

The Computer-Based Examination in China's Higher Education: Policies, Advantages, and Problems

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Abstract—China's educational industry is undergoing the informatization process under the background of the scientific development, the big data application and the integration of international education market. This paper, based on previous situation, firstly reviews a series of educational informatization policies issued by the central government, which are responses to contemporary educational development and guidelines for further promoting educational informatization in China. The article then discusses that the computer-based examination (CBE) is an inevitable outcome of the trend of educational informatization due to its implementation feasibility and advantages from the perspective of cost, validity, technical support, accuracy, and informativeness. The study on CBE in higher education finds out that though application of CBE in higher education has made great progress, there are bottlenecks on large-scale application and concept adoption. Yet the study also finds positive feedbacks from students' CBE experience, which indicates that popularization of CBE in university is achievable along with further informatization of higher education in China.

Keywords—computer-based examination, paper-based examination, high education, educational informatization

I. INTRODUCTION

High technologies represented by big data and artificial intelligence are promoting the informatization of the modern society. Under such circumstances, the traditional "in the classroom" education mode has been challenged, so is the examination method. The traditional paper-based examination (PBE) is considered as not efficient and environment-friendly enough as the increasingly popular computer-based examination (CBE). Also, PBE is impracticable in the situation of online distance education, which CBE is ideal to match with. CBE is now an important part of online course construction and teaching modernization process in Chinese universities.

In practice, the Test of English as a Foreign Language (TOEFL) and the International English Language Testing System (IELTS) have changed the traditional single PBE mode, to add CBE as additional option. The success and prevalence of CBE mode for both TOEFL and IELTS set a good example for testing model reform program undertaken in Chinese universities. In 2007, the National College English Test (CET) Band Four and Band Six started to adopt CBE as additional

option for examiners. After that, two large-scale CET examinations were given to further improve the validity and efficiency of CBE. [1] The success of CET paperless examination sets off a trend of CBE mode in Chinese domestic universities.

II. POLICY SUPPORT FOR AND REQUIREMENT OF THE EDUCATION INFORMATIZATION

In line with the time's requirement, Chinese central government and the Ministry of Education have issued a series of policies on educational informatization, which is the industrial background of the popularization of CBE mode. As early as 2010, the Ministry of Education issued the Guidelines of the National Program for Medium- and Long- Term Educational Reform and Development (Year 2010-2020), asking to speed up the educational informatization process from three aspects. Firstly, schools are encouraged to construct educational information facilities. The Guideline points out that information technology had revolutionary influence on educational development, and should be attached great importance to integrate educational informatization into the overall strategy of national informatization development. Secondly, it is a priority for educational institutions to develop and apply high-quality educational resources. Educational resources, according to the Guidelines, refer to online learning courses, digital library and virtual laboratory, and web-based public service platforms, etc. Thirdly, the establishment of national education management information system is required. According to this requirement, both the educational institutions and the governmental departments need to streamline their educational information network management, so as to improve their public service capability. [2]

In order to fulfill the Guideline's requirement, the Ministry of Education announced the Ten-year Development Plan of Education Informatization (Year 2011-2020). The Plan proposes to construct digital campus in colleges and universities. According to the Plan, digital campus should be characterized with high-speed networks, digital teaching equipment, virtual simulation training laboratories, high-quality online courses, etc. The Plan clarifies the all-round development goal of higher education informatization, including the facilities construction, personnel training, scientific research supporting and social service. [3] Currently, the Guideline and the Plan are being well implemented in

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higher educational industry, the popularization of the CBE is a concrete example of the digital campus.

At the end of the ten-year plan, a series of policies are issued to continue the modernization and informatization of the education industry. The Central Committee of the Communist Party of China and the State Council co-issued the Opinions on Deepening the Reform of Teachers' Team Construction in the New Era at the beginning of 2018. The Opinions requires improving the quality of university teachers, to promote connotative development of higher education and to promote education reform and renovation. [4] Immediately after the enactment of the Opinions, the Ministry of Education, the National Development and Reform Commission, the Treasury Department, and Ministry of Human Resources and Social Security and the Central Editorial Office together issued the Action Plan for the Revitalization of Teaching Professional and the Educational Industry (2018-2022). According to the Action Plan, "internet + teacher & education" innovation action¹ is one of the major measures for revitalization purpose. [5]

More supporting policies were publicized afterwards for better implementation of the Opinions. For example, the Ministry of Education enacted Education Informatization Action Plan 2.0. The Plan in April 2018, saying that university teachers needed to adapt to the information society and relevant government agencies should take advantage of the artificial intelligence to support the training and management of teachers and education reform. [6] Another example, the General Office of Ministry of Education further publicized 2019 Key Points of Education Informatization and Network Security Work, to ensure the implementation of educational informatization and modernization, to guarantee the high quality of education with the assistance of internet technology. [7]

III. FEASIBILITY ANALYSIS OF COMPUTER-BASED EXAMINATION

Firstly, CBE has comparative advantages in both the economy cost and the time cost comparing with traditional PBE. Although CBE requires additional time and labor to input test questions into the examination database system in advance, once the database is established, maintenance and updating of the test questions will be more convenient than relevant jobs required in PBE mode. In addition, CBE makes examination question storage and reuse possible to avoid the repetition of the process of proposition, proofreading, approval, printing, and preservation, which is tedious yet necessary in the PBE situation. As to examination paper grading, when the assessment is taken with CBE model, computer will check the answer for the true-or-false questions and multiple choices questions. This would make the grading process more convenient and precise comparing with the manual grading.

Secondly, the feasibility of CBE replacing traditional PBE also can be proved from the equivalence of verifying students'

mastery of curriculum knowledge. Early studies show that different conclusions may be drawn from the tests of different courses. [8] Also, students' familiarity with the computer examination operation system and the user-friendly interface of CBE affect students' performance in CBE to a great extent. However, with the popularization of computer in our daily life and the development of CBE software in the big data era, the CBE model now are getting matured both in practical operation and theoretical research. This enhances the equivalence between CBE and PBE. Especially for foreign language tests, the equivalence in these tests is most obvious for they use CBE model in the earliest time. [9]

Thirdly, the popularization of computer facilities and networks increases the feasibility of CBE replacing PBE. Computers and networks have become the necessary tools for daily life, which makes CBE acceptable more easily by the public. At the same time, the central government conforms to the trend of the times, and vigorously supports and promotes the digitalization of education. For example, the Ministry of Education's Guiding Opinions on the Construction and Application of Digital Education Resources Public Service System put forward the overall goal that the national public service system of digital education resources can basically cover the whole country by 2020, and emphasizes the promotion of the modern education mode of "Internet + education". [10] The encouragement of national policy will undoubtedly accelerate the large-scale application of CBE model.

IV. ADVANTAGES OF COMPUTER-BASED EXAMINATION

On the circumstance of CBE model, the computers are able to generate and grade examination paper automatically, which is more convenient and accurate than the tradition "proposition, proofreading, approval, printing, preservation, assessment, correction" process which is typical for the PBE model. The tedious process is thought to have a certain probability of error, because different departments and personnel are jointly responsible for different part of the process and the test paper proposition is usually carried out in the later part of the semester when teachers are more or less exhausted after one semester's teaching and scientific research works.

Another advantage of CBE is that it helps to realize the separation of teaching process from assessment process. The separation of these two processes is considered as good for the improvement of teaching quality. For teachers, they must make sure that teaching contents strictly comply with the requirements of the syllabus so that students can answer questions randomly generated by the system. For students, they will have to work harder on their daily studies since it is impossible to have "pre-exam highlighting key points preparation" anymore.

In addition, CBE is more conducive to data collection and examination function enrichment. The most basic function of examination is to check the students' mastery of the course content and give them corresponding scores. From the perspective of students' personal quality improvement and curriculum development, the examination also has a guiding function. One is to help students find out their non-grasped

¹ "internet + teacher & education" innovation action refers to a full use of cloud computing, big data, virtual reality, artificial intelligence and other new technologies to promote the construction and application of information-based teaching service platform for teaching and education, and to encourage the reform of teaching methods characterized by autonomy, cooperation and inquiry.

course knowledge and make up for them. The other one is to feedback teaching effect to teachers and help them improve teaching effects by analyzing the losing points. Computer's ability to store and analyze relevant data will help to realize the guidance function of examination.

V. DIFFICULTIES OF POPULARIZING COMPUTER-BASED EXAMINATION MODEL IN PRACTICE

Despite the supporting policies and the relative advantages, there are still some difficulties in the implementation of CBE model. In terms of hardware facilities, computers and accessories are the prerequisites for CBE. CBE is now applied limitedly to specific majors and courses at present, and is going to have a large scale use later. The extensive use of CBE requires adequate hardware facilities and professional maintenance personnel to make sure a considerable number of students can take the final exam at the same time. [11]

As to the separation of teaching and examination management model, though widely perceived as a good matcher and the final purpose of CBE model, it is still open to debate whether the separation of teaching and examination management model is applicable for every course. Separation of teaching and examination aims at promoting the implementation of syllabus content and avoiding teaching activities deviating from curriculum requirements. However, functions of university education are versatile. There are courses for skill training, such as the college English course, and courses for humanistic cultivation, such as the philosophy, history and literature studies. The former type is suitable for the teaching-examination-separation model, to ensure that students' skills meet the requirements. The latter may be more suitable for teachers to compile test papers according to their own teaching content and the characteristics of the audience, rather than compiling with a single standard. [12]

From the perspective of question types, CBE is more suitable for True or False and multiple choices, due to the certainty of their answers and the feasibility of computer scoring. Subjective questions, such as question and answer and case analysis, still need manual marking, their matching degree with CBE is therefore relatively lower than the objective questions'. In addition, the CBE mode puts forward higher requirements on students' precise memory. Take the blank-filling questions in non-Foreign Language Bilingual/All-English course examination as an example. The content of curriculum assessment is not foreign language itself, but a test to assess students' mastery of professional knowledge. Therefore, it is reasonable to overlook minor spelling mistakes when marking papers in tradition PBE mode. However, in the CBE mode, it is not possible to directly determine the reasons for the loss of scores, whether due to spelling mistakes or knowledge errors.

VI. AN EMPIRICAL STUDY ON STUDENTS' EXPERIENCE OF COMPUTER-BASED EXAMINATION

Previous discussion focuses on the theoretical significance, policy requirements, feasibility, pros and cons of the CBE. Yet how well do students accept CBE? In order to answer this question, a CBE experience survey was given to 82 juniors

majoring in international economics and trade of East China University of Political Science and Law. There were 77 questionnaires received. Also, in order to enhance the credibility of the survey, students were asked to answer the questionnaire within 24 hours after they finished the CBE. The survey indicates that the CBE mode is gradually accepted by the students due to its convenience and credibility, though currently traditional PBE mode is more popular.

Firstly, all the interviewees in the survey have previous CBE experience before the examination for which the questionnaire is directed. Even so, the survey reflects that most students are not accustomed to CBE mode. 54.55% of the interviewees prefer PBE mode and think that CBE is not a common examination method and will negatively affect their test result to some extent. However, 80.52% of the students agree that more practice of CBE will make them more familiar with the new examination method and more confident with their own performance. In another survey targeting at the same group of students², 77.78% of the interviewees think that after the mid-term CBE experience, they have been more adaptable to the CBE mode. It is therefore safe to conclude that, from students' perspective, CBE is workable and acceptable with sufficient practice.

At the same time, the survey finds out that, according to students' experience, the CBE mode is better than the PBE mode in the aspect of fairness and credibility. 55.84% of the interviewees believe that the random distribution of questions in CBE reduces cheating opportunities, hence improving the fairness of the examination. In addition, when comparing the time management issue in the two different test models, 46.75% of the students think that CBE is better for time management, 28.57% of them prefer PBE, and 24.6% of the students think there is no difference between the two test modes on time management. Accordingly, once CBE becomes more popular, it will be easier for students to accept the computer-based assessment method since the computer now is a daily device in urban life.

In addition, the survey gives some suggestions to relevant departments of the universities responsible for running examinations and supervising students. In terms of hardware and software facilities, 57.14% of the students think that the hardware facilities affect their performance to a certain extent due to the unfriendly user experience. The examination software system has comparatively higher user satisfaction, with 58.44% of the students considering the test operation system as user-friendly. In terms of students' management, pre-test training and simulation examination are strongly recommended to bring familiarity. Nearly two-thirds of the 47 students who have the training experience deem the experience helpful to familiarize them with the examination process. More than one-third of the 30 students without training experience want to have similar pre-test training or simulation examination.

² The first survey was conducted after students finished their mid-term examination of the World Trade Organization course, while this one survey was after students finished their final examination of the course. There were 72 questionnaires received in this survey.

VII. CONCLUSION

The 13th Five-Year Plan of Educational Informatization points out that the wide application of new technologies, such as cloud computing and big data, has accelerated the process of informatization in society, and enormously influences the educational industry. In his congratulatory letter to the First International Conference on Education Informatization, Chairman Xi proposed to "actively promote the integration of information technology and education." [13] This shows the great importance that Chinese central government attaches to educational informatization. The CBE mode, an assessment method consisting with the educational informatization, is becoming more popular due to its advantages on cost saving, accuracy, flexibility and data storage. Though currently difficulties do exist to make it fully acceptable by all students and universities, yet with the continuing technical and policy support, the CBE will have an equal importance as the PBE in a foreseeable future.

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