

# On “Credit Bank” Mechanism-based Engineering Education Curriculum Evaluation

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**Abstract**—Here we examine the engineering education curriculum evaluation based on “credit bank” mechanism by referring to the functional characteristics of banks. After analyzing the inevitable rise of “credit bank” mechanism, which is a result of requirement of equal opportunities for higher education, establishment of modern vocational education system and stimulating the diversification of equal opportunities, we elaborate on the effective implementation of such mechanism in curriculum evaluation by accomplishing functions like credits storage, credit replacement, credit recognition and comprehensive grade point. We further suggest a series of measures to guarantee its implementation including emphasizing teacher moral, inspiring students, managing scientifically, reorganizing resources and sticking to integrity. The implementation of “credit bank” mechanism in engineering education curriculum evaluation offers students free choices of learning content, paces, locations and methods, stimulating some to be excellent while allowing others to be ordinary.

**Keywords**—“Credit bank” mechanism, engineering education, modern vocational education system, development credit

## I. INTRODUCTION

“Credit bank” mechanism, as one way to implement credit system, simulating the functional characteristics of bank and taking autonomous course selection as its core, evaluates students' studies by means of credit storage, grade point calculation, etc. Compared with traditional learning system, this mechanism, with the advantage of flexibility, diversity, accessibility and efficiency, can to some extent exploit students' potential and initiatives, and thus increase their learning effectiveness and efficiency. “Credit bank” mechanism, with long-term overseas development, was introduced into China in the middle of 1990s and has since then been strongly advocated in vocational education and permanent education. Moreover, proposals were put forward to establish the assessment system of learning outcomes and credit bank mechanism in the recently published National Medium and Long-term Educational Reforms and Development Planning

Outline (2010~2010)[1]. Credit accumulation and transfer scheme (CATS) was also brought forth to promote the mutual recognition of learning outcomes in Decision of Accelerating the Development of Modern Vocational Education by the State Council. Thus the significance and unique functions of credits in vocational education are further illustrated. This study aims to investigate the implementation background of “credit bank” mechanism, with some possible function choices put forward, and the existing problems and challenges analyzed.

## II. RISE OF “CREDIT BANK” MECHANISM

“Credit bank” mechanism didn't emerge and develop for accidental factors but with the process of development of higher education, which has increasingly blurred boundaries with vocational education. And modern vocational education system, characterized by the function of connection, comes into being. As is known to all, universities, as a kind of social organization, differ in different countries and times. “The Paris of 1900 has little in common with the Paris of 1700; the Oxford of the twentieth century, externally so largely the same, is nevertheless a very different thing from the Oxford of the eighteenth century”[2]. Since the medieval time when universities came into being, “the uniqueness of the university, that peculiarly invention whose meaning and purpose have changed from age to age and from society to society from its birth in twelfth-century Italy and France to its colonization of the whole modern non-European world, lies in its protean capacity to change its shape and function to suit its temporal and sociopolitical environment while retaining enough continuity to deserve its unchanging name.”[3] Universities always illustrate their usefulness with their ever-changing forms and in turn contribute to their own development. As a worldwide strong power of higher education, the uniqueness of its higher education lies in its invention of a set of flexible credit systems, in which credits circulate as currency in them[4]. “Credit bank” mechanism was also put forward officially by Korean Educational Development Institute (KEDI) in 1995; lifelong learning account system was promoted across the UK in 2000; European Higher Education Area was established in 2010. The mutual recognition system of credits takes students to Europe and Europe to students. In recent years,

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pilot credit bank mechanism was also launched in China to explore the establishment mode of open university and set up mechanism of learning outcomes recognition and credit bank. "Credit bank" mechanism has been widely acknowledged in many countries and is historically inevitable.

#### *A. Requirement of Equal Opportunities for Higher Education*

In World Declaration on Higher Education for the Twenty-First Century (WDHE21stC) by United Nations Educational, Scientific and Cultural Organization (UNESCO) [5], equal opportunities for higher education was listed as the third item. When higher education in China stepped into the stage of mass higher education, colleges and universities were also expanding enrollment in many other countries, especially in North America, Europe and Oceania. After the enrollment expansion, the gross enrollment rate (from 9.8% in 1999 to 24.2% in 2009) merely rose by 10 in the worldwide rankings[6]. Higher education, at the request of the times, is no longer exclusive to the minority but accessible to the public. The popularization of higher education means tolerant entry into and strict exit from colleges and universities. However, strict exit does not mean limited exit. Therefore, necessary conditions should be offered for students of different personalities or levels to leave for the society at different time[7]. It is essential for colleges and universities to interact with educators and educatees open-mindedly to exploit resources stimulate students' desire for learning and offer access to lifelong learning and diploma to those capable social members who long to realize their dreams. "Credit bank" mechanism is to education what bank is to economic activities, the implementation of which will greatly promote the efficiency of education reform.

#### *B. Establishment of Modern Vocational Education System*

The WDHE21stC points out that it is essential to cater to students' needs and offer them necessary and powerful education or training in the knowledge-based society of 21st century[5]. With the advent of knowledge-driven economy, the intellectual labor becoming the major form in labor market, the application-oriented higher education has become an important mode in the field, which is characterized by equipping students with necessary skills to complete practical and specific works and potential social abilities. It is a kind of higher education in which students' professional abilities have to correspond with vocational education. Students should be appraised by authoritative vocational qualification department, and thus winning the vocational challenges. In response to vocational and industrial demand, higher education needs to "come down from the ivory tower" to be vocation-oriented eager to cooperate with colleges and universities in China. Below listed are some data from MyCOS Co., Ltd. There were various cooperation modes expected by employing units in 2011. 74 % of them offer internship in their own organizations; 50% take part in the teaching reforms of schools; 36% set up practical training base at schools; 28% supply schools with order form training [8]. It is not uncommon for some vocationally experienced people to receive higher education. In the meantime, some college and university graduates also participate in vocational training and receive vocational qualification appraisal. "Credit bank" mechanism could be adapted to effectively link vocation and education, vocational

training and school teaching as well as higher education and education of other forms.

#### *C. Stimulating the Diversification of Equal Opportunities*

WDHE21stC puts emphasis on the diversification of equal opportunities. Knowledge and skill acquisition should be viewed from a lifelong perspective. Students should be given various chances and flexible entry to and exit from higher education[5]. First, higher education should be human-oriented and respectful of individuality. Every student has his/her individual talents, as every living being has its own ecological niche. Therefore, students should be supported to develop their strengths against the prejudice from examination-oriented education, thus guiding their self-development. Secondly, higher education should lower its threshold to realize variable cultivation. Considering the difference in levels, basic requirements should be lowered so as to leave sufficient progress space for all students. Thus it is possible for latecomers to catch up, and pioneers to go further. Besides, various choices can be offered to students, such as technical skills, academic development, comprehensive development and research and innovation. Learners are chosen from them, and then make achievements in corresponding fields. Moreover, there should be a balance between breadth and depth. Thirdly, students' strengths should be developed and weaknesses, avoided. Students' energies, as the most important resources, are limited, and thus should be utilized to develop students' strong points to maximize their benefits. Every individual certainly has weaknesses, if he/she has strengths. Exceptional students should be provided with favorable conditions to work freely and realize their self-transcendence, while ordinary ones be guided and cultivated diversely so as to make achievements in a certain field. Thus, academically troubled students are assisted in accomplishing their basic goals[9].

Course selection system is the core and soul of "credit bank" mechanism. With it, students can freely determine majors, courses, teachers, lecturing time, learning method and quantities of subject and so on, according to their interests, abilities, strengths, etc. That is to say, students have opportunities of designing their careers by adjusting their choices in this system. That contributes to their pursuit of personal goals by motivating their initiatives.

### III. IMPLEMENTATION OF "CREDIT BANK" MECHANISM IN CURRICULUM EVALUATION

"Credit bank" mechanism, as one way to implement credit system, simulating the functional characteristics of bank and taking autonomous course selection as its core, evaluates students' studies by means of credit storage, grade point calculation, etc. It offers students free choices of learning content, paces, locations and methods, with which studies can be done anytime and anywhere.

#### *A. Credit Storage*

Credit storage realizes diversity in credits' sources and flexibility in time and location. Valid results are mutually recognized in different schools or educational institutions; credits can be obtained from courses beyond teaching plans or

a second major, success in national authoritative exams or appraisals, achievements in social or professional practice and invention, thesis or prizes awarded in relevant disciplines like science, technology, arts, sports, practice, etc.

Development credit system was implemented in Jiangsu Teachers University of Technology on the basis of the researches and practices of the author and others. Limited storage quota is converted to unlimited one. In the context of the current education management, it is rather difficult to carry out flexible schooling scheme in China, in particular when students want to graduate in advance. Through flexible credit system, students, however, are encouraged to accumulate more credits within finite time. Teaching planning provides all students with a threshold rather than limit. When allowed to be ordinary, students are also motivated to be exceptional in the context of popularized higher education. Apart from the aforementioned sources, credits can also be obtained from the following newly-developed modules, including discipline development, technical skills, education and teaching, minor program and, technological innovation, etc. Thus students can receive systematical guidance and training from any one of them.

#### *B. Credit Replacement*

Credit replacement encourages students to choose some learning contents according to their own strengths, and devote themselves to it in suitable ways. Thus education becomes an open system. There are four types of credit exchange listed as follows. The first one is institutional replacement. Different cultivation programs are designed for different students and measures are taken to grade curricula so as to satisfy the individual demands of students. For instance, the following courses are classified into different levels, including foreign languages, basic courses, professional skills, etc. In that case, students with different education backgrounds are able to develop their strengths and avoid their weaknesses, thus making achievements in their fields. The second is homogeneous replacement. Students are exempt from some courses or tests for succeeding in relevant authoritative exams or appraisals. Besides, self-learners also can be credited for passing exams organized by state or other qualified groups. In addition, the learning outcomes are mutually recognized in both theoretical and practical courses, as long as they are obtained at schools of the same level. They could be secondary vocational schools or tertiary ones. The third is individual replacement. The credit exchange follows the principles of homogeneity, if any academically troubled students want to change their majors. That is to say, credits should be exchanged within equivalent courses. The final one is compensatory exchange. With credits of superior quality or quantity, an imperfect student can compensate for his or her own weaknesses. For example, their innovation credits can be converted into courses credits within teaching plans, if students win any contests of invention and creation or professional disciplines. Development credits convert into credits of compulsory courses at the ratio of 3:1 in Jiangsu Teachers University of Technology. The purpose of this regulation is to create favorable conditions for extraordinary talents to develop their strengths and avoid their weaknesses.

#### *C. Credit Recognition*

Credit recognition is a sort of flexible credit management mode on condition of credit guarantee. With this program, a broader independent space is left with dynamic and capable students to coordinate the time, pace and method of learning. Thus they can exploit their talents to the fullest. Firstly, students are allowed to take exams without attending the corresponding classes, if they get high marks in last semester. In other words, these ones can take examinations of relevant courses through outside-class learning, except for PE and practical ones. They can obtain credits, as long as they reach good grades. Secondly, any examinees of graduate student entrance examinations can apply for exemption from the exams of related courses. The results can replace courses exams, if they succeed in any subjects or all of graduate student entrance examinations. Thirdly, students are exempt from some subjects, if they take part in research, engineering practice, practice and internship, school exchange or job training, etc. The achievements are acknowledged to be credits. Finally, those students who failure to get the bachelor degree due to academic failures can be awarded the degree within three years after graduation on the following conditions: They return and make efforts to obtain the required grade points; they achieve any breakthroughs in practice that are recognized to be credits.

#### *D. Comprehensive Grade Point*

Comprehensive grade point is used to evaluate students' studies by grade point average and weighted grade point in a separate or complete phase. As the indicator of quantity, credit determines whether students complete the whole learning process; similarly, as the water mark of quality, grade point measures their learning outcomes. Credit converting of integrated grade point was innovated in Jiangsu Teachers University of Technology by the development credit system. On the conditions (integrated grade point = grade point average\* (earned credits / required credits)), the balance is located between the quantity and quality of learning. Moreover, students have opportunities to get high grade points in compulsory subjects and credits in developments programs. Thus, it is to their advantage, whichever they choose between professional development and comprehensive development.

All in all, students should be managed differently in the "credit bank" mechanism. As a complete system, it leaves motivated and credible students with a maximal progress space by credit exchange and loans. It also assists students who are motivated but without planning in making choices by offering developments modules with tutors. Meanwhile, it supervises un-motivated students without goals, and reminds them to pay attention to the bottom line by the three-guide system and early warning system. Thus profits increase, and losses decrease in studies.

### **IV. GUARANTEE OF THE IMPLEMENTATION OF "CREDIT BANK" MECHANISM**

"Credit bank" mechanism involves a great variety of reforms and completions in many systems, including enrollment, conversion, credit, course, schooling, course selection and evaluation. The new system can confront



enormous challenges on condition of a large-scale reform on traditional education model.

#### *A. Emphasizing Teacher Moral*

In the context of long-term traditional education model and management system, some teachers, to a large extent, are stereotyped. Therefore, it is rather hard for them to adapt themselves to the new model. In terms of educational ideas, some teachers, influenced by cult of discipline, are reluctant to reform their teaching contents flexibly and dynamically; in terms of role orientation, it is hard for some teachers to accept students-centered teaching. Thus they are not adequately motivated and prepared to improve their teaching methods and treat students as peers; as for the teaching abilities, some teachers are hardly able to satisfy students' requirements for effectiveness and practicability. Moreover, they are unable to be the mentor of students with limited knowledge out of practice and simple methodology. From the perspective of working attitude, some teachers tend to spend more time in scientific researches, processes and complaints than in teaching, results and dedication. As put by Clark (1984:243), "Innovations 'fail' because the innovators cannot acquire enough power to protect their new ways. They are allowed to start but unless they attach the interests of various groups of their own, persuading potential opponents at least to be moderate in their opposition, they can be tightly bounded". [3] As a result, it is no wonder that some teachers react negatively to or even resist the reforms. To say the least, they are the biggest drag force of "credit bank" mechanism. With the popularization of this mechanism, it is very urgent to strengthen teacher's morality, improve their teaching, complete the evaluation standards, and establish teacher flow mechanism. As an effective form, tutorial system stimulates exceptional teachers to serve students and promote teaching reforms. Tutors help students transit their learning methods from the secondary school mode to the college mode, introduce them to the professional field to cultivate their learning abilities and help them solve problems in learning methods and professional development by analyzing their difficulties in their academic conditions, course selection and learning outcomes. In the meantime, tutorial system also attracts exceptional students to laboratory or team of teachers, thus engaging in high-level scientific researches. Therefore, students are offered favorable conditions to cultivate professional skills broaden disciplinary knowledge and explore other specialties.

#### *B. Inspiring Students*

Some students, unable to adapt themselves to the new mechanism in the context of examination-oriented education and passive learning, are likely to get lost in various choices for ignoring the essentials due to their narrow horizon and lack of social and industrial knowledge. Moreover, these students may not know the necessary systematical regulations, not to mention the scientific application of them. For one thing, they are not motivated sufficiently to devote themselves to learning; for another, they don't even care about the course modules and professional objective. For the insufficiency of learning abilities and self-discipline, some of them cannot complete the specified objectives, resulting in academic crisis. Therefore, "credit bank" mechanism should be designed according to the

practical situations of education in China. It operates autonomously under the guidance and supervision of authorities. Tutorial system aims to solve methodological problems; Early warning system sets out to deal with attitudinal problems. Besides, it guarantees the implementation of "credit bank" mechanism. It is not effective to simply rely on credit converting or exchange, if students concerned are insufficiently motivated or of bad learning habits. On the contrary, it is necessary to monitor or interfere in their learning process with academic warning system. This system includes academic censorship, early warning information archives, sorted tutoring, individual education, guidance and support, academic warning conversation and notification, contact system with students' guardians, treatment of school roll motion, etc.

#### *C. Managing scientifically*

"Credit bank" mechanism brings about a severe challenge to management personnel, the effective and accurate implementation of which needs to equip the personnel with open mind, human-oriented conception and cautious attitude and requires the management be done with scientific methods, accurate implementation and reliable quality. "Credit bank" means the quantitative management, which is based on class management and combined with department or major management, turns to individual student-centered variable management. Therefore, the number of students corresponds with the quantity of students' information management files and course selection modes at a school. Changes will happen in various aspects, including scoring methods, standards and procedures of credits recognition, commitment system and appraisal approaches, the quality-quantity relations of learning, approval of grade points and academic assessment. Therefore, new mechanisms of supervision, assessment, evaluation, promotion, punishment, and employment should be established concerning teachers' management.

#### *D. Reorganizing Resources*

Nowadays, the limited and relatively constant educational resources are hardly enough to meet the infinite and uncertain demand. Thus, efforts should be made to improve the use efficiency of educational resources with the advantage of "credit bank" mechanism. For instance, educational resources can be saved by mutual recognition of credits among different schools or educational institutions. There is no need for repeat courses and exams among them so as to save time. Credits recognition induces industry, enterprises and other social powers to participate in educational cause. It also motivates self-learners' initiatives. In that case, there would be abundant educational resources in China. Influenced by "credit bank" mechanism, some backward educational institutions are either to be updated or eliminated due to their inferior quality and efficiency.

#### *E. Sticking to Integrity*

Since market mechanism is introduced into "credit bank" mechanism, legal system is definitely needed to guarantee the fairness, justice, authenticity and credibility. Besides, an effective supervision mechanism should be established to prevent educators from violating educatees' rights and interests

against the nature of education. That guarantees the authenticity of credits. Tuition should be mainly used for educational activities, so as to protect the legitimate rights and interests of educators and educatees.

In the meantime, educatees' credibility should be regarded as the essential element; strict mechanism of monitoring, auditing and punishment should be applied to students' identification, scores calculation, learning experience recognition, credentials acquisition and quality of results. Moreover, it is necessary to implement the system of credit archives and signature commitment. The treasury to the bank is what the credit to the "credit bank". It is very important for the "credit bank" to preserve the authenticity of credits.

## V. CONCLUSION

Being innovated in development credit and integrated grade point with limited storage quota converted to unlimited one and the elastic credit system implemented, "Credit bank" mechanism offers students chances to get higher grade points in obligatory courses and more development credits, stimulating some to be excellent while allowing others to be ordinary. As a new mechanism, however, "credit bank" mechanism is still in exploration in China. Despite the present challenges it confronts when implemented in higher education, this system is sure to blossom in China with the deepening reforms in higher education.

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