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Research on the development trend of science and education evaluation in the context of new technology

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ABSTRACT

As the most emblematic new infrastructure technologies, the integration of 5G with Big Data, Cloud Computing, Internet of things (IoT), Artificial Intelligence (AI), and Blockchain will provide new development opportunities for scientific and education evaluation. This study examines the new developments, issues, and requirements in science and education evaluation that have arisen as a result of new technology. On this basis, the article proposes development strategies for science and education evaluation in the new era, including strengthening data governance of science and education evaluation, innovating a novel common evaluation mechanism for science and education evaluation, and constructing a cloud platform for science and education evaluation.

KEYWORDS

New technology; Science and education evaluation; Cloud platform

0 Introduction

With the disruptive and innovative development of big data, cloud computing, artificial intelligence, blockchain, and other technologies, as well as the acceleration of 5G network technology and the Internet of Things globally, the breakthrough application progress of each new technology is penetrating various fields at an unprecedented rate, bringing prosperous innovation to numerous industries. New techniques of scientific inquiry and knowledge production are likewise undergoing continual transition in the field of science and education evaluation. Facing major changes in the external technological environment, science and education evaluation is ushering in a new round of changes and transformations, and the chain breakthroughs sparked by new technologies are destined to propel it toward digitalization and intelligence and introduce new challenges.

1 Overview

1.1 New technology

Currently, new technologies typically refer to the collective name of technology clusters represented by 5G as the communication carrier and rising digital technologies such as big

data, cloud computing, the Internet of Things, blockchain, and artificial intelligence as branches. Figure 1 depicts the interaction between these new technologies, which are interconnected and mutually supported.

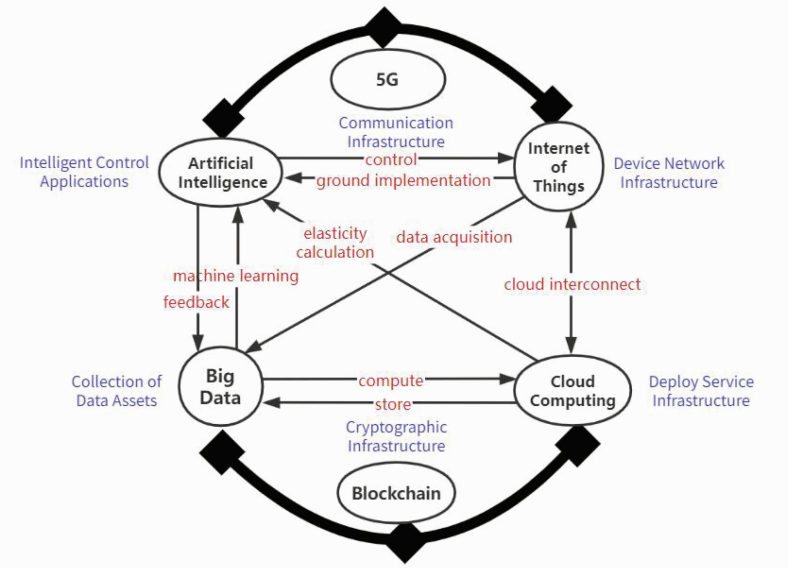

Figure 1 The relationship between big data, cloud computing, Internet of Things, artificial intelligence and blockchain

5G, short for fifth generation mobile communication technology, is a new generation of mobile communication system designed to meet the needs of mobile communication in 2020 and beyond, with characteristics like high speed, low latency, mobility, low power consumption, and broad coverage (Zhai et al., 2019). In the 5G state, all terminals are interconnected, Internet of Things uses various information sensors and devices in the interconnection to automate and intelligently control the whole process of identification, monitoring, and management of specific physics by collecting data such as sound, electrical signals, biological signals, chemical composition, and location information. Cloud computing and big data technology are mutually helpful. Through data gathering, storage, modeling, processing, analysis, and visualization tools, big data technology can manage a variety of data types, including a significant volume of complex information. Cloud computing improves the efficiency of system resource switching and processing by integrating distant resources and data comprehensively through the use of computer networks and powerful computing power. Artificial intelligence employs computer hardware and software to replicate human activities and intelligent behavior in order to assist humans in solving complicated problems and guiding their production and decision-making processes. Blockchain is an innovative application model of cryptography in the Internet era, incorporating distributed data storage, peer-to-peer transmission, consensus mechanisms, encryption algorithms, and other computer technologies to increase the security and dependability of recorded data and information (Li et al., 2022; Tian et al., 2021).

1.2 Science and education evaluation

Science and education evaluation refers to the evaluation of science and technology as well as education, a relatively broad concept that encompasses macro, medium, and micro

evaluation on three levels. At the macro level, science and education evaluation can shed light on the state and trend of science, technology, and education in the entire country and region, and serve as a foundation for macro science, technology, and education management and decision-making. Science and education evaluation at the middle level refers to the assessment of complex units of science and education activities, such as science and education plans and institutions. Micro science and education evaluation refer to the assessment of a discrete unit of science, technology, and education activities, including the assessment of people and events, with the assessment of people referring to the assessment of science, technology, and education talents, and the assessment of events referring to the assessment of science, technology, and education projects and accomplishments (Tang et al., 2020). Thus, science and education evaluation are primarily a comprehensive assessment activity focused on scientific research, disciplines and specialities, university administration, educational quality, and talent development.

1.3 Research on new technology in science and education evaluation

In recent years, China's new technologies have continued to mature through hardware and software development, key technology experiments, technical solution verification, and system validation, and have begun to play a significant role in numerous vertical fields, including communication, education, healthcare, security, tourism, transportation, and smart cities. Scenario-driven theory posits that the majority of the system's essential activities are represented by scenarios (Yu, 2018), as proven by past forms of Internet+Education, Big Data+Government Affairs (Y. Liu et al., 2021), Cloud Computing+Healthcare, AI+Game, 5G+Car Networking, Blockchain+Finance, etc. Although a literature review reveals that the number of discussions on new technologies and science and education evaluation scenarios in science and education evaluation research is currently limited. B. Liu et al. (2021) discussed the general framework and guarantee system of intelligent technology and application-enabled edu-

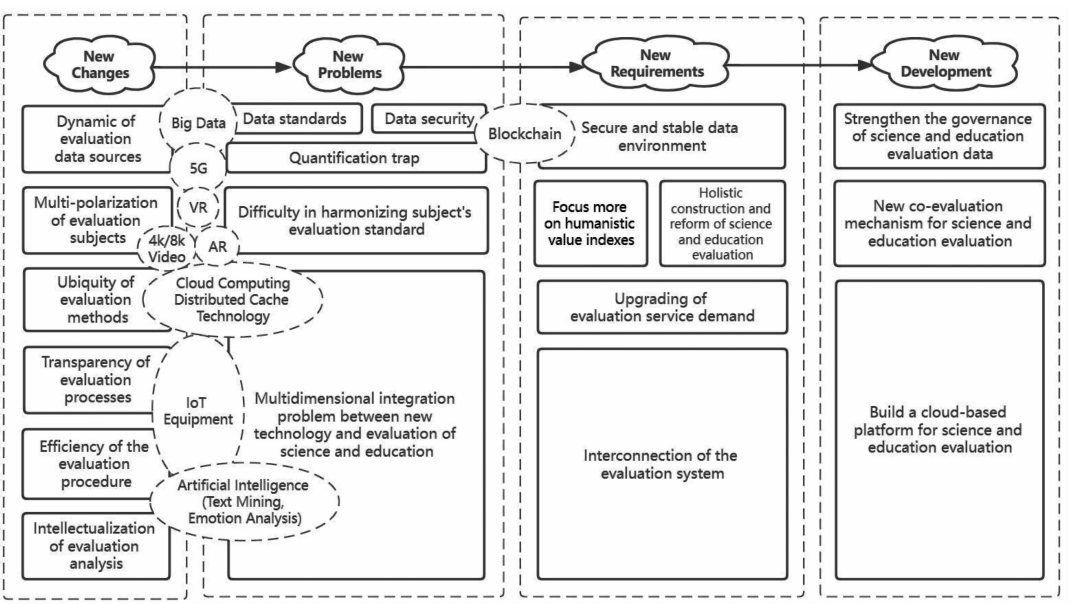

Figure 2 A developmental research framework for science education evaluation in the context of new technologies

cation evaluation. Guan and Xue (2020) highlighted the viability of utilizing big data and blockchain technologies to improve comprehensive quality evaluation for college admission. Fu and Liu (2022) proposed the establishment of three regional platforms for rural teachers' teaching evaluation, as well as a teaching database system and a remote listening and evaluation system, based on the three major technologies of big data, cloud computing, and artificial intelligence, in their study. Qiu et al. (2017), in addition, investigated the impact of the entire big data environment on scientific evaluation activities from the perspective of scientific evaluation theory, methodology, process, and environment. Based on previous research, this study will investigate the new development direction of science and education evaluation under the influence of new technology by analyzing the new changes, new problems, and new requirements of science and education evaluation in the context of new technology. The paper's structural framework is depicted in Figure 2.

2 New changes of science and education evaluation in the context of new technology

2.1 Dynamic of evaluation data sources

Traditionally, data for science and education evaluation came from a single source: statistics from government education departments, data from administrative departments of science and technology, data from universities, SCI and CNKI, and other significant retrieval systems and databases (Z. Liu et al., 2021). In the contemporary Internet context, the amount of semi-structured and unstructured data used in research and education has greatly increased, and the dynamic chain of research data has shown openness and cross-collaboration (Xue et al., 2021). The academic world is starting to pay attention to altmetrics metrics that stress social influence and the impact of social media communication. Big data technology can continuously identify, gather, mine, and evaluate dynamic citations, downloads, likes, comments, link counts, search volumes, and other massive online data and texts, and achieve accurate categorization and dynamic preservation for the high-speed iteration and dynamic growth of online research data.

2.2 Multi–polarization of evaluation subjects

Previous evaluations can be classified as official, semi-official, or unofficial (Luo, 2017). Government education departments, scientific research institutes, universities, commercial information companies, media websites, professional associations, and foundations are among the evaluation subjects. With the advancement of social democratization, individuals in society will gain empowerment as a result of the change brought about by new technology. Horizontal diversification of participation and human-computer interaction models based on artificial intelligence may become a new development trend. In the future, think tanks, representatives of the social academic community, investors, alumni, employers, teachers, students, and parents, as well as other stakeholders willing to participate, can all be included. Under the guidance of the jointly negotiate assessment principles (Zhou et al., 2019), based on 5G high-bandwidth, and low-latency communication network technology support, multiple evaluation subjects with high spatial dispersion can be placed in the same time sharing scenario through MR application, 4K/8K HD conference video, multiple signal live, etc., to carry out cross-regional remote group cooperative evaluation, such as evaluation program solicitation and co-editing, written review or hearing review of collegiality, group resource

sharing, etc., without complicated offline organization process, virtual presence saves time and manpower cost, realizing instant, paperless, three-dimensional, low-cost group evaluation.

2.3 Ubiquity of evaluation methods

In the digital era, scientific communication activities have become more widespread, and 5G enables improved wireless networks with edge computing capabilities that generate fast network responses. "Everything On the Cloud" brings local data transfer closer to real-time with the cloud. This provides a plausible foundation for pervasive evaluation (Peter, 2010). Moreover, cloud computing technology offers ubiquitous, on-demand network access to a shared pool of programmable computer resources. Rather than focusing on specific physical entities, users just need to select cloud service providers using their cell phones, PCs, and other devices, and log in to the cloud portal to choose the necessary service modules. Under such circumstances, the evaluation can be conducted and completed anytime and anywhere, and is no longer restricted to a specific time or location. Distributed caching, load balancing, and other technologies meet the requests for concurrent access from PC or mobile terminals used by evaluation subjects, and all evaluation data content is stored on the cloud server, which does not occupy mobile memory space and is easy to access, further liberating people in the evaluation scenario and increasing the evaluation's efficacy.

2.4 Transparency of evaluation processes

The asymmetry and incompleteness of information is a significant barrier to a dynamic evaluation in science and education (Lin, 2021), while the interference of administrative power, the influence of circle culture, and the insufficient implementation of the anonymous review system also contribute to an irregular evaluation process (Zhu, 2012). The evaluation implementation should focus on the evaluation of material closely related to people as well as the evaluation of usefulness (Song et al., 2021) and introduce the concept of evidence-based evaluation with the best available evidence at its foundation, emphasizing the instrumental rationale. Using radio frequency identification equipment, infrared sensing equipment, electronic camera equipment, and intelligent wearing equipment in the Internet of Things to save and automatically upload original supporting materials such as expert deliberation-type interview data, fieldwork-type case data, teaching record-type audio-visual data, and psychological variation-type emotional data, the evaluation object's complete picture is recovered in a full-cycle, all-round, and comprehensive manner. The real-time tracking and traceability of review materials makes the peer review implementation, testing, verification, and supervision processes more scientific, transparent, and equitable (Ye, 2021). Simultaneously, the prevalence of 5G enables high-speed network access among subjects, and the equality of technical facilities accelerates the elimination of the digital divide between geographic regions; after the generation of science and education evaluation results, information on evaluation content, evaluation basis, and evaluation reasons can be quickly made public so that schools, teachers, and students can can adjust and improve the quality of educational activities in a timely manner, gradually forming a network of evaluation trust relationships and positive feedback on evaluation activities.

2.5 Efficiency of the evaluation procedure

In the evaluation process of universities, there is a time lag between academic reputation,

academic performance, and scientific research; however, the value of the results of research activities must typically be reflected after a longer period of time, resulting in a degree of evaluation inefficiency. Big data technology and 5G networks make up for this deficiency, and the emergence of advanced sensors such as wearable devices enables comprehensive, automatic, and real-time data collection, and millisecond time delays can further improve the rate and accuracy of image recognition, providing the possibility of instant evaluation and big data monitoring and assessment based on scientific research scenarios. In the future, we may gradually adopt artificial intelligence-based evaluation methods to comprehensively optimize the evaluation of survey data such as citation, reprint, award, and unit adoption in the category of scientific research results in the collection of information, as well as the agreed procedures of evaluation such as subject and object dialogues and face-to-face reviews. In addition, AI can score the bibliometric indexes such as citation rate, reprint rate, H-index, G-index, impact factor, etc., with low dissent, as well as the actual input objective indexes such as faculty resources, student resources, funding resources, etc., by algorithmic intelligent judgment based on public data comparison, duplicate data screening and previous evaluation experience within the database. Evaluation experts only need to deal with information other than AI judgment to reduce evaluation pressure. In addition, during the special evaluation periods such as the outbreak of epidemics, which make on-site field visits impossible, the layout of smart devices has the advantage of quickly sensing environmental disturbances and alerting the evaluator to make flexible adjustments, prompting the arrangement of evaluation activities in phased cycles and local scopes, and promoting a more efficient evaluation process.

2.6 Intellectualization of evaluation analysis

In the scenario of big data application, data production factoring, data sharing, and data opening are becoming a reality, and data-driven prediction and evaluation will become the focus in the future (Huo et al., 2021). IoT intelligent service tools such as smart phones, smart laptops, smart bracelets, smart glasses, etc., are typically equipped with highly powerful background algorithms, and the integration of these devices with cloud computing and AI technologies will enable "smart evaluation". Through the automated measurement and simulation application of science and education evaluation system, AI can use key technologies, including machine learning, natural language processing, text mining, sentiment analysis, cognitive computing, and knowledge map construction to explore and analyze the big data of science and education evaluation from the perspectives of semantics, syntax, and pragmatics, make value judgments, and gain insight into the potential value information. In the past, it was difficult for evaluation subjects to distribute their attention to different evaluation objects in a balanced manner; however, AI can mobilize different indexes and data chains to achieve different aspects of evaluation, establish archives for each evaluation object (universities, teachers, and students),and customize an exclusive evaluation plan (Tang & Peng, 2022), so as to realize smart and intelligent evaluation in the sense of value-added contribution.

3 New problems of science and education evaluation in the context of new technology

3.1 No standards for metadata have been created

While the application of new technology enables real-time transmission and collection of

data for science and education evaluation, there are still issues with data standards in the standardized application process for science and education evaluation promoted by current technology. In terms of current domestic research, there are metadata standards DDL for describing social science data, CF for meteorological data, and SDMX for a survey and statistical data in the financial sector. The rise of open-source data in the era of big data has resulted in the multi-source and heterogeneous nature of science and education evaluation data. Along with massive structured data, unstructured data such as text, cases, images, audio, video, physiological performance values, and other unstructured data will all become data sources for science and education evaluation, albeit with varying statistical sizes. And because there has yet to be a systematic comprehensive science evaluation metadata standards and specifications for constructing idea and development guides, the lack of data description and interoperability protocol, in the face of demand for data integration and sharing, will prevent new technology and utility from realizing its full potential, limiting data circulation.

3.2 Risks associated with data security and privacy breaches

While the new technology will ease quick data collection and multi-channel access for science and education evaluation, it will also introduce new security threats and privacy concerns. As a complex information system, in addition to the uncontrollable risk of virtualization technology of cloud computing, all kinds of intelligent devices and access terminals in their actual landing, transmission and use, are bound to have the probability of information theft and interference. Once the perceived data has been tampered with, it will affect the final evaluation decision. At the same time, sensors, cameras, or in the item without knowledge of the context to collect a vast quantity of physiological, psychological, and behavioral data, such as facial recognition, coordinate positioning, and emotional monitoring, it is difficult to be held accountable by the law. Moreover, the evaluation of science and education frequently involves certain scientific research-related confidential information and intellectual property issues, and cloud platform assets such as scientific research results data face the risk of interception, leakage, and theft. Consequently, the extent of the data source records must be considered, and the scope of deployment of intelligent devices into science and education scenarios must be divided and regulated.

3.3 Calculation trap of simple quantification

In the era of big data, technical means are measurable, operable, and transparent, but the in-depth comprehension of the meaning system in the value field is disregarded, resulting in alienation and assessment distortion (Wang, 2021). In reflecting the quantitative characteristics of a certain aspect of university data and the collection of behavioral dynamics, "5G+IoT technology" has the unique advantage of being able to reflect the evaluation object in an objective and documented manner, but in the system and structure of cloud computing and artificial intelligence technology, etc. Nevertheless, "one-size-fits-all" measurement inevitably has the disadvantage of cognitive simplification, and the technocratic route of attaching importance to quantification strips away the historical context and social environment of the object, and the quantitative mode of using indexes alone tends to cause university evaluation to fall into an irrational zone (Zhang & Hu, 2022). The theoretical assumptions behind each data need to be clarified, and corrections need to be made in the process of qualitative evaluation to avoid being trapped in the audit calculation of algorithmic statistics and materialized symbols.

3.4 Difficulty in harmonizing subject´s evaluation standard

In the context of new technologies, the subject of evaluation expands from the academic field to the entire social field, and market forces with different cognitive standards, knowledge backgrounds, and value aspirations participate in it, adding additional criteria such as social acceptance, research efficiency, and market competitiveness (Gao, 2021). The issue of the balance of ratios between elite and popular experts merits consideration, as does their tendency may lead to the dispersion of attention to evaluation objectives and heterogeneous divergence of evaluation dimensions and perspectives, making the results presented more differentiated. For instance, in non-normative university reviews, parents pay attention to teaching quality and school popularity, and employers focus on graduates' business competence and overall quality, while students are more concerned about their own development, employment rate and salary (Yu & Zhang, 2021). The complexity of evaluation requires the unification of evaluation standards and index systems in a hierarchical manner, and whether the final evaluation results can truly and objectively reflect the whole picture of the evaluation object still needs to be tested, otherwise, it is likely to cause misguidance to researchers and the public. Currently, the application of evaluation science must be clear, not only to prevent the interference in the evaluation from social factors with different interests, but also to assure a professional, authoritative, and diverse workforce.

3.5 Multi–dimensional integration problem between new technology and evaluation of science and education

The evaluation of science and education involves the tilting and allocation of quality resources, such as competitive funding for universities, so the procedural implementation of the evaluation and the authentic data should be strictly regulated, which requires higher reliability and robustness of the technology application. Currently, not only is the construction of various types of cloud computing network frameworks time-consuming and labor-intensive, but the initial investment in 5G network and IoT environment configuration is also pricey, and numerous sensor devices have quality and capacity issues. Moreover, the "weak" AI based on big data learning and training at this moment lacks complex cognition and efficient intelligent reasoning capabilities, which prevents it from completely supporting the knowledge mining of implicit complex cognition and requires additional maturation time (X. Liu, 2021). Moreover, the high-frequency iterative nature of the new technology necessitates constant manual maintenance of the operation equipment and platform of science education evaluation in order to implement scenario verification, thereby imposing new requirements on the technical application capability of evaluation subjects and evaluation objects with distinct identities. Realizing the mutual matching application of human, hardware equipment, cloud computing network architecture, and artificial intelligence decision analysis technology in all elements of science and education assessment is thus a multi-dimensional problem.

4 New requirements of science and education evaluation in the context of new technology

4.1 Secure and stable data environment

In the era of big data, data resources are vast, varied, rapid, and dynamic. During the data flow process of scientific education assessment, the data source shifts from data based on

small samples to data based on big samples, and the data collecting method shifts from "intermittent collection" to "full process collection." Therefore, science and education evaluation requires a higher data transmission rate, data resource preservation, data flow security, and stable data processing and computing capabilities of the operating environment, and the security operation capability of new technologies must be enhanced, and system functions and interface performance must meet the standards. It is necessary to constantly upgrade 5G security networking technology, MEC data security protection technology (Lin, 2022), blockchain encryption algorithm and smart contract technology to improve the ability of data operation guarantee so that it can support a sufficient amount of data and hundreds of millions of device connections, deliver massive data and information to the intelligent cloud in a timely manner, and ultimately realize the association, collection, storage, processing, analysis, and deep mining of data.

4.2 Focus more on humanistic value indexes

Evaluation indices for science and education should not only focus on quantifiable research outcomes in academic dimensions such as papers, publications, reports, conference papers, and patents, but also include humanistic value indexes such as research climate, organizational culture, moral quality, social contribution, and learning ability. In the United Kingdom, the Research Excellence Framework (REF) adds the dimension of "research impact" to the quality of research results and the vitality of the research environment (Feng & Ma, 2021), and the Australian AUCEA university community service evaluation system presents the real state of affairs with statistical and qualitative questions of the community service performance questionnaire to compensate for blind spots that cannot be covered by quantitative indexes (Shi & Liu, 2021). In the new application scenario, 5G combined with IoT that deeply records the time, environment, and location information of research subjects can measure, record, calculate, evaluate, and provide feedback to data that could not be fully quantified in the past, such as the individual emotional behavior of universities and research institutions in science and education activities from the perspective of social context, and the process of specific science and education outputs. Currently, 5G and IoT technologies are being applied to science and education infrastructure in order to achieve efficient and intelligent connection of various elements and hardware terminals of the campus environment, as well as a comprehensive record of the flow, interaction, and operational characteristics of campus people, property, materials, time, and information (Sun & Cai, 2021). The subsequent step must address the measurement, correlation, and conversion of the information captured and identified by sensors with the original evaluation indexes, decompose and quantify the data indexes with behavioral significance, and assign corresponding weights to each constituent element of the indexes in order to create a new science and education evaluation index system (Zhou & Wu, 2016).

4.3 Holistic construction and reform of science and education evaluation

At present, the main body of science and education evaluation in China is still relatively fragmented, and the government undertakes the tasks of policy making, standard setting, evaluation implementation, etc., combining leadership, management and evaluation power as one. The three evaluation scenarios of college teaching evaluation, civilized campus evaluation, teachers' professional title evaluation are organized by the Ministry of Education, the Central Civilization Office and the Organization Department of the Central Committee of the

Communist Party of China, respectively, resulting in the significant phenomenon of multiple evaluations and duplicate evaluations, and the government, schools, teachers, students, society, and other evaluation forces have also not reached communication and collaboration (Yang, 2022). In the context of new technologies, evaluation subjects are becoming increasingly diversified, and their respective evaluation concepts, behavioral goals, and points of interest are inconsistent; therefore, it is necessary to promote changes in the overall structure of science and education evaluation and clarify their respective subject functions. To be specific, the government is responsible for oversight and regulation, as well as controlling the overall objective, progress, and quality. Schools are entrusted with the authority to foster innovation in science education evaluation and develop application scenarios for new technology-enabled science education assessment. As evaluation implementation subjects, teachers, students, and society must be aware of how new technologies are utilized and how they differ from their projected utility, as well as make reasonable use of intelligent technologies to assure evaluation implementation.

4.4 Upgrading of evaluation service demand

Formerly, educational management units at all levels mastered universities' capacity for scientific research and innovation, as well as their overall development trend, based on evaluation results, to implement higher education decisions and policies; Similarly, colleges and universities use it to determine the direction of a school, to plan strategically, and to evaluate teachers' scientific research performance, to optimize the scientific research environment and improve the quality of school administration; Enterprises use it as a reference for graduate recruitment and talent introduction; Undergraduate students, postgraduate students, and doctoral students use ranking information to select schools. Under the new technological environment, the demand for evaluation services has expanded and refined personalized demand has increased accordingly. Subjects with different identity backgrounds and subject areas expect to use evaluation information for intelligent ranking and diagnosis of subjects, targeted intelligent search and consultation Q&A. In addition, the evaluation application is more open, attaching importance to the user's sense of experience and interaction, and can use HD three-dimensional emerging media such as hologram to carry out more scenario-based and interactive cooperation, such as the use of "augmented reality" (AR), "virtual reality" (VR), "mixed reality" (MR) technology to realistically show the physical environment and increase the sense of immersive experience, and the virtual and real integration of the scene construction allows users to have a deep experience of stepping into the willingness to consult colleges and universities. According to the evaluation results, we can also promote the construction of cases for distinctive disciplines in colleges and universities, open several college live broadcasting accounts, and enable different colleges and universities to interact live via the 5G HD network, as well as to conduct long-distance situational teaching activities of high-quality disciplines in both directions, thereby promoting the flow of advantageous discipline resources.

4.5 Interconnection of the evaluation system

At present, Incite and Sci Val suite are widely used tools for scientific research performance analysis, and there are also scientific and educational tools such as "China Higher Basic Index Database and Diagnostic System" and "China University Research Results Statistical Analysis Database" in China. Universities can choose suitable scientific research evaluation systems

and evaluation indexes according to the evaluation purpose (Li et al., 2021). However, at this stage, there is still a lack of an integrated and intelligent mobile information evaluation management platform based on big data to meet the current realistic needs of science and education evaluation. With the accelerated evolution and enrichment of new information technologies such as 5G, big data, cloud computing, blockchain, and artificial intelligence, the trend of "Intelligence On the Cloud-Everything Connected" advocates abandoning the previous single isolated evaluation activities, and not only the data collection should be more widely associated with each other, but also the platform application, and the independent evaluation system should be optimized and upgraded. In addition, the science and education evaluation system should be fully interconnected and interoperable with a journal database, patent database, citation tracking database, selection and scoring expert database, public evaluation database, laboratory platform, result management platform, institutional knowledge base, high-level think tank, and other related management tools across systems, so as to realize data circulation and integration and form a closed loop of value, and to provide multi-source big data-based support for scientific management and accurate decision-making of science and education evaluation to carry out various forms of resource asset management and services.

5 New development of science and education evaluation in the context of new technology

5.1 Strengthen the governance of science and education evaluation data

Due to the large volume, rapid update frequency, and multi-source heterogeneity of science and education data under the environment of new technology, it is necessary to strengthen the standardization and management of science and education evaluation data. Standardizing metadata is the first step toward ensuring the long-term development of science and education evaluation and serves as the foundation for subsequent processing, analysis, and application of science and education data. To facilitate the standardization of science and education metadata, appropriate data standard strategies should be developed to map behavioural and emotional data indexes collected by IoT sensors to unified data dictionaries and data specifications, as well as to perform data modelling, relationship modelling, association indexing, classification and merging, and computational transformation. Additionally, it is necessary to strengthen the oversight of science and education evaluation data, adhere to resource standardization and intellectual property protection guidelines, and avoid the disclosure and tampering of critical scientific research data, classified information, and private information via a unified rules engine, scheduling engine, and process engine, to protect the legitimate rights and interests of the evaluation subjects and objects.

5.2 New co–evaluation mechanism for science and education evaluation

To begin, a social co-evaluation atmosphere must be established, public participation must be included, common governance of evaluation stakeholders must be implemented, corresponding social indexes must be added to the evaluation system, and meta-evaluation organizations and other special institutions must be established to recognize and review evaluation participants' qualification in terms of evaluation capacity, evaluation professionalism, evaluation credibility, evaluation activeness and evaluation recommendation rate. Screening personnel with neutral value orientation through threshold setting, incorporating them into

the corresponding management platform of review subjects, and sub-banking and stratified sampling, so as to achieve the purpose of maintaining fairness in the rationing of experts, third-party institutions, and the general public as well as fairness in the selection process. Additionally, personnel development, tracking, and supervision should be implemented. On the one hand, the application capability of evaluation participants for sensor equipment and evaluation systems should be enhanced to lay the groundwork for implementing full life cycle evaluation in the context of new technology. On the other hand, introduce a scientific evaluation program, optimize the evaluation process, except for the AI assessment undertaken on the side of the opinion assessment, strict sub-evaluation, set up evaluation operation to leave traces, prevent possible evaluation errors and evaluation moral risks, regularly spot-check and replace the offending evaluators, so that the evaluation work has clear authority and responsibility, independent and efficient.

5.3 Build a cloud–based platform for science and education evaluation

We should construct a high-level data governance architecture, implement cloud-based data sharing design concepts, and employ a range of technical means to construct and operate a cloud-managed terminal collaborative scientific and education assessment service platform that is highly effective and of high quality. The platform should have sophisticated and highly integrated features that cover the entire process of gathering, processing, publishing, applying, and servicing science and education evaluation data. As illustrated in Figure 1, the cloud platform system is composed of three layers: the Base Layer (IaaS), the Platform Layer (PaaS), and the Application Layer (SaaS). with new technologies (big data, cloud computing,

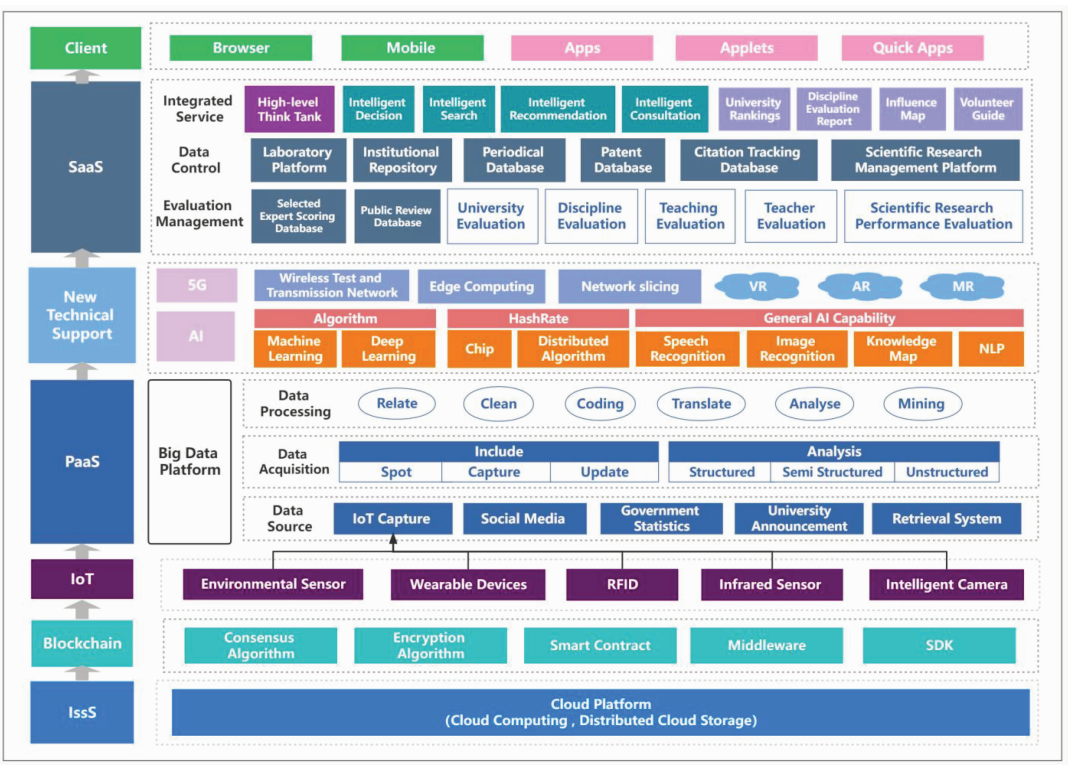

Figure 1 Science and education evaluation cloud-based platform in the context of new technology

5G, IoT, artificial intelligence, and blockchain) serving as the crucial operational support for the entire cloud platform.

(1) A base layer (IaaS). As the pillar of the entire cloud system, relying on the powerful computing power of cloud computing and the guarantee of blockchain to maintain the stability of the whole platform. Based on the 5G communication protocol in the core network layer, for science education cloud data, each university, evaluation unit and other measurement and control node subjects can set independent edge computing center for management, apply wireless measurement and distribution network to realize wireless coverage around the entity and large broadband transmission of data, and adopt different network configuration parameters to meet local or remote application requirements for different evaluation processing scenarios. Additionally, the sensor network comprises RFID radio frequency identification, environmental sensors, intelligent camera, infrared sensor and smart glasses and other wearable IoT devices. The former network bearer of wired networks, wireless WiFi, ZigBee/NB-IoT, and Bluetooth networks are transformed into a 5G network bearer with high bandwidth, high speed, high security, and low delay through 5G processing (Li & Wang, 2021). Local data processing minimizes data transmission delay. Simultaneously, the 5G network supports multiple terminal access to avoid lag. Multi-access edge cloud technology mitigates the risk of public cloud data leakage and ensures user access is secure.

(2) Platform Layer (PaaS). Data is shared through cross-domain real-time sharing technology of big data, the platform effectively integrates and calculates the data captured by IoT (eye movement trajectory, camera recognition, emotional corpus), social media data (search engine detection, Baidu entry collection, portal website mention, virtual community Forward, likes and comments), government statistics (organizational resources, social contribution and social reputation), Colleges and universities independently publish data (Progress of application plan, specific achievement of numerical objectives and outstanding representative achievements) and retrieval system data (citation rate, reprint rate, H index, G index, influence factor and ESI statistics). This platform provides the collection and analysis of multi-source heterogeneous and other complex data, realizes the association, cleaning, coding, translation, analysis and mining of data, and forms an expandable and flexible subject database for science and education evaluation business, which is conducive to the realization of university evaluation, discipline evaluation, teaching evaluation, teacher evaluation Scientific research performance evaluation and other scientific and educational evaluation activities with diversified standard interfaces and data support.

(3) Application Layer (SaaS). Evaluation of science and education was essentially a support activity. Its purpose is not only to identify and rate disciplines within colleges and universities, but also to provide guidance, allowing evaluation to more effectively identify problems, foster the development of scientific research innovation and symbiotic mechanisms, and finally, to foster the transformation and upgrading of evaluation services. According to the evolution of science and education activities, the evaluation system structure should be designed to enable the interconnection of all sources and databases at the bottom of the relevant platforms, to establish upstream and downstream links for science and education evaluation management activities, and to create distinct service modules:

Data control module. Based on system docking and self-uploading, it provides services such as data visualization, statistical analysis, and special topic mining. The laboratory platform collects and publishes critical track data on the behaviour, status, and performance of scientific research entities across the entire process of scientific research, including teaching,

scientific research data, materials and reagents, instruments and equipment, and procurement funds. The institutional repository provides the storage of academic data resources such as universities, university alliances and research institutions. Periodical databases, the patent database, citation tracking database can all be used to display the measurement metrics of significant scientific research achievements, and the chain analysis of the text data can track the real-time development of the research field. The scientific research management platform is responsible for the review of subject arrangement, analysis and demonstration of large-scale projects, research progress and funding flow review, and plays a core role.

Evaluation management module. The evaluation ecosystem evolves by using big data means, knowledge atlases and other technologies. The cloud platform supports the one-click generation of evaluation and acceptance materials through the aggregation and fusion of multi-dimensional factual data. Relying on relational data and intelligent working methods, the cloud platform extracts evaluators in proportion from the selection expert scoring database and public review database according to the recommendation principle and avoidance principle and uses intelligent positioning and navigation technology to give priority to the near end-users of colleges and universities for annual, medium and long-term, quarterly special evaluation tasks can be accessed through browser or mobile terminal applet, app, quick application and other channels. 5G mobile communication network ensures network slice transmission, maintains channel independence, reduces transmission delay, supports the online review, VR entry, remote cross-domain review and other evaluation scenarios, and records the results after evaluation implementation in the main chain, the peer-to-peer data transfer capabilities of blockchain ensure that the outcomes cannot be denied or altered, and that they are accessible for enquiries, appeals, redress, and oversight. Moreover, under the centralized network system, system operation and maintenance may be performed collectively, resulting in a significant improvement in maintenance efficiency.

Integrated business module. By establishing an evaluation information query system, applying University portraits and index scores to meet the informed needs of the public, and providing them with accurate and personalized solutions, such as allowing candidates to independently select ranking indexes to generate personalized ranking lists, and accurately matching the main content and technical criterion with the needs of applicable enterprises at the initial stage of key science and technology projects, so as to promote technology transfer business incubation and achievement transformation; By establishing an evaluation intelligent service system, cloud computing intelligent analysis of user platform operation dynamics, deep excavation of the correlation between user search behavior and high-frequency browsing records, refining core needs, AI to provide intelligent decision-making, intelligent search, intelligent recommendation, intelligent consulting and other intelligent services. Simultaneously, high-level think tanks bring together the minds of colleges and universities, Academy of Social Sciences and social experts, which accept consultation and decision-making requests from Party and government departments, as well as ordinary citizens, provide expert perspective interpretation, give play to the effectiveness of consulting the government and enlightening the people, gain and broaden the service channels of the influence of science and education evaluation.

6 Conclusion and Prospect

Technological advancement is a significant impetus for scientific advancement and transformation, and we should seize the initiative to adapt to the current technological trend. We

should make use of new technology revolutions, such as Big Data, Cloud Computing, the Internet of Things, Artificial Intelligence, 5G, and Blockchain, to advance the diversity, standardization, and intelligent design of scientific and educational evaluation.

At present, a new generation of 6G networks is currently being developed. The network's capacity and transmission rate will improve significantly, and the evaluation of science and education will undergo a new and more profound transformation. In this context, the cloud platform for science and education evaluation will also absorb a broader range of users, generate new evaluation indexes and tools, continuously promote platform structure and application service innovation, and we should explore and improve a more efficient and intelligent science and education evaluation ecosystem.

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