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Evaluation Model of Teachers' Informationized Teaching Ability based on System Dynamics Model

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Abstract

Based on the tools of complex scientific management system thinking and the principles and methods of system dynamics, this paper constructs an evolutionary system dynamics model for the evaluation of University Teachers' informationized teaching ability. In the optimization model, the comprehensive weight of key factors is obtained based on THEIL index; The weight and related parameters are substituted into the system. Taking a university A as an example, the changing trend of teachers' informationized teaching ability under different policy parameters is simulated, and the countermeasures to improve informationized teaching ability are put forward.

Keywords

Exploring Graph; Urban Water Resources; Sustainable Utilization; Factor Analysis.

1. Introduction

There are few researches on teachers' informationized teaching ability at home and abroad. In recent years, with the deepening of research work, the improvement of teachers' quality, which is mainly based on teachers' informationized teaching ability, is of great importance to education and teaching. There are many researches on teacher professional development, which have become a hot topic in the field of education theory at home and abroad in terms of teacher knowledge structure, teacher development stage, teacher information literacy and practical knowledge. Teachers' informationized teaching ability, what kind of professional ability the information education and teaching need teachers to possess and how to develop this professional ability are becoming a hot research issue in the field of teacher development.

In this thesis, the author's university as the research object, based on the complex scientific management system thinking tool -- exploration map, to build a preliminary system model based on college teachers' informationized teaching ability assessment; On the basis of the further study of teachers, students, teaching management, the informationized teaching management present situation of each subsystem, the evolution law and the feedback influence between each subsystem, action mechanism, construction of college teachers teaching ability system dynamics model, and through the regulation of parameters simulation under different policy parameters teachers change trend of the informationized teaching ability, And put forward the countermeasures to improve the informationized teaching ability.

2. A Preliminary System Model of College Teachers' Information-based Teaching Ability based on Exploratory Graph

Exploration map is a map created by researchers from the perspective of a broader environment through the investigation of the overall environment and based on their own experience, knowledge and information as well as creative imagination by using the thinking mode of complex scientific management system. The formation of this map is a process of collective creation, which shows all the factors that will or may affect the research topic.

ISSN: 1813-4890

The steps of forming the exploration chart of college teachers' informationized teaching ability evaluation are as follows:

First, convene a meeting of 6-8 experts related to the research topic to discuss the issues to be decided; Second, the host asked questions according to the decision, and the experts thought; Third, experts put forward their views according to their backgrounds and experiences, and the host drew many ellipses on the paper to show the factors affecting the theme; Fourthly, after the experts have fully expressed, visual analysis is carried out on the ellipse representation area. From the whole point of view, the redundant and the same factors are removed and integrated, and the factors of the same type are connected with the line, and then the various factors are circled by irregular means, and the ellipse of the deleted factors is marked. Fifthly, each random circle is named by an ellipse. Sixth, two-way arrows are used to represent the interactive relationship between factors, and the interactive exploration map of classification is obtained. After sorting out, the exploration chart of the evaluation of college teachers' informationized teaching ability is formed, which is also the preliminary system model of the evaluation of college teachers' informationized teaching ability. Finally, the evaluation index system of college teachers' informationized teaching ability is formed, as shown in Figure 1.

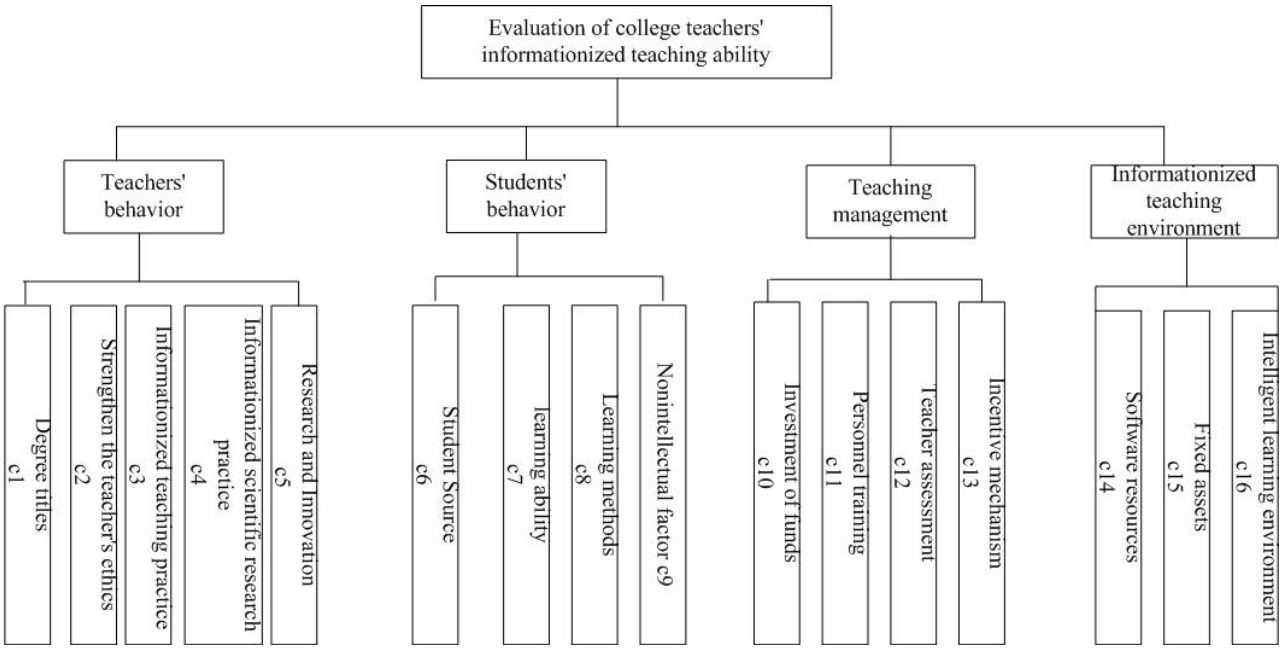

Figure 1. Evaluation index system of informatization teaching ability of College Teachers

3. Construction of Simulation Model for the Evolution of College Teachers' Informatization Teaching Ability based on System Dynamics

3.1. Research Methods--System Dynamics Model

System dynamics model is a computer simulation model system which is used to study the dynamic behavior of complex system under the guidance of the theory and method of system dynamics. Vensim simulation software is one of the most commonly used system dynamics simulation software in the world.

The general process of system dynamics modeling is: clarifying the problem; formulating the structural assumptions of the system; starting from the assumptions, designing the causal relationship diagram and flow diagram of the system, and listing the equations; defining parameters, model simulation, testing or modifying the model (parameters), strategic analysis and decision-making.

ISSN: 1813-4890

3.2. Simulation Research Hypothesis and System Boundary Setting

Build steps according to the simulation model, we need the boundaries of designated models, the model system of the line is really just an abstract, the outline of the purpose of modeling must be considered by the circle into the system, and will not consider other problems, system boundary internal should contain involves the concept of has an important relationship with the research questions and variables. Therefore, the system model analyzed in the previous paper is combined with the actual situation of the research object and the purpose of constructing supply-demand optimization simulation model. According to the requirements of SD simulation model, key factors are selected to study the effect intensity of different factors on their respective levels, so as to dynamically predict the evolution of teachers' informationized teaching ability.

The basic hypothesis of this study are as follows:

(1) the evolution of university teachers' informationized technology teaching ability evaluation system of the subsystems of related factors from teachers' behavior - the student behavior - teaching management subsystem - four aspects, the informationized teaching environment subsystem considers only after investigation and research, the important factors that does not consider other minor factors;

(2) Resource variables such as teaching expenditure investment rate, fixed asset investment rate and resource investment rate will change with time, but the change rate is slow. Therefore, they are input into the model at a fixed proportion in the form of constant, and do not change during the simulation, but only change when the policy changes the regulation model;

(3) Related variables in the subsystem of informationized teaching environment are only calculated as auxiliary variables, not as state variables.

3.3. Evolution Simulation Flow Diagram Model of College Teachers' Informationized Teaching Ability Evaluation

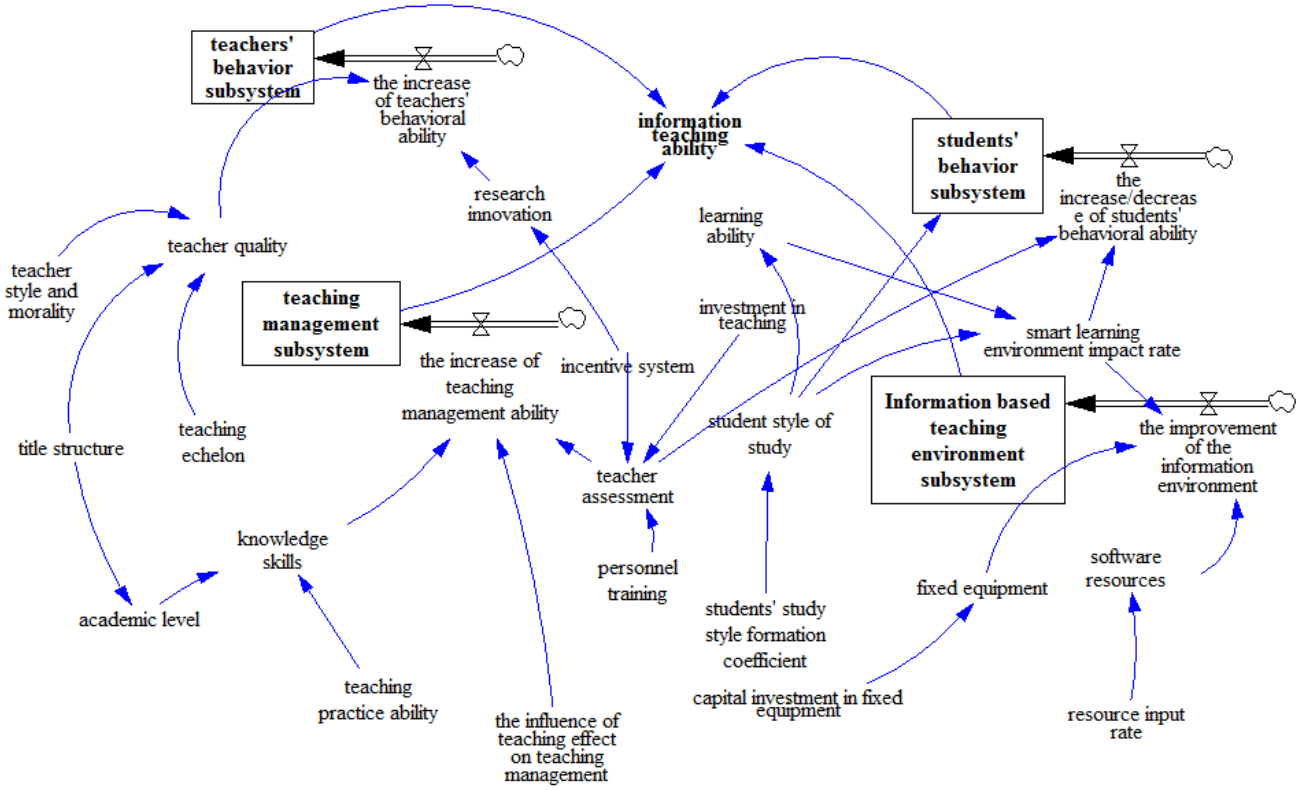

Figure 2. Dynamic model of college teachers' information-based teaching ability evaluation system

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This paper uses the flow rate basic tree modeling method, first divides the system into different subsystems, starts with teachers, students, teaching management, information environment and their interaction and mutual constraints in the system, and constitutes four subsystems respectively. Simulate the flow graph model, and then use the matrix, feedback loop and other related theories to comprehensively integrate the various subsystems to generate a dynamic model of the evolution simulation system for the evaluation of college teachers' informationized teaching ability.

Firstly, the simulation flow graph model of the four subsystems is constructed. Based on the feedback influence and action mechanism between the subsystems, the simulation flow graph model of the four subsystems is synthesized, and the dynamic model of the evolutionary system for evaluating the informationized teaching ability of college teachers is constructed, as shown in Figure 2.

3.4. Selection of Simulation Variables and Establishment of System Dynamics Equation

According to the figure above, the main variables in the model are as follows:

There are four level variables: teachers' behavior subsystem, students' behavior subsystem, teaching management subsystem and information-based teaching environment subsystem.

There are four rate variables: the increase/decrease of teachers' behavioral ability, the increase/decrease of students' behavioral ability, the increase/decrease of teaching management ability, and the improvement/decrease of information-based teaching environment.

Others are auxiliary variables and constants.

3.5. Simulation Parameter Determination and Model Testing

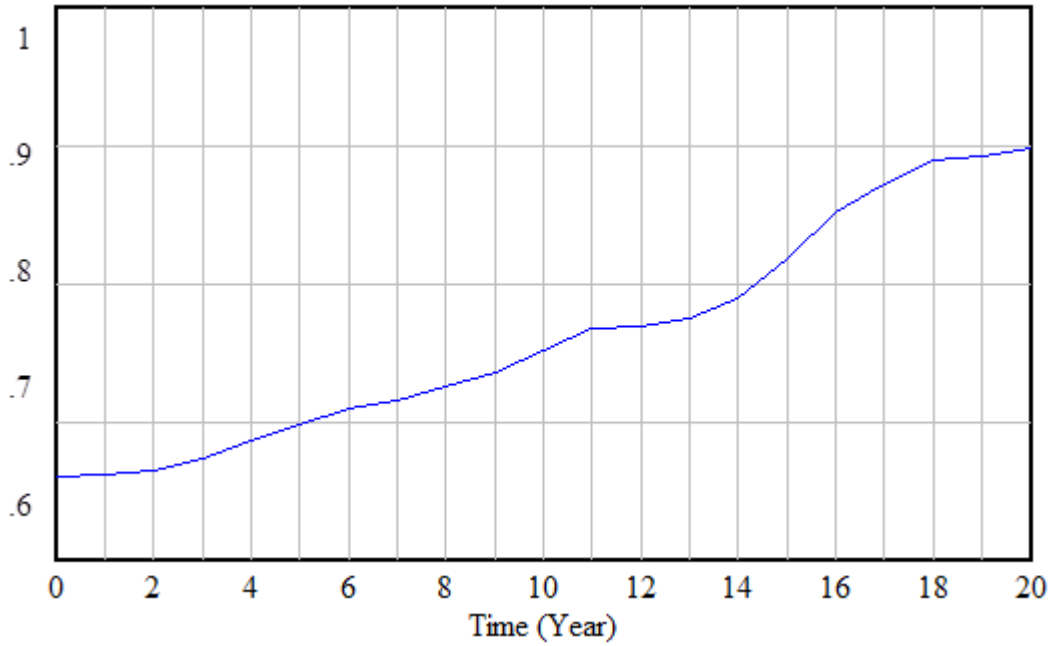

Figure 3. Evolution trend chart of informationized teaching ability

The determination of parameters in the model is the precise definition of the relationship between the relevant variables, which is the basis of model application and simulation. Variable assignment first needs to collect a wide range of practical data, and then use related mathematical methods to deal with, to meet the needs of the system dynamics variable value, and finally determine the parameter value, mainly involving the determination of constant

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value, the determination of the initial value of the level variable, the determination of the weight of simulation parameters. The determination of the weight involves several aspects of the weight, first: teacher behavior subsystem, student behavior subsystem, teaching management subsystem, information teaching environment subsystem in the whole college teacher informationized teaching ability evaluation system proportion; Second, determine the proportion of each influencing factor in the subsystem of teacher's behavior, student's behavior, teaching management and informationized teaching environment; Third: if there are more than one subordinate factor in the partial influence factor, the proportion of each factor should be determined. In this paper, THEIL index was used to obtain the comprehensive weight of key factors.

4. Simulation Scheme and Simulation Result Analysis

4.1. Simulation Operation

The model is used to evaluate and simulate the teaching quality of a university A. The university was formed by the merger of three universities in 2002. Therefore, the time boundary of the model simulation is 20 years from 2002 to 2022, and the operation step is 1 year. Substitute the set initial value into the equation, click run a simulation and the system enters the simulation state, click "Information Teaching Capability", and then click the Graph button to form a simulation running curve. From the figure, we can clearly see the evolution and development trend of teachers' informationized teaching ability, as shown in Figure 3. The results show that the school's teaching quality has gradually increased, and the growth rate is first slow and then fast, indicating that in recent years, due to the policies of the Ministry of Education, the school has responded to the call, especially in 2020. An unprecedented large-scale online education experiment. In the process, the recognition of information technology has been improved. By 2022, the information technology originally grown online has become an indispensable part of offline teaching.

4.2. Program Selection for Regulating Variable Changes

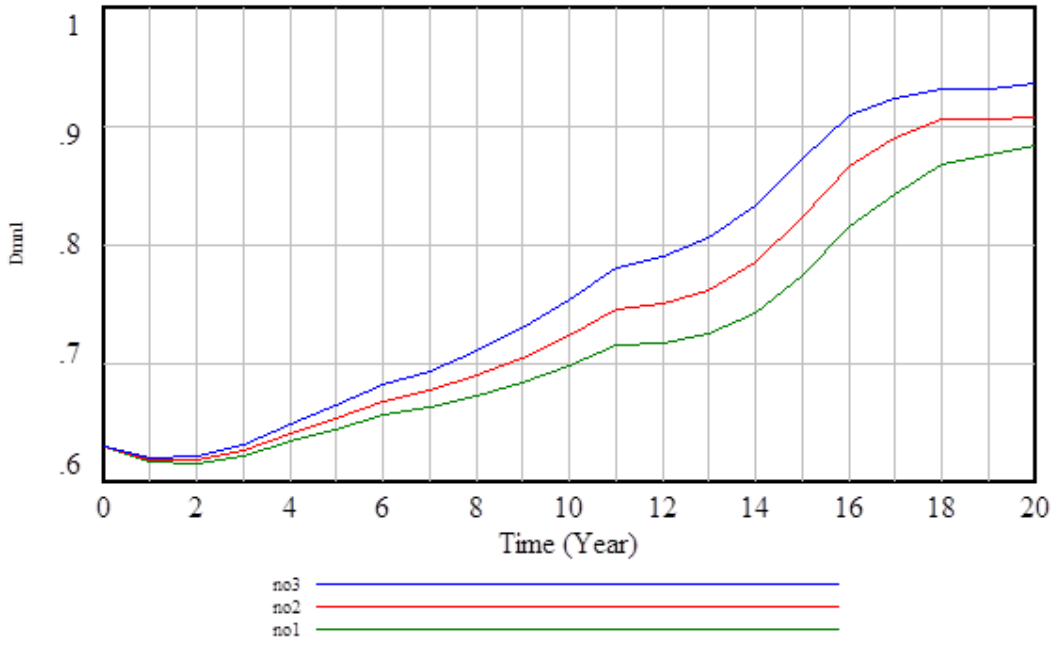

Figure 4. Trend of the evolution plan of college teachers' informationized teaching ability from 2002 to 2022

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Under different policy conditions, the operating status of the evolution system of college teachers' informationized teaching ability is different. In order to obtain strategies for improving teachers' informationized teaching ability through the parameter control model, the models were simulated for two measures: strengthening the construction of the style of study (No2) and increasing the investment in informatization fixed equipment and software resources (No3), and analyzed the effect of different policy parameters on information According to the influence of teaching ability, the optimization level of the scheme is set to 0.9, and the simulation results are shown in Figure 4.

The current plan has not yet reached the optimal level in the 20th year, while the strengthening study style construction plan (2020) has reached the optimal level target, while the plan to increase investment in informatization fixed equipment and software resources has reached the optimal level in the 16th year (2018).It is two years earlier than the plan to strengthen the school atmosphere.

5. Strategies to Improve the Informatization Teaching Ability

The evolution system dynamics model for the evaluation of University Teachers' informationized teaching ability can not only evaluate the informationized teaching ability, but also predict the development and evolution trend of informationized teaching ability, providing decision support for improving teachers' informationized teaching ability.

To improve teachers' information-based teaching ability, we can strengthen the construction of study style, improve teaching management, and increase the investment of fixed equipment and software resources in the information-based teaching environment. In the construction of study style, we should strengthen the construction of students' study style and strengthen the guidance of teachers' morality. In terms of teaching management, we should formulate a reasonable teaching plan, improve the teacher assessment system, pay attention to the introduction of high-level teachers, and improve the quality of teachers in terms of quantity. At the same time, we should pay attention to the development of teachers' industry, improve teachers' professional ability of informatization, and improve the quality of teachers from the quality. We will increase investment in information-based solid resources to ensure a smooth information-based environment.

6. Conclusion

Based on the complex scientific management theory, this paper constructs a preliminary system model for the evaluation of college teachers' informationized teaching ability. On this basis, taking the university of the author as the research object, based on the system dynamics theory, this paper constructs a system dynamics model for the evaluation of college teachers' informationized teaching ability. In this model, the THeil index is used to determine the weight of parameters, and then the changing trend of teachers' informationized teaching ability under different policy parameters is simulated, and the countermeasures for improving informationized teaching ability are put forward.

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