Examination Digitization: The Practical Exploration of Paperless Examination

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[**Abstract**] The development of digital technology has brought the impact to the examination mode of schools at all levels. Entering the digital era, paperless examination in primary and secondary schools generates vitality. Through the concept and feasibility of paperless examination, digital technology has derived the generation logic of paperless examination: mode innovation from offline to online, technological innovation from data to method, and service innovation from content to literacy. Based on this, the practice dimension will focus on four aspects: intelligent proposition and test paper composition, intelligent examination platform, intelligent marking, and intelligent examination analysis. Based on this, the means of digital technology can greatly promote the development of education examination, and make the modernization of Chinese education usher in new forms.

[**Key words**] paperless examination; examination mode; educational examination; digital transformation

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In the process of actively building informatization of "digital China" under the environmental guidance at home and abroad, tending to accelerate the digital construction transformation of education management is the need in the new era to adapt to the scientific development of China's contemporary education career, and a series of important measures to guide the construction of high-level education in China and realize the goal of building China into an innovative education power. The formulation of this development strategy is not only guided by social development and government policies, but also adapted to the reform and internal development of China's education system, as well as the promotion of scientific and technological innovation. It is an important measure to realize the development of education management informatization in China to use modern technology to assist the education, update the overall concept and realize the major reform of learning and thinking modes. Therefore, under the great development environment of China, examination reform, as one of the transformations of digital education, and an extremely important teaching activity in schools, must promote the development of digital transformation of education examination through the further reform of various systems and the bold exploration of social practical work.

1 Core essence of paperless examination

Paperless examination, also known as "computer test", refers to the entire process of testing directly through computers or other mobile devices. By adopting the examination method of paperless examination, and using the characteristics of big data, teachers can quickly complete the test bank, test paper composition and invigilation. In the marking, scoring and statistics, it takes less than a minute to know the results of students. The paperless examination can involve multiple people and multiple test points simultaneously, and can conduct big data analysis of the paper from multiple perspectives. Teachers can also use data mining and artificial intelligence technology to

better analyze and improve the teaching effect, and improve the teaching quality. The paperless examination system, which provides candidates with a combination of classroom teaching and paperless examination, can offer functions like real-time analysis, feedback and evaluation, and finally become an intelligent examination system with advanced technology, advanced methods and information characteristics. The modern artificial intelligence technology, big data application technology and digital multimedia technology are combined to establish a new examination knowledge system, and develop a computer examination training system with more practical, fast and convenient operation, clear and beautiful interface characteristics.

The test forms of the paperless education examination evaluation system are complex and diverse, including commonly used logical judgment understanding questions, cloze questions, short answer questions, essay questions, and even other test types, such as online tabulation or drawing exercises. When the teacher marks and evaluates all forms of test questions, according to the operating instructions, the computer paperless examination marking system can also directly help teachers to break through the geographical boundaries, learning time and other restrictions, and conduct paperless marking in an accurate, intelligent, efficient and convenient way. It can further help candidates to conduct a more scientific and accurate organization, arrangement and analysis of various exam questions. In this kind of paperless examination, some papers can be scored manually via the computer, which greatly increases the intelligence level of the students, thus reducing the workload of manpower.

2 Feasibility study of paperless examination

In the future, whether for social examinations, or for the primary and secondary schools and examination organization units themselves, paperless education examination system is undoubtedly an inevitable development trend in teaching application process development. This kind of digital test system can ensure the security, effectiveness and fairness of information test learning system for all kinds of students. Compared with other traditional paper education examination, paperless teaching examination method can greatly reduce the paper cost, effectively improve the organizational efficiency in the work content arrangement of teaching examination personnel, and promote the digital development of the whole school management.

With the development of the information age, the requirements of education quality evaluation are constantly improved, the requirements of examination are more and more strict, and the quality standards of examination evaluation are getting higher and higher. Under this situation, the evaluation system of paperless examination has the concept of improving the education examination, and is expected to become the examination carrier in the information age. In the process of artificial intelligence technology's penetration into education and teaching, it is planned to propose a new digital examination mode based on digital technology assistance, in order to adapt to the development trend of digital transformation. Each examination unit has set up special intelligent examination department, and been equipped with special staff, creating the necessary organization guarantee to build a quality evaluation system for paperless examination system. Scientific research system and financial support from the corresponding research units are the basis and capital guarantee of the quality evaluation of paperless examination system.

3 Digital technology boosts the triple logic of paperless examination

Examination has always been a final and main measure of colleges and universities to measure their teaching practice quality, and check the effect of the practice teaching. In particular, attending comprehensive admission examinations like national senior high school entrance examination, college entrance examination, graduate student unified examination and so on concerns not only the actual interests of students themselves, but also the training construction of higher education professional personnel and the deep level of the education management innovation. In addition, it has been impacted by some major epidemics and other factors in recent years. All kinds of problems such as how to achieve the fairness of the examinations have attracted great attention in the society, which has increased the difficulty of the organization, implementation and management of the examination. Together with the high attention to examination management, information, data security and other aspects, higher requirements for the

examination management and information construction are put forward. With the in-depth development of China's education examination system and "education informatization", China's education examination evaluation is constantly changing from the aspects of mode, technology and service.

3.1 Mode innovation: from offline to online

From the perspective of informatization, the scoring system of China's college entrance examination has gone through three development periods: "paper examination + manual scoring", "paper examination + electronic scoring" and "paper examination + intelligent scoring". The innovation of science and technology causes the transformation of test evaluation method, which changes the function and focus of the education department. The innovation of examination technology can play a positive role in promoting the digital change of education, accelerate the improvement and reform of the current examination and evaluation model, and give full play to the greater potential in more basic examination models. For example, in many application practice scenarios like self-study level examination, thesis writing defense, social recruitment assessment and government talent evaluation, the comprehensive, in-depth and extensive paperless information technology can effectively save all kinds of time, human resources and property cost, improve the efficiency of examination organizations, shorten the test registration time, and improve the quality of talent evaluation.

Paperless examination appeared in the late 20th century, and by early 2000, foreign exams, including the GMAT and TOEFL, had been paperless around the world. China's current paperless examination is mainly in the national scope, such as accounting, securities, CPA, as well as professional examinations in some national professional institutions. At present, the highly valued national college entrance examination is still mainly based on paper and pen, supplemented by online scoring. However, with the reform of China's education and teaching system, and the deepening and development of teaching information and other aspects, paperless examination is gradually being used in the high-risk level examinations. Cloud computing examination is a new examination method combining artificial intelligence and cloud computing technology. It can realize online examination, online interview and online defense, as well as online video surveillance, video uploading and remote supervision.

3.2 Technological innovation: from data to method

With the continuous application and iteration of artificial intelligence and other emerging technologies, intelligent test bank, intelligent identification system, intelligent monitoring system, etc., have appeared in the field of examination and evaluation. The new college entrance examination technology, such as intelligent scoring, has been tested in some fields of college entrance examination, teachers' professional titles and so on, and achieved remarkable results. The emergence of paperless examination has effectively solved the problems of the surrogate examination and fraud, improved the quality of the examination scoring, and enhanced the fairness and scientific nature of the examination.

The composition and elements of each link in the educational examination evaluation system are not isolated, but dependent between each other. In the process of implementing the digital education reform, it is necessary to connect it organically through the method of "technology chain". Given the increasing demand for information sharing, it can be expected that the relevance of various teaching methods will not weaken, but will increase. The educational reform in the digital era is highlighted in the change driven by data based on information interconnection, and the reform of teaching evaluation promoted by big data is the fundamental orientation of the current educational development, that is, the transformation from the traditional pen-written evaluation to the digital evaluation. To this end, it is necessary to establish a new digital teaching evaluation method based on data drive and technological innovation, especially to help and establish more process evaluation and the value-added evaluation methods through science and technology, so as to improve the scientificity and accuracy of the evaluation process.

3.3 Service innovation: from content to quality

Centered on students, the examination content and students themselves are combined as the main line. With

the continuous development of a new round of digital education strategy of education system in China, new technologies in emerging fields are gradually integrated and applied in the construction of various examination services. In addition to the new examination techniques, such as the new knowledge, skills and thinking patterns used in digital examinations, a certain level of digital innovation should also be gradually carried out on the connotation and content of its social education services, making all the students, teachers, parents, even the whole civilized social citizens gradually feel and consciously adapt to the use of this new form of examination means of social digital course teaching. For example, the whole-process record and feedback of the educational examination arrangement at the national level, the comprehensive examination process of students, the analysis of students' examination results and the targeted individualized examination plans, the intelligent examination evaluation process, etc.

In the past, without the participation of scientific and technological means, student evaluation only relies on human resources. As a result, it is difficult to carry out an all-round reasonable evaluation of candidates. Through the empowerment of science and technology, it can break the traditional connotation boundary, show multiple information interaction modes and feedback forms, and make dynamic adjustments and interventions in the whole process, so as to provide accurate and personalized services for candidates. Through the collection and analysis of "humanistic quality", "core quality", "personal potential" and other internal characteristics, the connotation of evaluation service has been greatly expanded, and much repetitive work of teachers can also be reduced, so that teachers have more time to complete accurate and personalized teaching and evaluation.

4 Digital technology empowers the practice and exploration of paperless examination

For examination evaluation, the empowerment and improvement of AI is a comprehensive and systematic process. It is necessary to study and evaluate the practical application of AI technology in the traditional outcome evaluation marked by examinations, and its impact on solving and optimizing the key problems of outcome evaluation. Based on this, it is necessary to have an in-depth discussion on the specific application process of AI in the four key scenarios of outcome evaluation and the improvement of each link.

4.1 Intelligent proposition and test paper composition

By using artificial intelligence-related technology, the information, automation, precision and intelligence of the proposition and test paper composition are achieved, improving the quality and efficiency of the paper preparation. This not only accurately conveys the intention of the question setter, but also effectively ensures the scientific nature of the evaluation tool. The evaluation of the improvement results is mainly reflected in: 1) reduce the risk of proposition repetition through automatic rechecking. Using the method of repeated tests to check the text content, mathematical expressions and images in the questions, combined with the similarity matching technology based on semantic understanding to conduct multiple contrast recognition, the reuse rate of the questions in the exam paper can be significantly reduced, and the possible collision problems during question setting can be greatly reduced; 2) with the help of an accurate problem evaluation system, we can predict whether the new problem has good performance. First of all, we need to decompose the topic into words, convert them into deep representation, and then input it to the difficulty prediction model, letting the computer independently measure the topic under the training data scale difficulty. At the same time, other basis besides experience and intuition can be provided to the question setter, which is beneficial for them to better understand the overall difficulty of the whole paper and distinction; 3) reduce the burden of proposition through the content of the test questions. Traditional proposition is limited by the difficulty in data query, and the inequality in proposition personnel and experience, while test content can be generated in accordance with the "proposition template" automatically for rough processing questions for reference, and support proposition personnel to make modifications by maximizing the transfer of knowledge reserves in the form of interactive dialogue access, thus significantly reducing the difficulty of proposition and cost; 4) provide stable guarantee for the quality of examination papers through intelligent test paper composition. The application of intelligent technology and machine learning can select the questions as needed and generate the test

content, meet the educational evaluation standards as much as possible to accurately measure the teaching ability and students, and reduce the technical threshold for preparing the questions and improve the quality of questions and answers, and their reliability and accuracy.

4.2 Intelligent examination platform

The intelligent examination platform integrates artificial intelligence technologies such as speech and semantic recognition, deep learning and behavioral action analysis into computerized examinations to build a fair, just, intelligent and humanized examination environment for examinees. On the one hand, the intelligent examination platform is compatible with traditional paper examinations, and solves a series of time-consuming problems of printing, transportation, recycling and scoring. On the other hand, it can innovate in the outcome evaluation method, and develop more abundant, interactive and meaningful outcome evaluation. The improvement of outcome evaluation made by intelligent examination platform is mainly manifested in three aspects: 1) simulating real situations to conduct a more in-depth evaluation of student's ability and accomplishment. After integrating the educational model, the intelligent examination platform can automatically generate a series of exploratory tests based on real problem solving, and collect student's operation and decision-making in the process of handling problems. Through the communication and dialogue between AI examiners and students, the intelligent examination platform can analyze student's emotions and psychological state in the face of challenges, so as to obtain diagnostic information related to student's personality traits and thinking style, and provide more basis for evaluating student's high-order ability and core accomplishment. In addition, the intelligent examination system can also provide an environment to show and evaluate the high-tech questions. Compared with the traditional type, it can greatly improve the effect of the test, and detect more diverse knowledge, skills and quality, making the paper and questions more close to the real life and learning situation; 2) supporting more evaluation of language ability. On the one hand, it will evaluate the types of words, vocabulary, grammar, articles and chanting, focusing on the accuracy and quality of student's phonetic expression. On the other hand, it will score oral translation, oral repetition, picture description, and topic explanation, mainly examining student's reasoning and thinking ability and language organization skills; 3) supporting the standardized evaluation of artistic accomplishment. Intelligent examination platform designs the corresponding machine examination question types for the examination of music and art culture knowledge, music performance and painting skills, and music and art appreciation feelings, providing a path for the construction of unified and quantifiable artistic literacy evaluation standards.

4.3 Intelligent paper marking

Using deep artificial intelligence technology such as image analysis, writing identification, natural language processing and deep learning, intelligent marking system can complete the subjective scores, useless answer check, similar paper judgment and automated score statistics for subjective questions, enabling the emergence of the idea that the computer can perform and implement subjective test evaluation like experts. The evaluation of intelligent marking is mainly reflected in four aspects: 1) intelligent marking realizes cost reduction and efficiency increase. Intelligent marking can automatically process large-scale examinee answer data in a short time, and significantly improve the marking efficiency, allowing the marking staff to focus more on the evaluation work itself. It can also shorten the marking cycle and greatly reduce the labor cost of marking; 2) the scoring criteria are objective and stable. In the process of scoring subjective questions, artificial intelligence can always maintain an objective and unified scoring standard, and fundamentally overcome the fluctuation of the scoring standard caused by the interference of human factors, so as to effectively guarantee the true objectivity of the outcome evaluation; 3) there is a trace in the scoring process. Through the scoring characteristics of abstract subjective questions and the scoring samples of deep learning experts, artificial intelligence technology can present the principle and scoring logic behind the scoring of subjective questions in a quantitative form, so as to improve the interpretability and credibility of the evaluation of test results; 4) efficient screening of plagiarism, set and other false results. Intelligent marking can automatically identify the false results that are difficult to find by the same artificial means, so as to guarantee

the fairness and justice of the examination results to the greatest extent.

4.4 Intelligent examination analysis

Using the concept of educational measurement as a guide, the relevant information is collected and sorted out with the help of automation, the internal connection and rules of the information are deeply analyzed combined with artificial intelligence technology, and then the results of analysis are presented in a scientific and intuitive way. This helps multiple participants, including government departments, faculty and students, to interpret and apply the test data more effectively, achieving comprehensive, accurate and multi-dimensional evaluation goals. The improvement of outcome evaluation made by intelligent examination analysis is mainly reflected in three aspects: 1) efficient processing of global examination data. Through the whole process of data (each part of the data, including test registration information, answer record, scoring results, and admissions) and different time of testing (all formal tests attended by the same class from 7th grade to 9th grade) of large-scale data application, we can effectively reduce the burden of test data processing and cost, discover a lot of potential information and patterns, and realize automation building correlation between students, questions, and score graph, which provides a solid foundation for multidimensional assessment; 2) deep excavation of various factors affecting the examination results. Through a clear and detailed analysis of the changes in previous test results and their deep reasons, useful information for student's learning and teacher's teaching can be revealed, and reference to improve the teaching quality, and guide teachers and students to reflect on the test results can be provided, thus correcting student's bad learning style, and improving teacher's teaching strategy in a targeted way; 3) the evaluation report helps to improve the education and teaching guidance. The reports produced by intelligent examination analysis are more diverse. They can not only be displayed according to individuals, classes, schools, regions and other levels, but also support users at all levels to adjust variables and generate customized analysis reports on demand, so as to provide more suitable data support for the overall teaching improvement and individual learning development.

Conclusion

The digital transformation of examination is the requirement of national policy, and the demand of the development of the times. As a digital transformation mode of examination, paperless examination is a process that requires the cooperation of various parties, which cannot be accomplished overnight: it does not simply copy the traditional examination mode, nor does it simply upgrade the traditional examination mode. We should not only ensure the integrity of the examination mode, but also make full use of digital technology to create a new, dynamic and sustainable examination mode. Therefore, it is necessary to support and cooperate with the "technology + examination" of multiple departments of the state, and it is also necessary to popularize the development of the digital transformation of the examination at the social level, improve the digital literacy of teachers and students, and build a digital examination mode that integrates mode innovation, technology innovation and service innovation.

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