Research on the Application of Big Data in Teaching Quality Monitoring Platform of Local Colleges and Universities

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Abstract. [Purpose] Through analyzing the characteristics of higher education, a teaching quality monitoring big data platform of local colleges and universities is constructed. [Methods] The data base of basic teaching state is applied to the teaching quality monitoring system, to improve the information gathering, processing, and feedback ability of quality monitoring, as well as to enhance the working efficiency and quality of monitoring. [Conclusion] The platform framework consists of business management information system, database, data analysis, data application and so on. [Suggestions] Based on database, the platform input the systematic data of all kinds of businesses in the data center into database, offering fundamental data support to systems like state database, academy evaluation, and application for the first-of-class majors. Then, these data can be obtained automatically, and processed to the fundamental basis required by all the systems, providing teaching quality monitoring and evaluation, and big data analysis for both universities and its affiliated institutes. On the other hand, the data generated by the system can be pushed to the data center of the university.

Keywords. big data; local colleges and universities; teaching quality monitoring

1. Introduction

The combination of big data and education has become the development trend of the times.[1] During the whole process of educational activity, educational big data collects the data set, which can create huge potential value and can be used for educational development based on educational requirements. Educational big data in colleges and universities can be divided into four types.[2] The first type is teaching management, which refers to the data generated during the process of teaching management, including student information, teachers' information, course information, and teaching plan. They are mainly structured data. The second type is teaching process, which is behavioral data during students' learning process, such as course learning, homework complement, after-class question answering, and examination. They are mainly online structured data. The third type are teaching resources, including course video, texts, test

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questions, and homework, which are mainly online and structured data. The fourth type is behavior, such as daily check in, communication, activity participation, and task completion.

Through the big data platform of teaching quality monitoring in colleges and universities, with the use of information methods and network technology, a regular monitoring mechanism for teaching quality in undergraduate schools can be constructed by combining the data reporting, data interpretation, and in-depth data mining of basic data from teaching. This can accelerate the information process of college management, and promote scientific management and decision-making.[3-4]

In October 2013, the Ministry of Education (MOE) of the People's Republic of China released the "Opinions on the Evaluation of Undergraduate Education in Ordinary Colleges and Universities",[5] which clearly pointed out that "based on self-assessment of colleges, taking academy evaluation, major certification and evaluation, international evaluation, and regular data monitoring of basic teaching state as main contents, a teaching evaluation system suitable for modern higher education system with Chinese characteristics will be constructed by combining multiple evaluation elements, such as government, schools, professional organizations, and society." The evaluation system is short for "five in one". It is a problem that every college urgently needs to work out about how to apply information tools, fully dig out the data value, improve work efficiency, and aid the college quality monitoring evaluation. Therefore, constructing a teaching quality monitoring platform for colleges and universities is a necessary measure to comprehensively push forward cultural construction of college quality, and to deepen the teaching reform of undergraduate education.

2. Existing Problems of Constructing Local College Big Data Platform

2.1 Lacking Database, and Low Data Availability

Some colleges haven't built up the data base aiming at the national higher education quality monitoring data, so the reported data are saved in forms or uploaded to national platforms.[6] Traditional data saving methods have greatly impeded the utilization of college data, so that the data value is extremely limited for colleges. For example, when making major certification, the basic information of professional teachers and students, their awards, and publications should be reported, so it is very difficult to inquire and reuse the data, thus reducing the work efficiency and accuracy. By making use of information platform, users can directly retrieve related data, and can manage the state data, basic information form of colleges, and the first-class data of the major. Therefore, there is no need to gather the data repeatedly.

2.2 Irregular Data Input

The national higher education quality data monitoring platform has opened to the colleges and universities since 2016. All the universities report their data based on the "reporting guidance", which would be updated and changed every year, or several times in a year. Therefore, it requires that the colleges has a deep understanding of the guidance, and keep up with the changes, to make sure that the data in the report accord with national standards. However, in reality, reporting data is only a periodical task. Sometimes, the data input may be irregular, because the responsible teacher may not

have an accurate understanding about the guidance, and they haven't kept up with the updates, or just because of their common understanding. For example, the coverage of students and the refined classification of tutors are among the problems.

2.3 No Closed-Loop Management for Quality Monitoring, and No Tracking for Reformation Effect

The purpose of teaching quality evaluation is not only to discover problems, but also to sustainably track and adjust the improvement or reformation effect of the problems. When tracking and following the problems, we can not only understand the improvement effect of teachers, but also adjust the direction and focus of teaching quality monitoring in time according to the problem feedback, so that the inspection for teaching quality will be more suitable for the teaching methods of the school. What's more, the reformation effects can be compared and analyzed, and can be regarded as the basis for assessing teachers' development and growth.

3   Conclusion

3.1 Big data Analysis Platform Framework of Teaching Quality Monitoring in Local Colleges and Universities

Construct the big data analysis platform of quality monitoring in universities, the framework of which is shown in Figure 1.
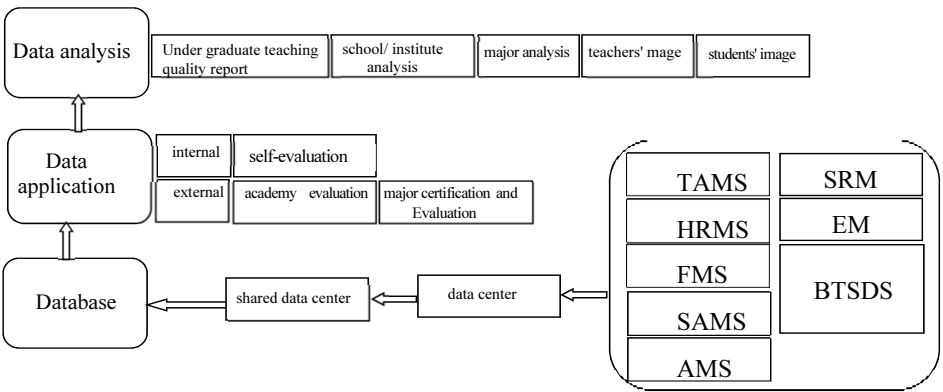

Figure 1. Bigdata Platform of Teaching Quality Monitoring

(1) Data analysis
     Including: undergraduate teaching quality report, school/institute analysis, major analysis, teachers' image, students'image.

(2) Data application
     Including: internal(self-evaluation); external(academy evaluation, major certification and evaluation).

(3) Database
      Including: shared data center, data center.

(4) Management information system
      Including: Teaching affairs management system(TAMS), Human resource management system(HRMS), financial management system(FMS), students' affairs management system(SAMS), asset management system(AMS), scientific research and management system(SRMS), experimental management system(EMS), basic teaching state database system(BTSDS).

4   Suggestions

4.1 Contents of Platform Construction

Based on database, the platform input the systematic data of all kinds of businesses in the data center into database, offering fundamental data support to systems like state database, academy evaluation, and application for the first-of-class majors.[7] Then, these data can be obtained automatically, and processed to the fundamental basis required by all the systems, providing teaching quality monitoring and evaluation, and big data analysis for both universities and its affiliated institutes. On the other hand, the data generated by the system can be pushed to the data center of the university. The main contents of project construction are as follows:

4.1.1 State Data

The data module of basic teaching state of colleges are the set of related basic functions conducted by surrounding the state data,[8] including state database, data report, data confirmation, index analysis, and data analysis report. The application of this module doesn't need the set of other functions, which completely match the quality monitoring data platform of higher education.

(1) Database
The data on the national platform from previous years can be input with one click, and the data from the first-of-class reporting platform, together with the basic statistics report of higher education can be input with one click. For diversified data collection, the data sheet collection can be customized, which can also be linked with the data from business systems, such as data center, teaching affairs system, personnel system, and student affairs system.

(2) Data Report
The data analysis report of verification evaluation, undergraduate teaching quality report, professional state analysis report, the monitoring report of normal major certification, and the data analysis report of major certification can be generated. Meanwhile, the data analysis report of the majors, such as clinics, engineering, and agriculture, to be put online can also be generated. The calculation methods of core indexes in the report coincide with those of national platform, and are updated synchronously.

(3) Data Analysis

According to the collected state data, the system can directly analyze related index, which completely includes the analytical indexes on the national platform. Meanwhile, more thorough analysis and comparison about the data will be conducted based on the "Briefing of National Monitoring Quality Check" published by the Ministry of Education, as well as the annual report of college teaching quality collected by utilizing big data analytic tools. For instance, the comparison of the core index tendency of college state data in recent three years, comparison between the core index with the regular module value at the same layer, with the same properties, and the same type, and the comparison of all the majors in terms of teachers, students, and courses.

4.1.2 Verification Evaluation

According to the division of "five-in-one" evaluation system, college and university verification belongs to the academy evaluation, which includes the budget for the verification and evaluation procedures, data analysis, online report presentation, connection of supportive materials, and online inquiry.

(1) Online Data Analysis and Report. On the platform, users can not only directly look through the analysis report of evaluation data generated by state data, but also the number of abnormal indexes about objective indexes in each chapter can be presented before it. Therefore, it is convenient for users to find out abnormal data.

(2) Inquiry of Supportive Materials. Targeting at evaluation system, users can connect it with supportive materials from supportive material base, and transform their format. Meanwhile, the supportive materials after connection allow online preview of evaluation experts, so that experts can access to the materials, to enhance the work efficiency of evaluation, and to reduce the work pressure of experts.

(3) Rehearsal of verification evaluation can be organized on the platform, and colleges can help set up index system, including initiators, department reviewers, and expert opinions. After all these procedures, the verification and evaluation report can be previewed online.

4.1.3 Internal Evaluation

Internal evaluation mainly serves all kinds of evaluation and certification tasks that are developed in the college by themselves, featuring the characteristics of flexibility, customization, and openness. The evaluation subjects include schools, institutes, majors, and courses. The specific functions are as follows:

(1) Management of Evaluation Standards

The management function of evaluation standards is to set up different evaluation systems in line with different evaluation subjects, including schools, institutes, majors, and courses. In each evaluation subject, different types of index systems can co-exist. For example, in major evaluation, the evaluation index system in the major of science and engineering can co-exist with the system in the major of literature and history, or even other types.

In each evaluation standard system, the parameters such as primary index, secondary index, tertiary index, index connotation, index attribute, standard value of quantitative index, index data source, and evaluation modes can be customized flexibly. The data source of quantitative index can be directly calculated from state data and customized data, while the evaluation mode consists of qualitative or quantitative mode, direct score, ranks and levels, and F/P.

(2) Management of Evaluation Tasks

The management function of evaluation task is to set up the implementation process of this evaluation task, such as the starting and ending time, self-evaluation stage, settings of evaluation experts, and the range selection of evaluation subjects.

(3) Implementation of Evaluation Tasks

According to the given evaluation mode, evaluation will be implemented. Objective indexes can be calculated automatically through data source, and corresponding values will be given, while subjective indexes will be converted by the scores or ranks given by experts.

(4) Presentation of Evaluation Results

Data will be analyzed through the scores of subjective and objective indexes. Then, the ranks of different subjects under the same index system will be compared, the scores of different subjects with the same index will be compared, and different scores from different experts for the same subject will be compared. Meanwhile, based on the template of analysis report, the platform can automatically present related analysis report.

4.1.4 Major Certification

Major certification can be used by schools to support the tertiary major certification work. Certification rehearsal can be carried out on the platform, to find out the weaknesses of the major, make adjustment with purposes, and enhance the passing rate of certification. This function consists of qualification analysis of certification indexes, online presentation of certification reports, self-evaluation report of certification, and major management of certification.

(1) Qualification Analysis of Certification Indexes

According to the state data, the qualification analysis for quantitative indexes with corresponding types can be calculated in terms of different majors, such as normal pre-elementary education, primary school, middle school, vocational education, and special education. Meanwhile, the unqualified elements of primary, secondary, and tertiary indexes will be pre-warned and alarmed.

(2) Online Presentation of Certification Report

Users can directly look through the state data, and then generate the analysis report on evaluation data. What's more, before each chapter of the report, the number of the objective index that is lower than the average value in the region will be indicated, so that it is convenient for users to look for the unqualified data.

(3) Self-Evaluation Report of Certification

Offer the presentation of self-evaluation report uploaded by the certificated majors.

(4) Management of Certificated Majors

Users can manage the majors that have passed the national major certification, to understand the certification period, the passing time, and other situations. Therefore, it is convenient to order the certificated majors to prepare for their annual report.

4.1.5 Panoramic Data Analysis for the Major

As the focusing unit of teaching quality monitoring and evaluation certification, major is the pivot for the operation of college teaching. The quality of major construction directly determines the quality of the students it develops, so it is extremely necessary to analyze the panoramic data of the major. The analysis includes the comparison between this major and the national average value, the comparison of the average value in the provinces, the comparison of international standards among the main type, and the analysis report of the panoramic data.

(1) Comparison of Average Value of Panoramic Data

It helps compare the index result of state data for this major with the average value of this major around the country, compares it with the provincial average value. Special marks will be given to the indexes lower or higher than the average value.

(2) Comparison of National Standards with Panoramic Data

Extract some data from professional talent development programs by making use of data analysis tools, compare them with the education quality standards of the 92 major types released by our country, and warn the situations of the program that do not comply with or satisfy national standards. Then, dig out the data, and understand the sources for the problems in details.

(3) Panoramic Data Analysis Report of the Major

This report is a summary of the overall situation of the major by combining the state data and some third-party data. Through the index system, weight, and calculation rules, the system can summarize the major in a fast, convenient and objective way. The report includes the ranks of the major, the comparison of the scores of the major, and the repeated contents of different major courses. It is a significant supportive material for schools to find out the real situation of the major, adjust the dynamics of the major, and adjust the threshold value of the major evaluation.

4.1.6 Teaching Evaluation

(1) Basic Data

Basic data includes the data of different departments in the school, basic information sheet of the major, information sheet of the class, information sheet of teachers, student information sheet, course information management, course opening, course arrangement, and course selection.

(2) Students' Evaluation of Teaching

- It supports customized index. Indexes can be selected according to different course types when assigning tasks.
- Managers can select the evaluation scope. The excluded scope refers to the targets of not taking part in the teaching evaluation, which does not included in the final data statistics.

- It supports online teaching evaluation, to fill in the suggestions and evaluation about teachers.
- Evaluation and the calculation of scores. By considering the college, the teacher, and the course, evaluation result and evaluation data will be calculated and analyzed.

(3) Lecture Evaluation

Support customized lecture evaluation index. With several systems, colleagues can set various types of questions.

There are two kinds of lectures that can be attended, given courses and optional. For the first type, managers should report the arrangement of the teachers expected to give lectures to related supervisors or leaders. On the other hand, optional courses can be selected according to the frequency of attending lectures, the lowest score of the lecture, random attendance, and personal selection. Then, the courses or lectures can be added to the list of lecture.

After arrangement of the lecture, task information would be sent to lecturers, in the form of systematic information, wechat, messages, or e-mail.

In my lecture, the arranged tasks and optional tasks can be viewed; support online evaluation from supervisors, leaders, and colleagues, as well as the evaluation from offline printed evaluation sheet.

For evaluation and calculation of scores, the evaluation results and data would be analyzed from the dimensions like college, teachers, and courses.

(4) Teachers Center

It supports feeding back the anonymous subjective evaluation messages from students' evaluation index to the evaluated teachers. After the teaching evaluation, the evaluated teachers can view the anonymous evaluation. The evaluation and opinion of the audience pushed by managers can be viewed, including the evaluation pushed by a single piece or together. Users can fill in some measures for improvement after viewing the evaluation, which would be fed back to managers.

(5) Questionnaire

Questionnaire management includes issuing questionnaire, setting questions, and view some details. The questionnaire includes anonymous questionnaire and real name questionnaire. Anonymous questionnaire can generate QR code and chained address. After scanning the QR code or logging in the chained address, users can fill in the questionnaire. Real name questionnaire can set up scope, and then issue questionnaires according to selected scope. When the questionnaire needs to add more questions, the indexes in shared index base and individual index base can be quoted, and the sequence of the index (title) can be changed through dragging. After issuing the questionnaire, the details of the issuing and the details of the question answering.

(6) Mobile Terminal

The mobile terminal mainly includes my lectures, evaluation management, my evaluation, and students' evaluation. Specific functions are as follows:

- Unfinished lecture arrangement and finished lecture arrangement can be viewed, and users can choose to listen to the lectures online;
- Revise and push the evaluation for lectures, or push the evaluation as a whole. Summarize course evaluation, report the opinions, and push to the teacher.

- Single evaluation push, as well as the lecture evaluation pushed to teachers as a whole can be viewed.
- Students are supported to fill in the evaluation for teachers on mobile terminal. The courses without evaluation, or the saved courses with evaluation can be viewed. However, the evaluation could be submitted after evaluating all the courses.

4.1.7 Images of Data

By summarizing and making the most of existing data, the images at the level of school, major, or teachers may be shaped. Meanwhile, the primary index presented by images can help dig out data, until data granules

It is the requirement of development in information era to apply the higher education national data platform (the database of basic teaching state) to the teaching quality monitoring system of local colleges and universities. Improving the information collection, processing, and feedback system of quality monitoring by means of information technology can enhance the work efficiency and quality of quality monitoring.

Acknowledgements

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