

Application Scenarios and Dynamic Mechanism of Data Based Decision Making

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Abstract: Adequate information is crucial for decision-making. In the digital age, the digital transformation of education is reshaping the daily practice and meaning generation in the field of education and teaching. The value advantage of "data-driven" lies more in making decisions more comprehensive, refined, and efficient, promoting teachers to break away from the "experience based" value judgment model in teaching decisions, thereby assisting in continuous improvement of teaching and learning, and promoting the achievement of high-quality teaching goals in the new era. The effective implementation of DBDM requires improving teacher data literacy, strengthening research on data-driven decision-making models, promoting multi-source heterogeneous data fusion applications based on scenario requirements, and creating a culture of data usage.

Keywords: Data based decision making; Value advantage; Application scenarios; dynamic mechanism;

1 Introduction

The integration and application of information technology in education and teaching has not only changed the paradigm of teaching and learning, forming intelligent applications such as blended learning, intelligent assessment, and smart learning partners, but also brought about the digitization of teaching and learning elements in universities, resulting in a large amount of structured and unstructured data precipitation, triggering the integration and development of learning analysis, digital mining, and other technologies with teaching. These educational and teaching data are becoming important production factors for universities at present and in the future. Data based decision making (hereinafter referred to as DBDM) is a new development in evidence-based culture for teaching decision-making in the data age. It is an iterative decision-making process that drives the design, development, application, management, and evaluation of data-driven teaching processes and resources. The improvement of teaching quality in the digital age requires understanding the value advantages of data-driven teaching decision-making, constructing application scenarios, exploring driving mechanisms, and fully leveraging the potential of data in improving education and teaching quality.

2 The value advantage of the DBDM

The emergence of DBDM not only compensates for the shortcomings of traditional experiential teaching decision-making, but also further supplements and develops the concept of existing teaching decision-making. US Secretary of Education Arne Duncan pointed out, "I firmly believe in the power of data-driven teaching decisions. Data provides a roadmap for improving teaching, and it can tell teachers the progress, direction, and path of teaching. The use of data by teachers in the digital age is no longer an option, but a necessity."^[1]

2.1 Data-driven teaching decisions are more sufficient

Under the traditional teaching decision-making paradigm, teachers generally follow the thinking mode of "observing phenomena finding problems analyzing causes and making countermeasures", and mainly rely on experience to make teaching decisions. Digital age, teaching decision increased the "what" thorough fastidious, pay attention to explore the law behind the complicated teaching phenomenon exploration and trend prediction, is more focused on the specific problems of teaching practice, through the "data team" scientific data mining, through the horizontal vertical comparison, analysis and evaluation, based on the "collective+data+experience" to make scientific and effective decisions;^[2] It may also be that has never been considered before through different types of "big data" interlinks without pre-defined assumptions And for educational purposes that have not yet been considered.

2.2 Data-driven teaching decisions are more refined

Under the traditional teaching decision-making paradigm, teachers mostly focus on the overall level of students or the common characteristics of several students. It is difficult for teachers to make personalized decisions on the basis of a comprehensive understanding of the detailed situation of each student. In the digital age, intelligent learning platform can accurately record the residence time of students' learning resources, answer accuracy and rumination ratio data in the teaching process, which can not only push targeted learning resources through accurate and effective diagnostic evaluation, but also help students to understand their own learning status more clearly; not only can help teachers to accurately describe the learning process and cognitive experience of each student, and read each specific and vivid individual students, but also can improve the ability of teachers to provide students with real personalized learning programs. DBDM can become a kind of "sample = all" decision, not only broke the traditional classroom teachers single teaching situation, and combines class, connect the online, not only improve the classroom teaching efficiency, and let students have more participatory, inquiry, experiential and collaborative learning experience, not only boost the construction of active learning system, and promote the symbiotic teaching new ecological reconstruction.

2.3 Data-driven teaching decision-making is more efficient

Traditional teaching decisions rely too much on experience, and have strong subjectivity and feedback relatively lag behind. Today, when the intelligent learning platform and the mobile teaching APP have been widely used, Some courses monitor online learning progress and use video placement to assess key knowledge points, To urge students to increase their investment in learning; Some course applications carry out online check-in, quick answer, field test, real-time feedback, etc., Improve the interest and participation of the course; Some courses work

together online through student groups, participate in discussions and show results in student squares or forums, To develop online companion learning; In addition, courses use information technology to innovate teaching evaluation methods while providing real-time feedback support services for students' learning process, With the help of the course quality monitoring system, "portrait" of "portrait" of "learning", Provide the basis for the continuous improvement of teaching methods. These applications not only become more and more timely and accurate in teaching design, teaching organization and management, academic guidance and other evaluations, but also promote the reconstruction of classroom teaching process and teaching ecology. The uniform traditional classroom is changing to an intelligent classroom with all-direction interaction and accurate feedback^[3] and Research suggests that data-based decision-making helps to improve student learning and performance.^[4]

3 Scenario conception of Data based decision making

3.1 The value goal of DBDM: the continuous improvement of teaching and learning

The value of the data lies in its use. DBDM is to redefine and define teaching with digital thinking, promote the internal governance of teaching quality by digitalization, and also be the pattern of the development of teaching quality in the digital age. But the use of data does not start with data, data is only one of the tools that can be used in the process of teaching improvement. The use of data needs to start with certain goals that are often related to improving the quality of teaching and should be specific and measurable. For example, at the student and classroom levels, they may be related to students' learning goals. At the school level, they may be related to certain comprehensive achievement goals involving the entire school. In addition, the goals may also evolve and change over time.

Previous studies on the setting of DBDM goals, which is mainly divided into three target modules: accountability goals, school development goals and teaching goals.^{[5][6]} Accountability goals are more focused on using the results of the evaluation to demonstrate progress to school evaluation agencies and parents, and school development goals involve monitoring and improving the functions of the school, which may involve policy making, curriculum development, and professional development planning for school staff. Teaching objectives and improve the quality of teaching, not only can be used to set learning goals, tracking the progress of students, also include students feedback about the learning process, is not only for the scientific decision-making itself, more fundamental is to meet the needs of students grow, the needs of personalized learning, learn weak group accurate support needs and the needs of the optimal allocation of resources.

Important stakeholders in the goal-setting process are the school leaders. A key task of school leaders is to ensure that school improvement goals are set together, not only to balance the goals of different stakeholders with the school culture, vision, mission and values, but also to translate policies into specific goals that they think schools should strive to achieve, to prioritize certain goals, can affect the data to be collected, can decide the location and way of decision making, and proposed improvement actions are actually implemented and evaluated. Attitudes and behaviors of school leaders can also influence faculty attitudes and behaviors, including the process of teacher involvement in goals, willingness to commit to setting goals and the degree of involvement in data use.^[7]

Data-driven teaching decision, is to absorb evidence-based management and education ecological information management concept, to promote teaching and learning continuous improvement as the goal, through the collection, integration of teaching and learning evidence of multi-source heterogeneous data, combined with teaching and management requirements for alignment correlation and feature extraction, for students, teachers and teaching management, actively play a data science and artificial intelligence technology represents the role of data diagnosis technology value, build the school teaching "digital and intelligent business decision-making" new sample, teaching reflection, students' learning management, curriculum and professional construction demand change accurate response and efficient support.

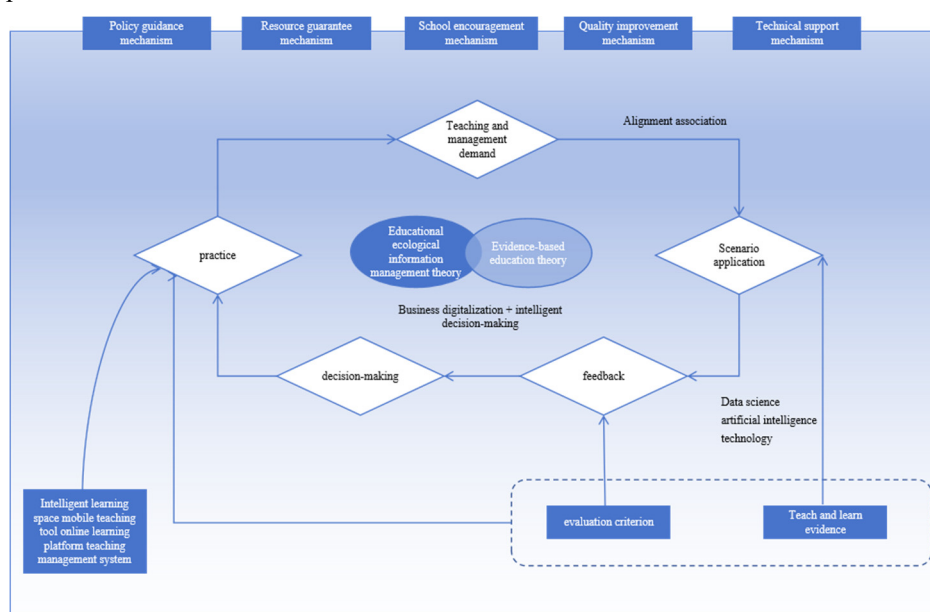


Fig. 1. DBDM ideas diagram for the continuous improvement of teaching and learning.

3.2 Scenario conception for continuous improvement of teaching and learning

DBDM focuses on practice, using technology to present data in a meaningful way and support the data usage process, Figure 1 shows the idea of DBDM for the continuous improvement of teaching and learning. With the purpose of continuous improvement of teaching and learning, the author tries to construct four DBDM application scenarios at the school level:

1. Construction of teaching class 360, service teachers' teaching improvement. Closely around the mixed teaching state of colleges and universities, Based on the educational administration management platform, resource learning platform, mobile teaching tools and other platforms, Integrating attendance status, online learning, homework completion, teaching interaction, goal achievement, Student evaluation, supervision evaluation, peer evaluation and student achievement data, Class Construction Class 360: For teachers, Presenting students' online learning progress, classroom interaction status and goal achievement status in real time, As well as students, peers, supervision and evaluation information, Help teachers to timely

understand the course teaching state,Strengthen teaching reflection and adjust teaching strategies in time;For the students,Push the attendance warning information,the process assessment results and the target achievement status,Help students to self-restraint, self-improvement;For the supervision and management departments,Comprehensive display of course teaching status,teaching evaluation and other information,To facilitate the scientific evaluation of course teaching, Regularly push the weekly attendance,monthly attendance and semester attendance report,Promote the real-time management of classroom teaching.

2.Develop a learning dashboard to achieve accurate learning intervention. Around the students' personalized learning needs,With artificial intelligence, blockchain,big data and other technologies,Developing learning dashboards for different levels of needs:for course teachers,Integrating student learning behavior data and outcome data,One-key integration of multi-subject evaluation and in-class evaluation,stage evaluation and final evaluation process data,Provide feedback on class learning status,Timely implementation of teaching precision intervention; For the academic tutors,Integrating academic performance,second class,practical training,living consumption, physical exercise,book borrowing and other data, Real-time observation of students' learning performance,Get early warning information and take precise intervention;For the students,Introducing the AI Assistant,Through goal setting,timing reminders,message push,course warning,experience sharing,progress feedback,etc.,Automatically generate and push personalized learning suggestions and learning resources,Help students to achieve self-reflection and real-time improvement.

3.Generate a learning portrait of students to track their academic progress. To promote students 'academic progress as a starting point,the students' learning process,learning investment,interaction between teachers and students,classroom participation,grades,learning preferences,to the students and the information for different people and demand push students learning portrait:students push personal portrait,depicting resource learning preferences,activity participation habits, etc.,help students personal self monitoring,improve self-efficacy, timely adjust individual learning behavior.Push group portraits for teachers,depict learning progress and ability achievement degree,mark students with difficulties,implement real-time monitoring of learning situation and timely adjustment of teaching strategies;provide graduate portraits for the society,depict personal ideology and moral character,learning input,learning style,knowledge breadth,quality expansion, practical exercise,and physical and mental health, and show students' core literacy to meet the needs of multi-dimensional inspection of employers and potential employers.

4.Create a real-time teaching state large screen,study and judge the development trend of teaching. Integrating the big data of all-region education and teaching,Build a large real-time data screen that can accommodate many forms of data,First,it can create the overall state of teaching operation large screen, Show the situation of all students,the teaching plan and operation status, the classroom teaching attendance status,the busy state,Help teaching managers to grasp the overall state of teaching operation;Second,to build a large classroom state observation screen,Integrating intelligent learning space and mobile teaching interactive tool data,Observing the classroom teaching practice scenarios, resource construction and students' learning situation,students' classroom activity participation rate,students' homework submission rate,student attendance rate statistics, etc.,In the form of multi-source evidence,such as classroom recording, classroom interaction and resource learning,Help supervise and carry out distance teaching evaluation,observation and other evaluation

activities,Help classroom teaching innovation in teachers and students to inspire each other and thinking collision.

4 The dynamic mechanism of Data based decision making

Some scholars believe that the current research on the influencing factors of DBDM not only lacks systematic integration, but also lacks the review of the teaching decision itself, but also puts more vision on the technical application level of data.^[8]More research findings^{[9][10][11]}, Teachers for digital decision-making is affected by various factors, some belong to the individual level, such as data literacy, teachers' mind, knowledge and skills and attitude, intervention and adjustment is relatively easy, and some belong to the school system building level problems, such as technical infrastructure construction, data accessibility, system maintenance ability is insufficient, school leadership, data culture and school internal cooperation, improve time-consuming and laborious.^[12]To fundamentally solve the problem of DBDM practice towards, need to study based on the specific scenario of DBDM dynamic mechanism, should fully forecast DBDM project implementation circuitous and iterative, from teachers data literacy to team data wisdom accumulation, need from motivation to ability, from technology to method, from process to the result,from cultural mode to system design,to guarantee in the DBDM practice build learning organization based on data,so as to ensure the persistence of DBDM application.

4.1 Establish teachers 'students and students' awareness of data decision-making,and improve teachers' data literacy

In the digital teaching environment,the bottleneck of traditional empirical decision-making is prominent,and teaching decision-making based on data has gradually become a necessary quality for teachers.Not only do school leaders have a direct impact on the DBDM process, but both school leaders and teachers need certain data literacy to use data effectively.Previous studies^[13] have suggested the difficulties that teachers and school leaders may encounter in some aspects of this process. For example,it may include difficulties in analyzing or translating data into action pTn help improve efficiency,improve teaching in real time, improve satisfaction, etc.Therefore,it is suggested that data understanding and data literacy ability cultivation should be implemented in the specific teaching situation of teachers. By establishing the mapping and interaction between students' behaviors and teachers and data,teachers can feel the real decision based on data,so as to improve the initiative of DBDM practice.When teachers link data with their own teaching roles and activities,and focus on how to transform data into practices of classroom improvement,the role value of DBDM occurs.

One of the key stakeholders throughout the data use was the school leader. School leaders have the necessary data literacy skills to be able to monitor, model, guide, and encourage the use of data to establish a school-wide culture of data use. School leaders need to recognize that a compliance orientation to data use does not lead to real or sustained data use.The data use framework should be for continuous teaching and learning improvements,rather than activities that meet accountability requirements.^[14]Data use should not only focus on students 'learning achievements and ability defects,but also pay attention to students' strengths and strengths.

4.2 Weaken the technical aspect of data-driven teaching decision-making and strengthen the research of data-driven decision-making mode

In the process of implementing DBDM, simply discussing the potential value of data mining technology may be easy to bring teachers teaching "technology panic" or "technology dependence", suggested to weaken the data-driven teaching decision-making technology, strengthen the study of data-driven decision-making mode, focus on DBDM demand accurate matching, promote the interaction between teachers and students, meet the demand of personalized learning, promote the value of curriculum goals, focus on how to form a data can promote the sustainable improvement mechanism of all relevant stakeholders.

The model construction should be based on the theory of educational ecological information management, focus on the key links such as "people-things-field", and pay attention to the demand research of teaching, learning and management. First, teachers should sort out the relevant needs in the teaching process, such as teaching input, teaching evidence, teaching evaluation and teaching optimization, and collect the teaching evidence chain for the study, practice and life, such as learning preferences, learning style and accurate assistance, learning and life, and the business process of academic tutors, course leaders, professional leaders and supervisors based on management behavior and decision-making. Data association is implemented around the three-level evidence chain of teaching, learning and management, and the input and sorting of the evidence chain of teaching and learning are taken as the main line, so that the information flow runs through every link of the ecosystem, and each component is integrated into an organic whole.

4.3 Focus on the diversified composition of data, focusing on the fusion of multi-source and heterogeneous data

The traditional majority of data use in models focused on collecting data in a formal and systematic manner is often possible for teachers

Incomplete data was used for decision-making. In the digital age, it is important to go beyond traditional or typical data sources and use multiple data sources to improve teaching, rather than relying too much on evaluation data in its narrowest sense. Previous studies have proposed a broad and inclusive data definition,^[15] data collected for the goal can be different types, can be systematic or collected in a less formal way -- for example, through informal classroom observation and discussion data (sometimes known as informal data), the data can be collected as part of the formative assessment of a learning assessment method. A third data source that schools can use include educational research evidence, and recent developments in the field of 'big data' also suggest that this may be a fruitful data source that can be used to help inform educational decisions.

Due to the multi-source and heterogeneous characteristics of teaching evidence, The need to translate this evidence into machine-readable data, Based on the above scenario requirements, Not only integrating online and offline data, Association recombination based on the sequence characteristics of teaching activities, Form a data closed-loop with teaching significance; In addition, the "hard data" monitored and recorded by the equipment and the "soft data" generated by the radiation of the host and object to the environment, Replacing objective sensing data with smart environmental data, Enhance the scientific nature of the evidence; We should not only integrate the history teaching data accumulated in the early stage with the

latest data generated by the platform, Find the overall teaching and learning rules of teachers, students and classes, Analyze its teaching and learning situation, Predict and judge the potential problems; And to integrate time-domain data and airspace data, To evaluate the time relationship and spatial structure of different people in different scenarios, Mining its teaching and learning habits, teaching and learning path and other personality characteristics.

4.4 Establish a multiple data team and create a culture of data use

The same data may have different meanings for different people, and different types of data can lead to different types of meaning-making processes. For example, the analysis and interpretation of formal data is a completely different process from the analysis and interpretation of informal data, which are often obtained at a faster rate and therefore require faster decision-making processes: this may pose challenges for teachers, who may not be supported by professional development in this field. Therefore, it is urgent to build a data team based on data mining, analysis, expression and communication to explore how stakeholders can cooperate and how data interactions can support teaching.

The data team is one of the few interventions in the world that have been systematically studied. The data team intervention was focused on the use of data to improve professional development in schools for the ^[16]. The programme consists of collaborative groups using data to address selected educational issues within the school. Data teams need three different types of human resources as important guarantees for teaching decision-making power, namely, the data decision-making leadership of school managers, the data decision-making promotion power of professional data workers, and the data decision-making execution of teachers. School administrators should plan and lead the development direction of teachers to apply data to improve teaching, and control the construction of overall school data culture; professional data workers should provide teachers with knowledge, methods and tools for applying data to improve teaching, and teachers should carry out data-based teaching decision practice in real teaching situations, so as to promote the development of DBDM.

Data team is not only the realistic carrier for the sustainable development of teachers' data literacy, but also the power source for further creating a collaborative data culture atmosphere. Data culture is a learning environment in a school or school district, including attitudes, values, goals, norms and practices, and a clear vision of the use of data, and the important impact of expected data on the decision-making process^[17]. A culture of positive data use is generally reflected in the collective responsibility and trust of the data team, the determination to use data for continuous improvement, the good vision of sharing data use and the urgent expectation of forming data use, and respect for teachers' autonomy in data use. Having a positive data use culture and atmosphere often helps schools to achieve a shared vision that promotes faculty use of data to improve teaching practices.^[18]

5 Conclusions

"Data based decision making" is the product of meeting the needs of The Times and the development of information technology, and has increasingly become a new paradigm to effectively improve the quality of teaching decision. It is guided by the concept of evidence-based education, supported by artificial intelligence and other intelligent technologies, and

with the whole process of data decision-assisted implementation as the object, to achieve the comparison, analysis and judgment of the conformity between the teaching decision results and the expected goals, so as to adjust and revise the decision plan. Based on "goal-data decision-influence results" the process of perspective will expand and deepen the "data-driven teaching decision" quality comprehensive evaluation research, help to comprehensive.

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