method: a decade of data from China. *Sustainability*. 2022;14(23):15871.
35. Zhao Z, Gao F. [Comet as an instrument for quality development in Chinese vocational education and training.]. *Educ Prof*. 2022;(6):213-218.
36. Sun L, Xu G. The Development and Evolution of Teaching Reform in Secondary Vocational Education in China. *Vocat Educ Forum*. 2015;(3): 4-15.
37. [International Comparative Study Report on the Integrated Development of Middle and Higher Vocational Education]. Institute of Curriculum and Textbook Research; 2024.
38. Zhao Z. Competence Research. In: Zhao Z, Rauner F, eds. *Areas of Vocational Education Research*. Springer; 2014: 167-188.
39. Hager P. Competency standards-a help or a hindrance? an Australian perspective. *Vocat Aspect Educ*. 1995;47(2):141-151.
40. Röben P. *Competence and expertise research*. In: Rauner F, Maclean R, eds. *Handbook of technical and vocational education and training research*. Springer; 2008: 371-379.