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Innovation in Education Management and Talent Cultivation Models for New Quality Productivity: Based on Data Driven and Intelligent Teaching Management

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Abstract: The rapid development of information technology and the emergence of new quality productivity, the education management and talent cultivation models that meet the needs of modern society have to be innovated. Data-driven education management combined with intelligence, is an important innovation direction that improves the utilization of teaching resources, optimizes the teaching process, and provides customized learning support for students by leveraging data analysis and intelligent algorithms, has become an important innovation direction. This paper elaborated the key concepts and principles of data-driven, intelligent-based teaching management mode, and analyzed the realization and roles of data-driven, intelligent-based teaching management mode in terms of education management, and talent cultivation. The application of intelligent teaching management model based on data has achieved positive results. Teachers have given a positive evaluation of the model proposing that it can improve the utilization efficiency of teaching resources, optimize the teaching process, and personalize the support of student learning.

Keywords: Instructional Management; Data-Driven; New Quality Productivity; Talent Development.

1. Introduction

The rapid growth of information technology and the emergence of new high-quality productivity have brought new opportunities and challenges to the field of education management and talent cultivation. The traditional teaching management model has been unable to meet the need for talents in modern society. Therefore, it is necessary to develop innovative management models that are suitable for the current educational context. In this respect, management studies that are data oriented and intelligent based can be a research direction worthy of attention.

The project is carried out with the focus on the research into data-driven, AI-based teaching management model, with a focus on the model, in general, its research and application on education and talent development, meanwhile, the paper provides a conclusion and summaries of the current situation and trend in AI-based management and evaluation. At the end of literature review and theoretical study, the paper identifies model's core principle and core mechanism as the outcome of the research, as well as what can be conducted in the education sector, how to conduct the empirical part, and what can the implication in practice be. This empirical part discusses effectuation of the model on education and how this model works on the talent management and the impact on the cultivation of new students. Meanwhile, the paper conducts surveys and interviews on the teachers about their ideas and feedback about these model itself, and to ensure the understanding of how the model will be conducted in theory.

The structure of this paper is as follows: first, we will introduce the theoretical foundation and background knowledge of the data-driven and intelligent-based teaching management model. Then, we will explore in detail the ways and effects of the model's application in education management and talent cultivation. Then, we will analyze teachers' evaluations and opinions on the model through empirical research, so as to gain insight into its practical application. Finally, we will summarize the results of the study and present our outlook on the future development of the data-driven and intelligent-based teaching management model.

2. Related Work

Many people have conducted research on education management. In response to the problem that the teaching management of multiple experimental courses in the college cannot be achieved on the same digital platform for experimental teaching management, Fan Shuyuan conducted a classification study by researching the teaching management models currently used in open laboratory management in universities, and developed a digital platform for experimental teaching management aimed at multiple open management models [1]. Liu Xiaoping analyzed the current situation and existing problems of teaching management in medical colleges, and proposed targeted teaching management methods to effectively improve teaching quality, aiming to provide a basis for the reform of teaching management models in medical colleges [2]. Gao Jianfang introduced the ideas and measures of teaching

reform of higher vocational education in the context of information technology, and proposed the use of information technology such as Internet of Things, cloud computing, big data, artificial intelligence and other information technology to build a smart campus, realize the management of education and teaching and teaching reform, and improve the quality of talent training [3]. Zhang Guangbin designed and developed the experimental teaching management system based on B/S architecture to promote the deep integration of information technology and experimental teaching, and effectively run the open experimental teaching and management mode [4]. Li Na mainly explained the significance and connotation of teaching management in colleges and universities, analyzed and discussed the main problems found in teaching management, and explored the paths and methods of teaching management in colleges and universities to support the scientific development of teaching management [5]. Карінцева О analyzed the peculiarities of the method of designing subject information and educational environments using Google services [6]. Shaturaev J examined the fact that the development of education and democratization continued to show a mutually reinforcing relationship [7]. McGarr O explored the growing use of virtual simulations in pre-service teacher education, particularly in developing pre-service teachers' behavioral and classroom management skills [8]. The purpose of Shank MK's research was to describe how teachers developed a sense of unpreparedness in classroom management, including recommendations for teachers and their mentors [9]. Pei Z designed and developed a digital music course teaching system based on computer-aided teaching technology [10]. This article aims to study the application and effectiveness of data-driven and intelligent teaching management models in educational management and talent cultivation.

3. Method

3.1. Sources and Acquisition of Educational Data

In the field of education, data can be obtained from multiple sources, including school management systems, student information systems, online learning platforms, and teaching assessment systems. These systems record multi-dimensional data such as students' academic performance, exams, attendance records, subject preferences, and learning behaviors. In addition, richer educational data can be obtained through questionnaires, student feedback, and teacher evaluation [11-12]. Supposing a school has a student information system and an online learning platform. The student information system contains information such as student personal information, course selection, and academic performance. The e-learning platform also records students' online learning behaviors in each subject such as watching video clips, completing online exercises, taking part in online discussions, and so on. The student information system and the e-learning platform can make educational data accessible, including academic performance, students' preferences for subjects, and the learning progress, preferences, behaviors of students. Table 1 demonstrates the records of students' academic performance:

Table 1. Record of accomplishments

Student ID	Name	Math Score	English Score	Physics Score	Chemistry Score
001	Zhang	85	90	78	92
002	Li	92	88	95	87
003	Wang	78	82	80	79
004	Zhao	88	85	90	92

In addition to academic performance, education data can be used for more comprehensive analysis and assessment. For example, the overall performance of each student can be calculated and ranked. Table 2 shows a ranking table:

Table 2. Ranking

Ranking	Name	Student ID	Overall Score
1	Li	002	90.5
2	Zhao	004	88.75
3	Zhang	001	86.25
4	Wang	003	79.75

By using the source and access to educational data, educational administrators and teachers can have access to academic performance data, academic subject preference and learning behavior data of students so that it can be further analyzed and applied in teaching management and innovation of talent cultivation model.

3.2. Data Analysis and Mining

Data analysis and data mining are significant approaches to using sophisticated data technologies and machine learning algorithms to identify potential information and patterns in educational data [13-14] that support educational decision-making and optimization of teaching in a data-informed and intelligence-informed instructional management. Educational institutions and teachers can benefit from data analysis and mining because they provide insights into learners' learning behaviors, academic achievements, subject preferences, and so on, and then they can adjust teaching strategies or personalize learning programs.

Data analysis and mining applications are commonly utilized in the teaching of management. By examining the teaching data of students, problems, difficulties, and personalized learning guidance can be inferred. For instance, the past teaching data of students can be used to realize that the learning difficulty of students lies in a particular mathematic concept. Therefore, students can be given corresponding learning guidance materials and exercises according to the concept of the mathematic. It can obtain the mean and standard deviation of student scores from the dataset, this can help educators understand the overall teaching achievement and performance distribution. At the same time, education administrators and teachers can be given a better idea of the teaching achievement, student overall performance and how teaching and learning effect the final student data [15-16]. The formula is given below:

$$Mean = \frac{Sum\ of\ score}{Number\ of\ students} \quad (1)$$

$$S = \sqrt{\frac{(Score - Mean)^2}{Number\ of\ students}} \quad (2)$$

The mean is represented as M for average while S represents standard. Data analysis and data mining can be utilized by teachers in order to evaluate the effectiveness of their teaching as well as to identify areas for improving upon. It is possible to evaluate the effectiveness of teaching patterns and to identify areas for improvement. For example, teachers can use data mining to identify the common mistakes students make in math assignments and guide in what elements the teachers need to aim at. Education administrators can use data analysis and mining to make decisions and optimize resource allocation. By scrutinizing the school data, teacher data, and curriculum files, educational stakeholders can identify efficiencies and potential logjams concerning resource utilization and make an informed decision about how to optimally allocate resources towards strategic objectives. Data analysis can tell administrations which courses need to seek out more teachers to meet the needs of the students, or what types of subjects need more supplementary learning resources like textbooks.

3.3. Optimization of Teaching Resources Management

Schools have limited teaching resources, including classrooms, teaching materials, laboratory equipment, etc., while the demand for teaching is growing. In order to better meet students' learning needs and improve teaching effectiveness, a data-driven approach was undertaken to optimize teaching resource management [17-18]. Teaching and learning data over a period of time were collected, including students' course selection, classroom usage, and textbook borrowing records. Using these data, the school set up a teaching resource management system and applied data analysis and mining techniques to extract useful information. It was perceived through an analysis of students' course selection and classroom use that some students' course selection was too high while classrooms' utilized capacity was low, causing classroom overcrowding and a disordered learning environment to students. To make efficient use of resources, the university used a linear optimization model to determine an optimal course scheduling plan based on course credit, number of students taking the course, and classroom capacity. The plan was based on constraints for classroom capacity and students' learning and was carried out and modified to maximize classroom use and student learning quality.

3.4. Analysis of Student Learning Behavior

Through analyzing student learning behavior models, schools can identify students' learning habits, preferences, and signs of learning adversity. For example, student learning activity logs and online interaction data, schools can identify which students tend to use certain learning tools or resources, or which students tend to study at certain time of the day. This information will enable schools to provide personalized learning support (e.g., recommending course schedules according to individual learning time slots or recommending appropriate learning resources). Identifying learning difficulties and potential learning risks through student learning behavior models. Through analyzing the students' assignments submitted, learning progressions, and performance grades, schools can identify those students with slow learning progressions or learning difficulties. This will enable schools to provide early intervention for these students and provide support in overcoming challenges and improving student learning results through one-to-one academic tutoring, provision of supplementary materials, or participate in specific learning groups.

By using models of student learning behavior, instructional strategies could be enhanced, and the allocation of resources can also be improved [19-20]. By analyzing students' response to different teaching and learning processes, schools can learn the more appropriate teaching methods, for the differing students. This can help to adjust the methods of teaching by teachers to suit the students' real learning needs, improve the effectiveness of teaching. Schools can also optimize the allocation of teaching resources, with the model of students' learning behaviors, such as rational allocation of classrooms, library equipment and learning materials in the study for the student learning preferences and requirements, and provide better learning environments and resource support.

4. Results and Discussion

4.1. Experiment Description

The experiment aims to verify the teaching management function with regards to quality, evaluate the effectiveness of the data-driven and intelligence-based teaching management system, a scientific experiment to evaluate the benefits and challenges the method has, find the feasibility and advantages of the methods, and provide the concurrent decision makers of education an instructional supervision strategy by assessing the effectiveness and implementation of data-driven and intelligence teaching management. In order to ensure the investigation or mnemonic of the study, we built a scientific experiment based on our research intentions. We set up an experiment environment, which includes classroom equipment, learning platform and related software systems, to create the internal environment of the experiment. The establishment of the science experiment and classroom is the initial foundation for the experiment operation and the data collection. In order to compare the differences between data-driven and intelligent teaching management methods based on data and traditional teaching management methods, we need to set up an experimental group and a control group. The experimental group of classes applying the new teaching management method for one semester will be recorded as Class 1, while the control group will continue to be taught using the traditional method, recorded as Class 2, with 25 students in each class, which will ensure the reliability and accuracy of the experimental results. Comprehensive grades, utilization of teaching resources, and teacher satisfaction were chosen as evaluation indicators, and random grouping was used to ensure statistical balance between the experimental and control groups.

4.2. Experimental Results

The students' final grades were evaluated comprehensively after one semester and graded with a total score out of 100, and the results are shown in Figure 1:

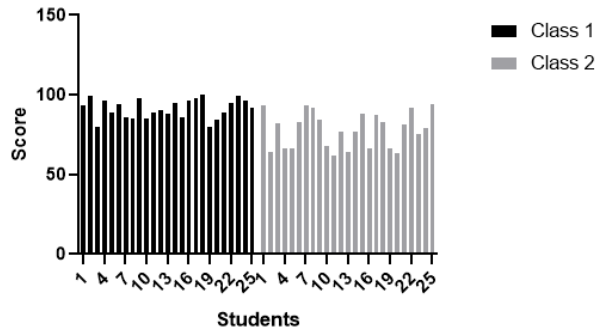

Figure 1. Combined results

After a semester-long study, the two groups showed different results in terms of composite scores, with Class 1 having the highest composite score of 100, the lowest of 80, and an average of 91.28. The control group had the highest composite score of 94, the lowest of 62, and an average of 77.8. The results of Class 1 were much higher than those of Class 2, which indicates that the educational management of the methodology of this paper has played an obvious effect that can improve students' performance.

Increased utilization of teaching resources is usually associated with increased teaching efficiency. When teaching resources are effectively utilized, teachers can carry out their teaching activities better and students can access the resources and learn more fully. This contributes to improved teaching effectiveness and learning outcomes, resulting in better utilization of students' learning time. Figure 2 shows the comparison:

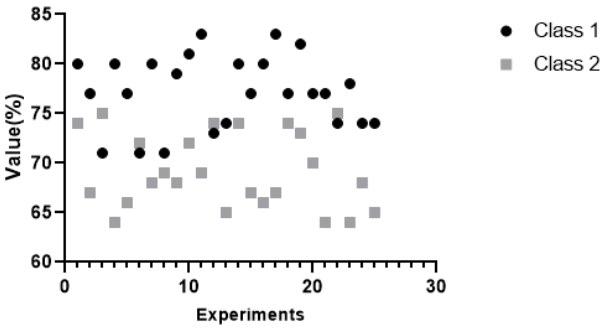

Figure 2. Utilization of teaching resources

In the above index test, the resource utilization rate of class 1 could reach a maximum of 83% and a minimum of 71%. Class 2 performed worse, with a maximum resource utilization rate of 75% and a minimum of 64%. The reason why the method in this paper has a higher resource utilization rate is that the data-driven and intelligent teaching management method based on data analysis and intelligent algorithms utilizes technologies such as data analysis and intelligent algorithms, which are able to more accurately assess the degree of matching between students' learning needs and teaching resources.

Figure 3 shows the Teacher Satisfaction Measure, a questionnaire was administered to 30 teachers to investigate their satisfaction with data-driven and intelligent based instructional management and the level of satisfaction was categorized as I,II,III,IV. Among them, I is the most satisfied, IV is the least satisfied, and Figure 3 shows the results:

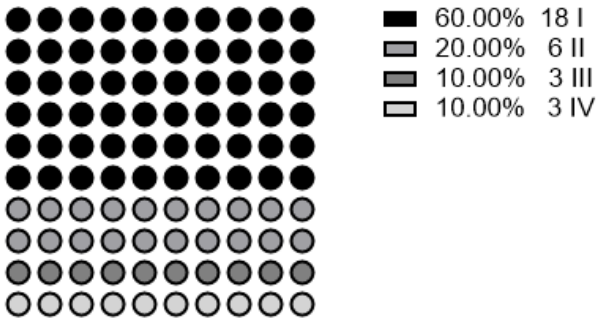

Figure 3. Satisfaction survey

In the satisfaction survey, 18 teachers gave an I rating, 6 gave an II rating, 3 gave an III rating, and 3 gave an IV rating. Overall, 80% of teachers gave satisfactory evaluations. This includes improving teaching effectiveness, improving student academic performance, and providing personalized support for the learning process. The satisfaction of teachers reflects their recognition of the positive changes and improvements brought about by this method.

4.3. Shortcomings

It is essential to think critically about how to apply a data-driven and smart instructional management model that is based on data, tech infrastructure and informational support to create good instructional practices. Some schools or district education systems do not have sufficient resources to support this level of innovation. Teachers need to have adequate training and support to use these data-informed management models. They need to have the ability to access data through the use of data analytics dashboards and understand how to use data or smart algorithms in their instructional practices, making sure that ongoing teacher engagement and competency are the biggest barriers.

5. Conclusion

The data-driven and intelligent teaching management mode mentioned above can improve the efficiency of using teaching resources and prevent waste of resources and unnecessary idleness of resources. It can directly provide students with the most suitable teaching resources according to their actual learning needs, teachers can ensure the maximum utilization of teaching resources, significantly improve the efficiency of teaching, and enhance the teaching effect and student learning effectiveness. If better use of the teaching resources is made, more and better learning opportunities will be made available to students. The model optimizes the teaching process by improving teaching efficiency, quality and students' learning effectiveness. By real-time monitoring and analyzing the learning data and teaching process, teachers can understand students' learning, progress in real-time, and improve teaching strategies by adjusting and optimizing the teaching based on this.

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