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Blended Teaching Research and Practice Combining Ideological Political Instruction and Data-Driven Method

Yan Gui[1, a], Xue Qin[1, b], Yunyun Du[2, c], and Xia Deng[3, *]

[1] School of Big Data and Information Engineering, Guizhou University, China;

[2] School of Sports Engineering and Information Technology, Wuhan Sports University, China;

[3] School of Foreign Languages, Guizhou University, China.

[a] 2057741750@qq.com, [b] xqin@gzu.edu.cn, [c] dyunyun@whsu.edu.cn, * xdeng1@gzu.edu.cn

Abstract. In order to alleviate poor course learning effect caused by learning goal confusion and the lack of learning motivation in big data major courses instruction, this paper proposed a blended teaching solution combining ideological political education and data-driven method. Firstly, with the help of smart teaching platform, main instruction process, including pre-class, in-class, after-class and practice, has been restructured and condensed, and teaching materials on ideological and political education towards data science major has also been designed which can enrich in-class interaction and inspire learning interest, and firmly established the professional learning objectives. Secondly, the learning behavior data derived from logs of smart teaching platform is used for analyzing, feedback and early warning, which can help students track their learning status and knowledge mastery, and thus drive them to adjust their learning plans and cultivate active learning habits. Finally, our blended teaching program has been carried out in the course of Principles and Technology of Big Data with 4 teaching classes. The statistics from teaching practice and research show that our solution can greatly improve in-class participation, interest and initiative in learning. Moreover, profiting from learning behavior data analysis and feedback, learning progress can be more accurately mastered, which can supervise students to perform courses learning, and consequently are conducive to the improvement and optimization of the teaching process and significantly improve the quality of course learning.

Keywords: Blended teaching; Ideological Political Instruction; Data-Driven; Learning behavior analysis.

1. Introduction

The rapid development and deep application of big data and artificial intelligence promote the deep integration of information technology and education, and provide effective support for comprehensively tracking the learning process and effect of learners. The data on learning behaviors will help learners better understand their own problems, and teachers will be able to grasp the learning status more comprehensively and carry out targeted teaching activities [1]. Teaching reforms such as transforming learning scene and innovating teaching mode combined with information technology have gained a lot of research and application. The research and application practice represented by MOOC, smart classroom, online and offline blended teaching have achieved remarkable results and been widely promoted [2]. In these teaching practices, the network and various intelligent terminals are the carriers of learning resource acquisition and interaction. Big data, machine learning and other technologies are immersed into the whole learning process [3], which can effectively support multiple scenarios, online, offline and hybrid learning methods.

Internet, big data, artificial intelligence and other technology integration of online courses and traditional education and teaching from interdependence, support, to promote the direction of integration, the importance of mixed teaching is becoming more and more obvious [4]. A large number of studies have shown that online learning alone can only achieve the same or even worse teaching effect than classroom teaching [5]. By using blended learning, we can achieve better results than online learning or classroom learning alone [6]. Compared with traditional classroom teaching method and pure online teaching method, the hybrid teaching method adopts the methods of pre-class guidance, autonomous learning, strengthening the key and difficult points in class,

online and offline learning, discussion and special topic exploration, etc. , from the traditional "Teaching"-centered model to the "Learning"-centered model of students [7, 8]. At present, blended teaching with smart classrooms has been widely promoted, and a large number of smart classrooms have been built and widely used in various universities. In a smart classroom, students can not only draw resources and services from the environment, but also interact well with the environment [9]. Under this model, relying on the smart classroom and combining with the panoramic teaching management service platform, it covers the learning links such as online pre-class preview, offline classroom teaching, in-class test and multi-channel interaction, so as to improve the learning experience while collecting the learning process data in a senseless way. At the same time, big data and machine learning technology are used for in-depth analysis and mining of learning process data, which provides the possibility for accurate diagnosis of individual learning state, learning early warning and personalized guidance, and also provides a solid foundation for quantitative analysis of group learning behavior.

On the other hand, the improvement of information technology, education methods and infrastructure has provided the necessary conditions for large-scale intelligent education. However, our teaching team found some significant phenomena in the teaching of big data, teaching reform research and practice, through the data analysis of the survey and interview of students and graduates, teacher interviews and teaching videos, which mainly include four aspects: (1) lack of initiative in course learning, (2) low participation in class, (3) insufficient depth of knowledge acquisition, thinking and analyzing ability, (4) insufficient class time.

In view of the above phenomenon and performance, the teaching and research team, through discussion and analysis, concluded that there are two main reasons. One is the lack of clarity of learning objectives, and the other is the lack of internal drive for learning. For the first reason, limited to the development law of the new major itself, the training system and objectives are continuously improved and perfected, coupled with objective reasons such as professional diversion, the professional cognitive link needs to be continuously optimized to help students further clarify their professional and course learning goals. Secondly, the lack of clarity in learning objective will inevitably lead to confusion in the learning process, which in turn will result in insufficient internal motivation for learning, the direct manifestation of which is that the course learning effect cannot reach the expected goal.

From the deeper perspective of student training and development, the key to solving this problem lies in how to guide college students to establish correct outlook on life and values [10].Focusing on this goal, the firm feelings of home and country, craftsman spirit, professional norms and engineering ethics are integrated into the professional curriculum, the ideological and political education is organically combined with the professional teaching content, and the students are helped to clarify the professional learning objectives, enhance the learning motivation, and achieve the cultivation goal of enhancing students' ideological and moral heights and knowledge and ability levels [11] .

Based on this, this paper takes Principles and Technologies of Big Data as the carrier to explore the methods and practical approaches of blended teaching under the scenario of smart education. On the one hand, through optimizing the ideological and political links of the course, it stimulates learning interest, enhances the professional identity of the big data industry, and improves learning motivation. On the other hand, through the analysis and feedback of learning behavior data, students are helped to clarify their learning status and knowledge level, and students are urged to learn efficiently.

2. The blended teaching design method of ideological political instruction and data driven

This paper proposes the blended teaching design method and formative evaluation research of ideological political instruction and data driven. The professional core course Big Data Principles

and Technology was selected as the object, and the teaching design and practice were carried out around three aspects.

2.1 Content design of Ideological and political traction

The main purpose of ideological and political traction is to adopt the method of ideological and political education in the curriculum to guide students to clarify their learning objectives and improve their learning drive. “Ideological and political education in the curriculum” is to integrate ideological and political education into all aspects of the curriculum teaching, with the function of “Implicit ideological and political”, together with the course of “ Explicit ideological and political theory”, to jointly construct the whole curriculum education pattern [12]. The implementation method is based on the nature and characteristics of the course, combined with the national big data strategy, Guizhou big data industry development achievements and industry typical application cases and other materials, condense ideological and political elements and organically integrate them into the course teaching process, imperceptibly enhance the confidence of the country and Guizhou big data industry development and personal career prospects, and guide students to further clarify the major direction and learning objectives, enhance the internal drive for learning.

2.2 Reconfiguration of teaching based on data driven

The curriculum in our country has experienced two teaching paradigms: experiential imitation teaching and computer-aided teaching, and now it is entering the third development paradigm of data-driven teaching [13]. Data-driven teaching uses new information technology such as Internet of things, Big Data, cloud computing and mobile Internet to collect and analyze online and offline learning data of teaching objects, the research object's behavior habit and the development tendency, according to the research result carries on the improvement to the teaching link, the teaching object [13]. The main purpose of data-driven is to reconstruct the teaching content, transform the teaching process, evaluate the learning effect based on process data, provide timely feedback and urge students to complete the course learning tasks with high quality. Combined with the principles of blended teaching, the course teaching process is divided into four parts: pre-class independent learning, classroom lectures and discussions, after-class tests, and offline practice. The teaching practice will be combined with smart classrooms and teaching management platforms (Rain Classroom, Learning Pass, etc.), organized in a mixed online and offline way, and use the platform to automatically collect learning process data, which will be used as the basis for course learning evaluation, assess the completion and effect of each learning unit, and release timely feedback to learners and teachers. For learners, the results help individuals to grasp their own learning situation and urge students to adjust and arrange their learning plans in a timely manner. On the other hand, these data analysis results can help grasp the overall teaching effectiveness of teachers' courses as a basis for adjusting teaching activities, and can also accurately grasp the learning status of each student, which helps in early warning and personalized guidance. The specific organization and implementation are as follows.

2.2.1 Online pre-class independent learning design program

The team reconstructs teaching content and learning resources according to the characteristics of the platform, releases learning resources (courseware or video) and preview tasks in advance, and the platform automatically records the completion. At this stage, the courseware contains a test, which is used to check the effect of preview. Students can also make marks and feedback difficult problems while preview. This method is conducive to cultivating students' self-learning habits and abilities, and also helps to relieve the pressure caused by the lack of class hours. Because of the large amount of commonsense knowledge in the course, students have prepared for it in advance, which can reduce the burden of classroom teaching content to a certain extent.

2.2.2 Classroom teaching organization

Classroom teaching can pay more attention to the sorting out of the knowledge system and the explanation of key knowledge points, focusing on the depth of knowledge, thinking and problem analysis and solution ability training. In order to enhance students' participation and exercise their analytical thinking ability, the whole class should focus on discussion, combined with teaching, in -class testing, flipping and other interactive methods. In this process, we make full use of the advantages of smart teaching platform, technologies such as casting, pop-up, random roll call, and dynamic analysis to provide timely feedback on classroom situation, enliven classroom atmosphere, guide students to think, analyze, express and communicate, urge students to improve classroom attention and participation, so as to improve classroom teaching quality.

2.2.3 Post-test and learning design

To deepen students' understanding and application of course knowledge, the platform is combined with the release of extended learning resources and tasks for online exchange and discussion. Also, there are stage tests to help students better grasp the learning effect and also help teachers grasp the overall teaching effect.

2.2.4 Off-line practical session implementation

The organization of this session mainly adopts the release of course experimental topics and reference materials for students' self-study and operation, checking completion, demonstrating and answering questions for each experiment, and recording grades.This session is mainly conducted by offline manual checking of records.

2.3 Formative teaching evaluation program design

According to the teaching design and implementation process, this course combines online and offline mixed teaching mode and adopts formative evaluation assessment method. On the basis of the process data collected by the platform, course scores are counted and generated to evaluate the course learning effect of students. Reference criteria: procedural record evaluation (70%) and computer experiment (30%). Among them, the procedural record evaluation covers the recorded data of pre-class preview, class discussion and interaction, attendance, stage test, flip report and other aspects.

3. The teaching practice of Big Data Principle and Technology

According to the ideological and political traction and data-driven strategy, blended teaching and formative evaluation methods are adopted to reconstruct and integrate the whole process of pre-class preview, classroom and after-class review test of course teaching. According to the different content modules of "Principles and Technology of Big Data" course, different teaching methods and means are adopted.

3.1 Design and implementation cases of ideological and political traction

In combination with the teaching content Overview of Big Data and according to the characteristics of big data, the ideological and political elements and contents of the course are extracted and condensed from the outstanding achievements and demonstration cases of big data development of the country and Guizhou Province. Introducing these excellent cases can make students resonate with great achievements in development and enhance their pride and confidence in career development. At the same time, it guides students to interpret it from the perspective of big data, deepen their understanding of big data technology, and cultivate the habit of thinking about data. The following are two typical ideological and political cases condensed by combining the characteristics and applications of big data.

Ideological and political Element 1: Select Chinese Assistant Foreign Minister Hua Chunying's post, "What can Happen in a Minute?", showcasing China's remarkable achievements and

highlighting national pride. At the same time, it is combined with data and discusses the features behind it that support big data (as shown in Figure 1).

Ideological and political element 2: Introduction of data cage big data application cases. "Data Iron Cage", as the exploration of technical supervision, anti-corruption and clean government, reflects the determination of the Party and the government to clean and anti-corruption, and the original intention of serving the people, guiding students to analyze and discuss the big data technology and charact eristics behind it. (As shown in Figure 1)

Achievements and results like these can significantly increase students' confidence in their future career prospects, firm up their learning goals and boost their motivation.

Figure 1. Example of ideological and political design for Big Data courses

3.2 Blended curriculum teaching design combined with smart education platform

According to the training objectives of undergraduate majors, the core content of Big Data Principles and Technology course is big data storage and processing methods and technologies, mainly including overview of big data, Hadoop architecture, distributed file system HDFS, distributed database HBase, NoSQL database, MapReduce and optimization of YARN architecture. For this part, the teaching method is to carry out online pre-study, classroom lecture, discussion, accompanying test, after-class test and offline practice operation in combination with smart teaching platform, and record learning behavior data to provide support for evaluation.

In addition, according to the professional curriculum, there are some extended and expanded knowledge content, which aims to prepare for the articulation between courses and to expand students' knowledge in the field of big data. It mainly covers spark, stream computing, graph computing, visualization, big data application cases and so on. For this part, the teaching method is to combine the intelligent teaching platform to carry out online self-study and test, flipped classroom and so on.

3.3 Statistical analysis and feedback of learning process data

The statistical analysis and feedback of learning process data are mainly adopted in two ways. One is the automatic statistics in the background of the teaching platform, where students can refer to the completion of each unit pre-study, classroom and unit test at any time, the other is the mid-term statistical analysis and feedback. The teaching and research team divided the process data into three aspects according to the implementation process of blended teaching: pre-class preview and independent learning, classroom learning, after-class and others, and selected different statistical indicators around these three aspects (see Table 1), which better reflect the learning status of the course. During the teaching process, in the 6th and 12th teaching weeks, the statistical analysis data are given based on these teaching indicators, and the assessment of the course performance is given based on the formative evaluation method.

Based on these process data and assessment feedback, students can clearly grasp their course learning status, predict course performance and effectiveness, and adjust their learning plans in a

timely manner. On the other hand, teachers can further optimize the subsequent course design and teaching activities based on the overall learning situation to help students better complete their courses.

Table 1. Statistical indicators of process learning data

Stage	Statistical index	Description
Preview and self-study before class	Degree of completion	Preview completion, percentage
	Scoring rate	Cumulative score, percentage system
	Learning duration	Online learning duration, unit in minutes
Classroom	Class attendance rate	QR code sign-in statistics, percentage
	Number of interactions	Cumulative number of valid answers and discussions
	Scores on in-class tests	Publish test scores in class，percentage system
After class and others	Unit test score	Online unit test score，percentage system
	Experimental score	Offline experimental scoring，percentage conversion system
	Flipped Classroom (including debriefing)	Class report and other methods of grading, percentage conversion system

4. Implementation and analysis

According to the principle and implementation plan of the teaching mode reform of this course, the teaching practice of this course (mainly including 7 core teaching units) was organized and carried out in 4 classes of Data Science and Big Data Technology from 2021 to 2022 in Grade 2019 (2 teaching classes, 145 students in total) and Grade 2020 (2 teaching classes, 136 students in total). The traditional teaching of grade 2018 (1 teaching class, 66 students) is taken as reference. The implementation statistics are shown in Table 2, Table 3 and Table 4.

Table 2 Statistical data of pre-class preview and self-learning

Statistical index	Grade 2018	Grade 2019	Grade 2020
Degree of completion	×	90.3%	89.4%
Scoring rate (percentage)	×	62.7	65.01
Average learning time (minutes)	×	23.6	22.7
Median learning time (minutes)	×	33	35
Total number of unprepared students	×	18	31

Table 3 Classroom learning statistics

Statistical index	Grade 2018	Grade 2019	Grade 2020
Attendance rate (QR code sign-in)	×	98.9%	99.5%
Average number of interactions (courses)	2.7	6.3	7.6
Number of interactions (median)	×	2.5	2.5
In-class test (number of times per unit)	×	4.3	5.1
In-class test score (percentage scale)	×	74.9	82

Table 4 Statistical data after class and other sessions

Statistical index	Grade 2018	Grade 2019	Grade 2020
Unit test score (percentage scale)	×	65.3	77
Experimental scoring (Percentage system)	78.6	79.6	81.3
Flipped Classroom (including debriefing)	81.3	82.6	86.9

Note: (1) "×" means that this data was not collected. (2) There were 6 experiments and 2 optional experiments in the experimental section. (3) For the flipped classroom debriefing session, grade 2018 and grade 2019 were completed in group form, the coverage rate was 100%.Grade 2020 adopted voluntary registration form, with a total of 16 people, and the participation rate was 11.8%.

Statistics show that after the implementation of the curriculum reform, students' learning enthusiasm has been significantly improved, and their learning initiative and classroom participation have been greatly increased. On the other hand, behavioral data help teachers better grasp students' learning state of the course, teaching feedback is better targeted, the grasp of the core knowledge of the course and the course learning effect has significantly improved.

From the statistical data, the average number of effective participation and interaction of students of grade 2019 and grade 2020 in the course is 6.3 and 7.6 respectively, which is significantly higher than that of the control data of grade 2018 (2.7 times). On the other hand, in- class testing is an interaction involving all students in class. The average number of interactions per unit for level 2019 and 2020 is 4.3 and 5.1 respectively, which translates into 30 and 36 interactions for the 7 core units of the course. There are two main reasons for the improvement of initiative and class participation: (1) The smart education platform is used to effectively carry out and supervise pre -class preparation. The median duration of pre-class preparation for 2019 and 2020 is 33 minutes and 35 minutes respectively, and the completion rate of pre-class preparation is about 90%. Effective pre-class preparation provides necessary knowledge reserve for students to participate in interactive discussions in limited classes. (2) Smart classroom infrastructure and teaching platform

provide rich and colorful interaction methods, and good interactive experience is conducive to the development of classroom interaction.

5. Summary

The statistical data analysis and effect of curriculum practice show that the hybrid teaching design scheme of ideological and political traction and data-driven proposed in this paper can improve the learning effect of the course and enhance the learning motivation of students. The collection, analysis and feedback of the learning process data can help to find the problems in the learning process, assist teachers to adjust the teaching arrangement in time, and effectively drive students to actively improve their personal learning plans and improve the learning quality.

In the course of carrying out ideological and political teaching in this subject, ideological and political teaching has great impact on the original curriculum system, teaching design and teaching content. Teachers' targeted teaching ability is not strong. By adjusting teaching objectives and teaching positioning, modifying teaching content and teaching system, improving teaching methods and assessment methods, this course naturally integrates typical ideological and political elements and cases in the field of big data into and throughout the whole teaching process. Teaching research and practice have proved that through the combination of online and offline teaching and the adoption of digital technology, ideological and political elements are fully integrated with this course module and knowledge points, and the course ideological and political teaching can be carried out smoothly. In the future teaching, the ability of ideological and political teaching can be improved by means of periodic teacher network training, offline communication and discussion, observation and demonstration, and collection of targeted cases and materials.

According to the research implementation and statistical data analysis of this topic, one of the weak sections is that the quality of pre-class preview and independent learning needs to be improved. According to the statistical data, the completion degree is 90%, but the scores are 62.7 and 65. The test questions in this part mainly involved the details of knowledge points and a little comprehensive understanding, but the average score of students was low, which reflected the lack of concentration in independent learning and the lack of in-depth thinking to a large extent. This also proves from another perspective that online independent learning alone is not enough, and teaching feedback and interaction must be combined with offline classroom.

Another area that needs to be improved is classroom learning, where student participation needs to be further strengthened. The median number of effective class participation was 2.5, indicating that more than half of the students effectively participated in discussions no more than 2 times throughout the course. As can be seen from the distribution of the whole class, a small number of students participated in more than 15 discussions, and about 1/5 students participated in 0 interactions effectively. Therefore, it is also necessary to explore and enrich the way and frequency of classroom participation, and encourage a wider range of students to actively participate in classroom interaction.

In addition, the study is currently only carrying out teaching reform and research in 4 teaching classes of one course. The effectiveness of this method needs to be verified by more practices and data, and the implementation plan needs to be continuously implemented, accumulated and optimized.

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