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College Education Management Strategies Supported by Artificial Intelligence and 5g Communication Technology

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Abstract The integration of AI and education makes the education field more "intelligent" and "flexible". The new era calls for AI to boost the construction of teachers. Under the influence of traditional educational concepts in the past, there are still many problems in college education management in many aspects. This paper first analyzes the evaluation projects, indicator systems, documents, policies, and development context of domestic and foreign college education informatization, and constructs the maturity model and evaluation informatization. The experimental results prove that the optimized structural equation model, combined with the innovative education concept, and optimizes the practical of various education management work in the school under the innovative education concept. And through the analysis and research of these problems, the specific corresponding methods and countermeasures are proposed. It provides a theoretical basis to a certain extent for university administrators to better apply innovative ideas to educational management.

Index Terms artificial intelligence, 5G communication, higher education, structural equation model optimization

I. Introduction

LOOKING at every change and development process of mobile communication technology in the world since modern times [1]. For example, the teaching media used in the classroom has gradually changed from a single "book + blackboard" combination in the traditional teaching environment to a teaching media environment that can now be combined with "mobile devices + multimedia devices" supported by mobile communication technology [2]. The traditional classroom will gradually become a smart classroom. What's more, various new teaching media (such as mobile smart phones, iPads, UAVs, robots, VR all-in-one machines, AR, 3D projection, etc.) can be used to build a virtual learning space with zero delay, high speed, large capacity and excellent user experience, and an integrated and intelligent intelligent learning environment can be formed through intelligent interconnection between teaching media [3].

Teaching media will also tend to be diversified, mobile, intelligent and virtual, which will lead to a huge change in teaching media. Under the application of mobile communication technology and the transformation of media, while breaking the time-space boundary of traditional education and teaching, making the teaching activity site transfer from reality to virtual space, and truly realizing the cross space-time, education management departments, etc. In addition, the dual transformation of mobile communication technology and teaching media will also make the current education and teaching means, education management mode, and even the entire education system undergo earth shaking changes [4].

With the rapid development of artificial intelligence, teachers have been given many expectations from all walks of life, and the diversity and complexity of role expectations often lead to teachers' role ambiguity and other crises, which to some extent hinder teachers' professional development [4]–[6]. Based on the "media scene theory" of foreign scholars, following the research idea of "new scene - new requirements - new role - new path", using speculative research methods, we extract the universal concept of teachers' role in the context of artificial intelligence, integrate the characteristics of the times such as "spatial", "social" and "temporal", clarify the positioning of teachers' role in the context of artificial intelligence, and propose the path to reshape teachers' role, In order to promote teachers to effectively realize the role transformation and better play their role in the artificial intelligence society [7], [8].

Teaching management has become more and more complex and diverse (different student backgrounds, training methods, school systems, etc.), posing a huge challenge for teaching organization and management [9], [10]. In addition, while the amount of information and data in teaching management has doubled, making teaching management more difficult. With the increase of management pressure, managers have gradually weakened the concept of serving teachers and students in order to complete their work tasks. As a result, most teachers and students suffer from the situation of "difficult access and ugly face" in addition to "breaking their legs"

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when handling business [11], [12]. The emergence of these problems is not a human factor, but a lack of efficient, humanized and information-based education management model, teaching management has become more and more complex and diverse (different student backgrounds, training methods, school systems, etc.), posing a huge challenge for teaching organization and management [13]. In addition, the integrated application, while the amount of information and data in teaching management has doubled, making teaching management more difficult. With the increase of management pressure, managers have gradually weakened the concept of serving teachers and students in order to complete their work tasks [14]. As a result, most teachers and students suffer from the situation of "difficult access and ugly face" in addition to "breaking their legs" when handling business. The emergence of these problems is not a human factor, but a lack of efficient [15], [16].

To sum up, based on the above problems and focusing on the contradiction between the current development needs of artificial intelligence technology in 5G communication technology and the insufficient development of education management informatization, this research conducted experiments on students.

II. Structural Equation Model Optimization

There are two types of variables in the structural equation model: One is measurement variable, also known as explicit variable, which is an observation index in the model and a variable that can be directly measured; The other is structural variable, also known as hidden variable or latent variable [17], [18]. It is a variable that cannot be directly observed and is expressed by its corresponding explicit variable. According to the variable relationship in the model, the structural equation includes two sub models: the structural model, which describes the causal relationship between hidden variables; Measurement model - a model that describes the relationship between implicit variables and explicit variables. If the measurement model is constitutive:

$$\xi = \prod_{\xi} X + \delta_{\xi}. \tag{1}$$

$$\eta = \prod_{\eta} Y + \delta_{\eta}. \tag{2}$$

The measurement model can be represented by the following equations:

$$\xi = (\pi_{11}, \pi_{12}, \pi_{13}) \begin{pmatrix} X_{11} \\ X_{12} \\ X_{13} \end{pmatrix} + \delta_{\xi 1}. \tag{3}$$

Put all the principal component coefficient vectors obtained into a sparse rotation matrix:

$$R_i = \begin{bmatrix} a_{i,1}^{(1)}, a_{i,1}^{(2)}, \ldots, a_{i,1}^{(M_1)}, & [0] & \cdots & [0] \\ [0] & a_{i,2}^{(1)}, a_{i,2}^{(2)}, \ldots, a_{i,2}^{(M_2)}, & \cdots & [0] \\ \vdots & \vdots & \ddots & \vdots \\ [0] & [0] & \cdots & a_{i,K}^{(1)}, a_{i,K}^{(2)}, \ldots, a_{i,K}^{(M_K)}, \end{bmatrix}. \tag{4}$$

With the potential factor model, user ratings can be expressed as follows:

$$r_{ui} = \theta_{ui} + \varepsilon_{ui} = p_u^T q_i + \varepsilon_{ui}. \tag{5}$$

In order to obtain these hidden vectors, the regularized SVD method can be used to estimate them. The loss function is defined as follows:

$$\min_{P,Q} \frac{1}{\Omega} \sum_{(u,i)\in\Omega} \left(r_{ui} - p_u^T q_i\right)^2 + \lambda \left\{ \sum_{u=1}^{n} J\left(p_u\right) + \sum_{i=1}^{m} J\left(q_i\right) \right\}. \tag{6}$$

$$f(x) = \operatorname{sgn}\left(\sum\nolimits_{i=1}^{i} a_i^* y_i K\left(x, x_i\right) + b^*\right). \tag{7}$$

For the two word frequency vectors, the calculation formula is as follows:

$$K(x, y) = \sum\nolimits_{i=1}^{K} \min(x_i, y_i). \tag{8}$$

To further explain the composition of the structural equation model of university education management strategy, we assume a structural equation model with four implicit variables and their corresponding explicit variables, as shown in Figure 1.

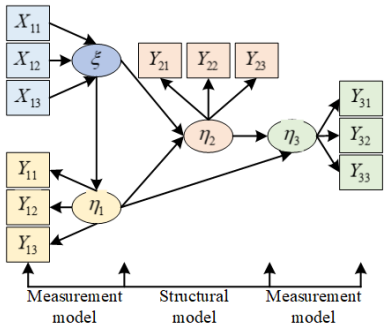

Figure 1: Structural equation model path optimization diagram of university education management strategy

III. Methods

In April 2018, the Ministry of Education continued to emphasize the popularization of AI knowledge in colleges. However, the discipline characteristics of AI education formed resistance to effective teaching in schools. In addition, the content structure has changed greatly, and the teaching implementation methods and measures are not yet mature. In recent years, the educational circle has set off a boom in the concept of innovative education. The spirit of innovation has become an indispensable mainstream ideology and important policy.

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Figure 2 is the construction system of disciplines can be divided into internal and external systems. This paper only discusses their internal systems, that is, the knowledge system and normative forms of disciplines. Among them, the former mainly refers to the discipline concept system, which is characterized by logical self consistency; The latter includes such normative forms as the research object, the nature of the discipline and the methodology system of the discipline.

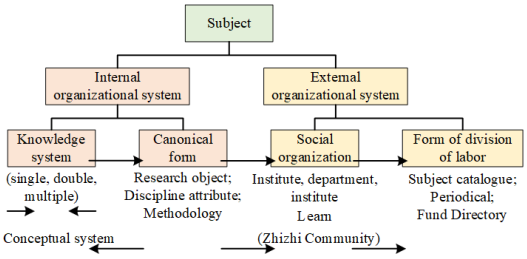

Figure 2: Schematic diagram of discipline construction of university education management (the relationship between internal and external organizational systems)

There are many difficulties in promoting AI teaching in China, such as lack of professional teachers, lack of teaching resources, backward or inadequate allocation of teaching infrastructure. To solve the current dilemma, relevant researchers and educators need to work together to find a breakthrough in actual teaching and promote the steady progress of AI teaching in domestic universities. Similarly, if the learner chooses not to have learned, it will present relevant basic knowledge points according to the language the learner wants to learn. Let the learner learn first, and then test after learning. If the test is qualified, it will end, and then enter the next module for learning. If the test is unqualified, it will continue to learn. The optimized workflow of the higher educationt module is shown in Figure 3.

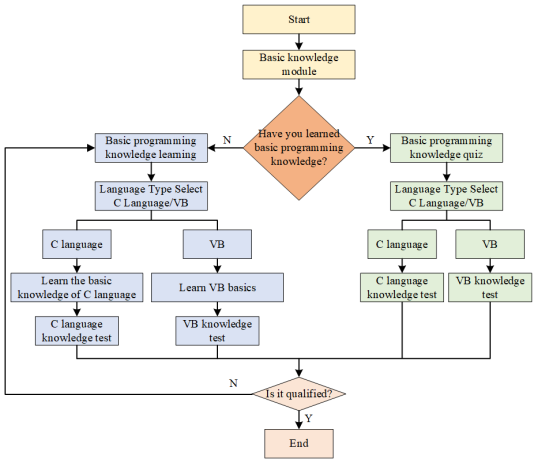

Figure 3: Work flow of optimization of university education management module

Managers can formulate management strategies with strong pertinence and applicability under the guidance of innovative ideas. In terms of student management in colleges and universities, following the concept of educational innovation, managers should not only rely on "managing" students, but should change their ideas and renew their ideas. Everything should be people-oriented, with the overall development of students as the core. University administrators should change from "management" of students to service for students, and from managers to guides and service providers. As Figure 4, the "overlapping" education management discipline governs (university) pedagogy and (university) management discipline. Its research object is the training of senior talents and the processing of advanced knowledge. Its corresponding discipline nature is the "overlapping" attribute of university education and management.

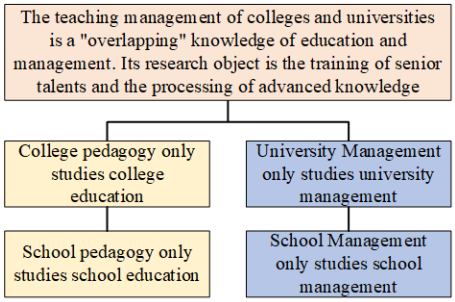

Figure 4: Schematic Diagram of "Overlapping" of University Education and Management

Education management is not only the management of various education related facilities and equipment, but also the management of all educational activities and plans, that is, under the guidance of leaders, the education management departments use scientific methods to plan, organize, guide, supervise and coordinate educational institutions and organizations at all levels. It can be seen from Figure 5 that advanced knowledge has inherited the 1+3=4 basic discipline classification (grammar ->humanities; medicine ->nature, law ->society, theology ->philosophy) of the medieval university tradition and the American higher education timeless tradition, and further refined the eight basic disciplines, namely: humanities, nature, engineering, society, psychology, philosophy, logic, and mathematics.

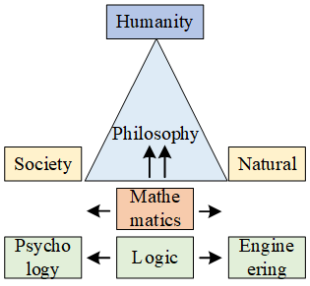

Figure 5: The overall model of disciplines supporting the macro theoretical framework (in-depth "overlapping" exploration)

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The track of gradual improvement and maturity, as shown in Figure 6.

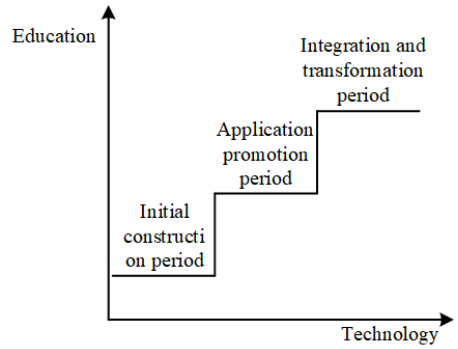

Figure 6: Hierarchical structure of the maturity model of college education informatization

The so-called education management, such as computer, network communication and multimedia, to manage all kinds of education affairs at all levels under the guidance of modern education management ideas, the analysis process of structural equation model is shown in Figure 7.

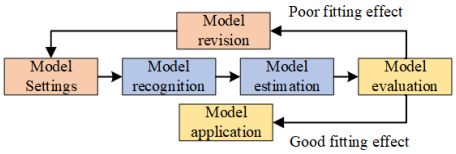

Figure 7: Flow Chart for Optimization of Structural Equation Model of University Education Management Strategy

Since human beings began to have educational activities, there has been a trace of educational management. It can be said that education has promoted the development of educational management theory, and the continuous research and progress of educational management theory gave birth to educational management science, which is the development of the most traditional educational management theory, while modern educational management theory really began to develop in the 20th century. After the Industrial Revolution, educational activities became more and more complex, and the modern educational management theory also developed accordingly. Its development was promoted by modern education, modern management theory, new technology and new methods. During this period, the scale of education expanded rapidly, the types and levels of education continued to diversify, and the relationship and role between education and society became increasingly complex, which urgently needed the support of new management theories; In addition, the continuous innovation of enterprise management theories has promoted the development of scientific management that pays more attention to efficiency.

The connotation of "AI teaching" includes two educational activities: "teachers teach AI knowledge" and "students learn AI knowledge". In teaching, students are taught AI knowledge to help and guide them to learn and master the basic concepts, principles, applications of AI, meet their personalized learning needs and further education needs, cultivate their logical thinking ability, programming ability.

IV. Results

Education management is not only the management of various education related facilities and equipment, but also the management of all educational activities and plans, that is, under the guidance of leaders, the education management departments use scientific methods to plan, organize, guide, supervise and coordinate educational institutions and organizations at all levels.

Based on the above discussion and principles, this paper proposes an indicator system for the maturity model of university informatization as shown in Table 1.

In the 5G education application scenario, all kinds of virtual reality media can not only complete the high-definition video shooting of all kinds of teaching scenes, the collection and splicing of materials, and realize the high-speed transmission of teaching resources, but also allow users to experience all kinds of activity sites at any time, anywhere and without delay through all kinds of virtual reality media. The virtual teaching media allows teachers and students to immerse themselves in the virtual environment built by virtual reality media, as shown in Table 2.

Next, the hypothesis path in the model is tested, and the results are shown in Table 3.

The specific effect values of each influencing factor in the model on learning participation are shown in Table 4. The information in Table 4 includes influencing factors, paths, direct and indirect effects, intermediary effects and total effects.

To sum up, the experimental model has been verified by combining the practical application of AI and 5G communication technology to optimize college students' education management strategies.

V. Conclusion

After analyzing the types of teaching media in 5G education application scenarios, the research proposes that the teaching media in 5G education application scenarios should have seven characteristics, namely, mobility, extreme simplification, interconnection, intelligence, virtualization, faster response rate and excellent user experience. It is proposed that the teaching media in the 5G education application scenario should have five major media functions: wireless transmission of signals and teaching resources, cloud storage and processing of teaching resources, remote control and monitoring, intelligent interconnection and analysis, and construction of immersive teaching scenarios. Strengthen the top-level design of university education management informatization: formulate strategic planning, strengthen organizational leadership and clarify the development structure. Improve the construction of information system of university education management. Promote the collaborative development of education management informatization: the university's macro leadership,

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Key processes	Key Process Area	Key Practices
Infrastructure	Network environment	School Internet Access Bandwidth (Mbps)
Infrastructure	Network environment	Campus network backbone bandwidth (Mbps)
Infrastructure	Network environment	Wireless network coverage (%)
Infrastructure	Multi-Media Classroom	Average utilization rate of multimedia classrooms (%)
Resource construction and application	Education and teaching	Proportion of digital teaching resources construction (%)
Resource construction and application	Education and teaching	Proportion of virtual simulation experiment teaching project resource library construction (%)
Resource construction and application	Education and teaching	Coverage ratio of information teaching system (%)
Resource construction and application	Scientific research	Coverage ratio of scientific research information service system (%)
Resource construction and application	Scientific research	Purchase of digital teaching and research resources (%)
Management informatization	Management system	Function realization rate of information management system (%)
Management informatization	Management system	Proportion of management information systems realizing data sharing (%)
Management informatization	Management system	Basic data application coverage of management information system (%)
Management informatization	Information safety	Safety system function realization rate (%)
Management informatization	Information safety	Campus coverage of security monitoring system (%)
Management informatization	Information service	Realization rate of all-in-one card function (%)
Management informatization	Information service	Utilization rate of uniformly opened information publishing platform (%)
Safeguards	Personnel support	Proportion of establishing school level information management leading schools (%)
Safeguards	Personnel support	Proportion of schools that employ full-time personnel to support the development of informatization (%)
Safeguards	Personnel support	The proportion of teachers who participated in the special training of education informatization (excluding school-based training) in the last year (%)
Safeguards	Material and financial support	Specify the proportion of informatization funds invested in schools in the form of documents

Table 1: Maturity Model Indicator System of College Education Informatization

Media type	Typical media
Mobile interactive media	Mobile phones, tablets, mobile computers, smart speakers, smart robots, smart campus apps, mobile eye movement products, etc.
Classroom display media	Holographic projection, holographic podium, fog screen, projector, interactive electronic whiteboard, LCD TV, intelligent learning pen, normalized recording and broadcasting set, high racket, mobile booth terminal, 3D printer, cloud desktop, desktop eye movement, eye movement for teaching development, etc.
Intelligent wearable device	Hands: smart watch, smart bracelet, fitness wrist strap Force, wrist calculator, Key gloves gloves;
Remote control and monitoring media	UAV, intelligent recording and broadcasting 1+N, smart campus security system, multiple biometric all-in-one machine, education cloud platform, remote control camera, remote control air switch system, etc.

Table 2: Specific classification of teaching media in 5G education application scenario

Assumed path	Estimate (β)	S.E.	C.R	P	Inspection results
Resource platform	Intelligence literacy	0.277	0.044	6.189	Remarkable
Self efficacy	Teacher support	0.344	0.05	4.899	Remarkable
learning interest	Resource platform	0.304	0.058	5.443	Remarkable
learning interest	Teacher support	0.342	0.066	5.356	Remarkable
Learning participation	Self efficacy	0.261	0.032	7.723	Remarkable
Learning participation	learning interest	0.177	0.036	4.706	Remarkable
Learning participation	Intelligence literacy	0.185	0.033	5.989	Remarkable
Learning participation	Resource platform	0.237	0.045	5.576	Remarkable

Table 3: Test results of model assumptions

Influence factor	Route	Direct effect value	Intermediary effect value	Total effect value
learning interest	Learning interest → learning participation	0.177	-	0.177
Intelligence literacy	Intelligence literacy → learning participation	0.185	-	0.415
-	Intelligent literacy → resource platform → learning participation	-	0.06	0.415
-	Intelligent literacy → resource platform → learning interest → learning participation	-	0.166	0.415
Self efficacy	Self efficacy → learning participation	0.261	-	0.261
Teacher support	Teacher support → self-efficacy → learning participation	-	0.095	0.202
Resource platform	Resource platform → learning participation	0.237	-	0.374

Table 4: Path relationship and influence effect value of each influencing factor on learning participation

the collaborative management of various departments and the strengthening of school enterprise cooperation.

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References

[1] Zhang, C., Ueng, Y. L., Studer, C., & Burg, A. (2020). Artificial intelligence for 5G and beyond 5G: Implementations, algorithms, and optimizations. *IEEE Journal on Emerging and Selected Topics in Circuits and Systems, 10*(2), 149-163.

[2] Ullah, Z., Al-Turjman, F., Mostarda, L., & Gagliardi, R. (2020). Applications of artificial intelligence and machine learning in smart cities. *Computer Communications, 154*, 313-323.

[3] Xu, X., Li, H., Xu, W., Liu, Z., Yao, L., & Dai, F. (2021). Artificial intelligence for edge service optimization in internet of vehicles: A survey. *Tsinghua Science and Technology, 27*(2), 270-287.

[4] Deng, S., Zhao, H., Fang, W., Yin, J., Dustdar, S., & Zomaya, A. Y. (2020). Edge intelligence: The confluence of edge computing and artificial intelligence. *IEEE Internet of Things Journal, 7*(8), 7457-7469.

[5] Chen, H., Li, L., & Chen, Y. (2021). Explore success factors that impact artificial intelligence adoption on telecom industry in China. *Journal of Management Analytics, 8*(1), 36-68.

[6] Nguyen, H. X., Trestian, R., To, D., & Tatipamula, M. (2021). Digital twin for 5G and beyond. *IEEE Communications Magazine, 59*(2), 10-15.

[7] Gacanin, H., & Di Renzo, M. (2020). Wireless 2.0: Toward an intelligent radio environment empowered by reconfigurable meta-surfaces and artificial intelligence. *IEEE Vehicular Technology Magazine, 15*(4), 74-82.

[8] Lv, Z., Singh, A. K., & Li, J. (2021). Deep learning for security problems in 5G heterogeneous networks. *IEEE Network, 35*(2), 67-73.

[9] Ahmadzadeh, S., Parr, G., & Zhao, W. (2021). A review on communication aspects of demand response management for future 5G IoT-based smart grids. *IEEE Access, 9*, 77555-77571.

[10] Mohjazi, L., Zoha, A., Bariah, L., Muhaidat, S., Sofotasios, P. C., Imran, M. A., & Dobre, O. A. (2020). An outlook on the interplay of artificial intelligence and software-defined metasurfaces: An overview of opportunities and limitations. *IEEE Vehicular Technology Magazine, 15*(4), 62-73.

[11] Qadir, Z., Ullah, F., Munawar, H. S., & Al-Turjman, F. (2021). Addressing disasters in smart cities through UAVs path planning and 5G communications: A systematic review. *Computer Communications, 168,* 114-135.

[12] Jiang, D., Wang, Z., Wang, W., Lv, Z., & Choo, K. K. R. (2021). AI-assisted energy-efficient and intelligent routing for reconfigurable wireless networks. *IEEE Transactions on Network Science and Engineering, 9*(1), 78-88.

[13] Cui, Z., Zhao, Y., Cao, Y., Cai, X., Zhang, W., & Chen, J. (2021). Malicious code detection under 5G HetNets based on a multi-objective RBM model. *IEEE Network, 35*(2), 82-87.

[14] Huang, Y., Liu, S., Zhang, C., You, X., & Wu, H. (2021). True-data testbed for 5G/B5G intelligent network. *Intelligent and Converged Networks, 2*(2), 133-149.

[15] Zhai, Y., Bao, T., Zhu, L., Shen, M., Du, X., & Guizani, M. (2020). Toward reinforcement-learning-based service deployment of 5G mobile edge computing with request-aware scheduling. *IEEE Wireless Communications, 27*(1), 84-91.

[16] Liu, R. (2020). Development and implementation of integrated curriculum in vocational colleges. *Barnard Education Review, 1*(1), 60-69.

[17] Cao, B., Sun, Z., Zhang, J., & Gu, Y. (2021). Resource allocation in 5G IoV architecture based on SDN and fog-cloud computing. *IEEE Transactions on Intelligent Transportation Systems, 22*(6), 3832-3840.

[18] Zhang, S., Li, M., Jian, M., Zhao, Y., & Gao, F. (2021). AIRIS: Artificial intelligence enhanced signal processing in reconfigurable intelligent surface communications. *China Communications, 18*(7), 158-171.