



# Application of Data Visualization Technology in Ideological and Political Education in Colleges and Universities from the Perspective of Educational Informatization

Kebing Cui<sup>1a</sup>

<sup>1</sup>Henan University of Animal Husbandry and Economy, Zhengzhou, Henan, China  
1394454834@qq.com

## Abstract

Based on Web technology, using Canvas combined with big data technology, data analysis and visualization under the online learning system of ideological and political education in colleges and universities can be realized. At present, in the teaching practice of ideological and political education in colleges and universities, a major difficulty is how to give detailed teaching arrangements around different teaching contents for different student groups, so as to truly "teach students in accordance with their aptitude". With the help of the Internet and big data practice of large enterprise groups, combined with the teaching characteristics of ideological and political education, especially the market-oriented and flexible teaching management mode of colleges and universities, it is more suitable to try a new way of ideological and political education, that is, to design and implement the data visualization of the whole process value chain of ideological and political education to realize the refined and digital transformation of ideological and political education, and to provide new ideas for improving the teaching effectiveness.

**Keywords:** Education informatization; data visualization; ideological and political education system; Canvas

## 1. INTRODUCTION

With the gradual maturity of Internet technology and information technology, it has been widely used in various industries, and the education industry is also among the technical applications. In the main points of work released by the Ministry of Education in 2021, it is clearly pointed out that the goal and task of actively promoting the construction of educational informatization is to accelerate the high-quality development of educational informatization, and it is emphasized that educational informatization is one of the contents of China's education reform, which occupies an important position, and colleges and universities should strengthen the construction of basic information to promote the development of the modern level of educational informatization [2]. Ideological and political education in colleges and universities has achieved staged success under the blessing of educational informatization policy, but it can't be

guaranteed that every student can fully adapt to the current ideological and political teaching mode and can't guarantee the quality of education. Therefore, it is easy to see the following situations in education and teaching: ideological and political teaching content and teaching mode can't meet the growing learning needs of students, that is, ideological and political education in colleges and universities can't teach students in accordance with their aptitude under the background of educational informatization [5]. The arrival of the era of big data provides methods and paths for ideological and political education in colleges and universities from the perspective of educational informatization.

Big data technology refers to the application technology of big data, which involves various big data application technologies such as big data platforms and big data index systems. It is of great significance to apply big data technology to ideological and political education in colleges and universities. On the one hand, it provides a more comprehensive and fast data analysis channel for ideological and political education, timely

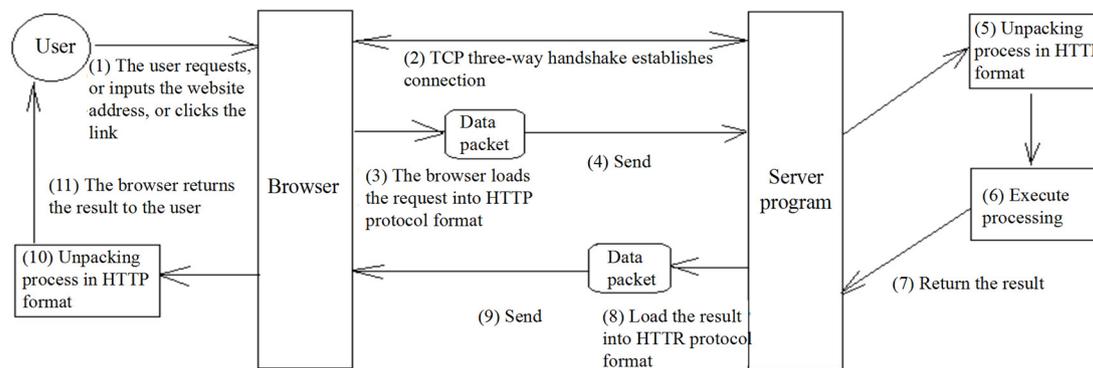
captures the problems existing in the teaching process of ideological and political education in colleges and universities, and improves the effectiveness of ideological and political education. On the other hand, big data technology enhances students' sense of acquiring ideological and political theory knowledge to a certain extent, and sees more diversified values and evaluation criteria, which is conducive to the cultivation of students' values and comprehensive quality [10]. Therefore, this paper holds that combining with the current situation of ideological and political education, the online learning system of ideological and political education in colleges and universities based on Web development technology and big data analysis and visualization technology can organically integrate big data technology, Web technology and ideological and political education. It not only solves the problem of "unable to teach students in accordance with their

aptitude" in the ideological and political education under the background of educational informationization, but also makes the ideological and political education more refined, digital and effective. And it helps to stimulate students' learning enthusiasm and improve their comprehensive ability.

## 2.OVERVIEW OF KEY TECHNOLOGIES

### 2.1. Web technology

Web technology refers to the technology that users use network devices and browsers to run Web servers to obtain information, and then realize Web services. The Web server can not only store information, but also run scripts and programs based on the information provided by users through the Web browser. Its working principle is shown in Figure 1 below.



**Figure 1:** The working principle of Web server

From the working principle of Web server in Figure 1, we can know that its working essence is realized by receiving data, HTTP parsing, logical processing, HTTP packet and sending data.

Commonly used Web development technologies can be divided into static development technology and dynamic development technology. Static development technology includes HTML technology and XML technology. Dynamic development technologies include ASP technology, ASP.NET technology, PHP technology and JSP technology. The technology to be used in this paper is HTML technology, in which HTML files begin and end with `< HTML >` and `< /HTML >`, the information between `< head >` and `< /head >` is the header information of the file, and the code between `< body >` and `< /body >` is the main body of the file. A high-quality webpage processing HTML technology also needs the cooperation of js, css, jquery and other technologies.

In this paper, B/S architecture is needed in the system based on Web technology. B/S architecture refers to the browser/server structure, and the transactions involved in the server side are concentrated.

B/S architecture is divided into three layers: presentation layer, logic layer and data layer.

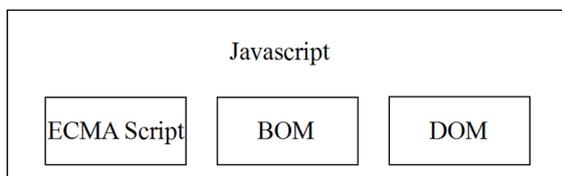
### 2.2. Canvas

Canvas is a means of drawing graphics on the browser side, and it can run without any external plug-in. Canvas itself does not have drawing ability, so it needs to draw images with the help of scripting language, which is usually JavaScript. Canvas can not only draw basic graphics and characters, but also deform and synthesize graphics. It can also make animation and games, and is often used to draw charts with many graphic elements. Canvas is a new tag element of HTML5. It also provides API of 2D and bitmap graphics based on JavaScript.

### 2.3. Javascript

Javascript is a web page programming language. The program file is a text file with the extension. JS. It can use text editor software such as Notepad as its development tool and support all PC browsers. Javascript is often embedded into HTML to realize its functions, and its dynamic language is relatively simple,

so it is often used to design dynamic web pages. Javascript consists of three parts, namely ECMA Script, BOM and DOM, as shown in Figure 2. Among them, ECMA Script constitutes the grammatical basis of JS core. BOM refers to the Browser Object Model, which is used to operate the objects on the browser, such as the browser's forward and backward, the pop-up prompt box. DOM refers to Document Object Model, which is used to manipulate elements in web pages, such as modifying html nodes in browser memory.



**Figure 2:** Javascript composition

JS has three advantages, namely, information dynamic interaction, prohibition of direct access to local hard disk, and it can be used as long as the browser that can analyze JS, which has nothing to do with the platform. Therefore, it has three characteristics: interactivity, security and cross-platform. It is different from Java in that it belongs to the direct translation scripting script language, but Java needs to compile into bytecode and then use the virtual machine to achieve running.

## 2.4. Development environment

According to the use requirements of the above related application technologies, we have completed the construction and deployment of the overall development environment of the system. The system adopts the B/S architecture based on Web technology, Javascript scripting language and HTML markup language are selected at the client, and APACHE HTTP server is selected as the Web server configuration. It is a commonly used Web server at present, with small size and high stability. The development language is PHP, and the database is MYSQL. LINUX is chosen as the physical environment because of its high stability and outstanding economy.

Through the explanation of the key technology theory in the system, we have determined the overall environment of system development, the configuration of related software and tools, and also made clear the overall technical feasibility of the online learning system of ideological and political education.

## 3. DEMAND ANALYSIS

### 3.1. System function analysis

The demand analysis of ideological and political education in colleges and universities from the

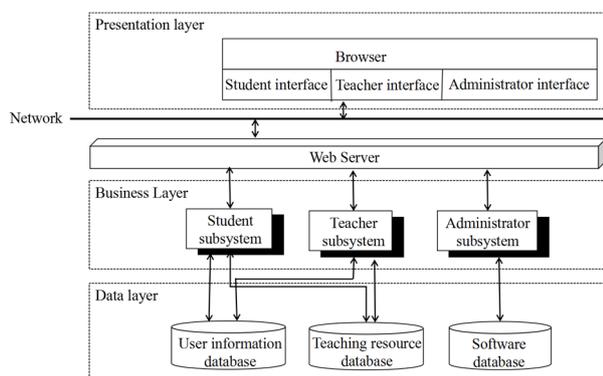
perspective of educational informationization needs to be elaborated from two aspects: realization value and realization purpose. From the perspective of realization value, some colleges and universities can't realize the value of ideological and political education by existing education methods. The fundamental reason is that the colleges and universities don't pay enough attention to ideological and political education. The specific analysis is as follows: Teachers in some colleges and universities don't put ideological and political education at the center of student education, but only regard it as one of the teaching tasks. In addition, the ideological and political education courses in most colleges and universities are very boring, and the teaching methods are backward. The teaching methods adopted by these colleges and universities are carried out through teaching materials and other forms, which is divorced from students' real life [6]. From the perspective of realization purpose, ideological and political education is to make students better adapt to society, so strengthening students' quality education will become the top priority of education. The specific analysis is as follows: To some extent, each student has different understanding of the concepts of rule of law, justice and equality, honesty and friendship, which requires teachers to implement targeted teaching for students [4]. Through the analysis of the value and purpose of ideological and political education in colleges and universities, the online learning system of ideological and political education is designed.

### 3.2. Global design

The system is constructed with a three-layer framework of B/S. The first layer is the presentation layer, which displays information, collects data and responds to user requests through user interfaces (student interface, teacher interface and administrator interface), and is the entrance for users to use the system. The second layer is the business layer, which mainly implements the requests sent by users in the presentation layer. This layer involves three major systems: student subsystem, teacher subsystem and administrator subsystem. The third layer is the data layer, where business data is stored. It has three databases. One is the user information database, which contains the basic information of students and teachers and their browsing information records. The second is the teaching resource database, which includes the teaching materials and tools used before, during and after teaching. The third is software database, which is used to store system software. Figure 3 is the content structure diagram of the three-layer framework.

The system divides user groups into three categories: teachers, students and administrators. Teachers and students only need to log in to enter the system, in which the main role of teachers in the system is to design and improve the publisher and implementer of educational

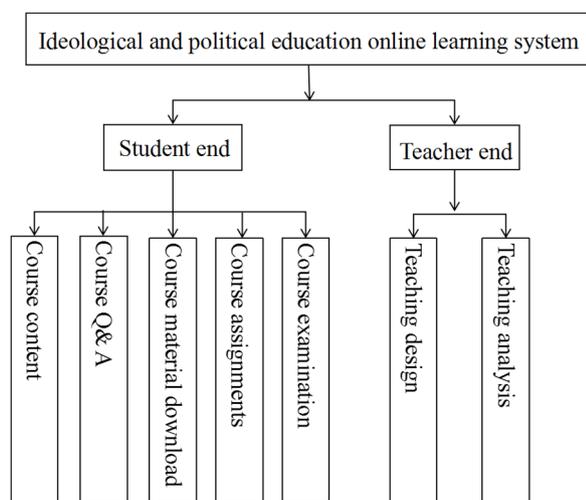
programs, and students are the subjects of education and the experiencers and feedbacks of programs. First, the teacher designs the educational scheme according to the students' learning preferences, habits and the popular trend of ideological and political topics, and then modifies the educational scheme according to the feedback from the students' experience. After logging in, the administrator enters the system, which is responsible for improving system functions and updating software in the management subsystem. Through the design of this system, it not only emphasizes that colleges and universities attach great importance to ideological and political education, but also realizes the education mode of "teaching students in accordance with their aptitude". And at the same time, it enhances students' comprehensive quality, such as strengthening students' concepts and consciousness of rule of law, justice, equality, honesty and friendship.



**Figure 3:** Content structure diagram of the three-layer framework

#### 4. FUNCTION REALIZATION

The following is an explanation of the main functions of the online learning system of ideological and political education, taking the students and teachers as examples, and its structure is shown in Figure 4.



**Figure 4:** System partial structure diagram

#### 4.1. Student end

After logging in to the online learning system of ideological and political education, students can enter the main interface. The functional modules of the main interface include course content, course question and answer, course material download, course assignment and course examination. On the student end, students can learn the course content anytime, anywhere, ask questions and answer questions about the content they don't understand in time, finish homework online, download relevant materials, and check the learning situation through online exams. In addition, the log file generated by the students' online operation records the students' operations in the learning system, such as login time, study duration, course learning times, homework completion times, data download times. After the student end submit homework, and the teacher corrects it accordingly, the completion of the homework truly reflects the students' mastery of the knowledge content in the learning process. The completion of the homework will be combined with the final assessment results, and the formed data information will be saved in the database, which will become a comprehensive evaluation standard for students' learning situation and learning effect. The questions raised by students in the daily learning process and the contents in the communication process can also reflect students' learning preferences and learning habits for ideological and political education from the side, and provide the basis for the subsequent teaching analysis. This will facilitate teachers to understand and analyze students' learning situation in time, and then guide students to adjust their learning attitude, learning methods and learning progress [9].

#### 4.2. Teacher end

Teachers can directly access the functional interface by logging into the online learning system of ideological and political education. The functional modules on the teacher end are divided into two modules, one is teaching design, the other is teaching analysis.

In the teaching design, teachers learn about students' learning preferences through questionnaires and private negotiations, learn about learning habits by analyzing students' learning situation on the student side, learn about the current trend of ideological and political education by using big data technology, and then analyze the learning styles and teaching forms suitable for current students as a whole [7]. In this process, teachers need to use the Flume NG tool of big data capture technology to collect students' daily learning and browsing situation on the student side in real time, and use the Content Grabber software of Web crawler technology to collect students' information about ideological and political education in major websites

and the current trend of ideological and political education, such as WeChat, Weibo, various learning websites, etc. Then, Sqoop is used to transfer the data of students' browsing, the combination of homework and final assessment results, questions and exchanges to HDFS, which plays the role of storing data. With MapReduce to calculate and clean the stored data, users can use Hive to query and analyze the cleaned data (the introduction of technical tools is shown in Table 1 below). Finally, teachers can get an analysis report on students' preferences, habits and hot topics of ideological and political education, and put forward educational models, such as introducing micro-classes and flipping classes in the teaching process. In addition, teachers can obtain more excellent educational information according to the report and the related data of data collection, calculation and cleaning, so as to provide better teaching programs such as teaching steps, teaching resources, classroom interaction, homework and exam questions.

**Table 1:** Tools used in Big Data technology

Big data technology	Tools used	Tool introduction
Data capture	Flume NG、Sqoop、Content Grabber	Flung NG is a real-time log collection tool; Sqoop is a data transmission tool; Content Grabber is a Web crawler technology software, which continuously obtains other web pages on the network through the hyperlink information of web pages, and can use C# to control the crawler program.
Data storage	HDFS	The HDFS is used for the data storage.
Data calculation and cleaning	MapReduce	MapReduce is used for the parallel computation of the large datasets.
Data query and analysis	Hive	Hive's main job is to translate SQL language into MR program (which saves users the process of writing MapReduce program), and provides HQL(Hive SQL) query function.

Data result presentation	Echarts	Echarts is a Javascript chart library, whose bottom layer depends on the Canvas class library ZRender, and it is a visual front-end framework.
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Teaching analysis module is that after the implementation of the teaching plan, teachers can investigate students' learning situation and learning performance from questionnaires, examination links, questions and answers, etc. to obtain students' learning effect, and analyze the effect. Finally, it needs a data visualization tool, specifically Canvas, which can be understood as a canvas and acts as a statistical analysis of the data, and managers need to write relevant Canvas programs to obtain charts. Figure 5 shows the code settings for drawing pie chart with Canvas. Including pie chart definition settings and content settings, such as coordinates, graph radian and proportion settings. Among them, ctx. fillStyle refers to setting the filling value, let x and let y refer to calculating the coordinates of the middle position of each arc, ctx. stroke () refers to the stroke tool, and the default stroke is black, and ctx.fillText () refers to the drawing percentage.

```

drewPieChart: function(){
    var shortAxis = this.width < this.height? this.width: this.height
    this.radius= 0.4 * shortAxis
    var width= this.width
    var height = this.height
    this.centerPoint= {x: width/2, y: height/2 + 20}
    this.drawPieLegend()
    this.calcPercentage()
    this.drawPie()
},
drawPie: function(){
    var offset=0
    for(let i=0; i< this.data.length; i++){
        this.ctx.beginPath()
        this.ctx.moveTo(this.centerPoint.x, this.centerPoint.y)
        this.ctx.arc(this.centerPoint.x, this.centerPoint.y, this.radius, 2*Math.PI*offset,
2*Math.PI*(this.data[i].proportion+ offset))
        this.ctx.closePath()
        this.ctx.fillStyle = this.data[i].bg
        this.ctx.fill()
        this.ctx.beginPath()
        let x= this.centerPoint.x + Math.cos(2*Math.PI*(this.data[i].proportion2+offset))*this.radius
        let y= this.centerPoint.y + Math.sin(2*Math.PI*(this.data[i].proportion2+offset))*this.radius
        this.ctx.moveTo(x,y)
        let x1 = this.centerPoint.x + Math.cos(2*Math.PI*(this.data[i].proportion/2 +offset)* (this.radius + 50))
        let y1 = this.centerPoint.y + Math.sin(2*Math.PI*(this.data[i].proportion/2 +offset)*(this.radius + 50))
        this.ctx.lineTo(x1, y1)
        this.ctx.stroke()
        this.ctx.fillText(this.data[i].proportion + '%', x1-10,y1)
        offset += this.data[i].proportion
    }
}
    
```

**Figure 5:** Code of drawing pie chart by canvas

Teachers need to pay attention to the content of data visualization, because the content of this part will decide whether to change the teachers' teaching plan, and they need to analyze students' personality and hobbies

simultaneously while analyzing the learning effect, so as to get a new teaching plan. In the teaching plan, contingency design is made for the evaluation of teaching achievements, and the previous 7:3 formula (70% of achievements and 30% of classroom performance) is changed to 4:3:2:1 [1]. Finally, the teacher provides personalized counseling for students' learning situation, personality and hobbies, and finally achieves the goal of improving students' comprehensive ability.

## 5.CONCLUSIONS

The online learning system of ideological and political education in colleges and universities based on the Web technology is the digital cultural product of the present era. With the help of Web technology, the system can query anytime, anywhere, and has the characteristics of simple maintenance and easy expansion. In addition, by using data visualization technology, the transmission efficiency of ideological and political information can be enhanced, the overall education of ideological and political education can be better operated, the latest trend of ideological and political education can be quickly identified and the teaching effect of students can be accurately analyzed, and charts superior to traditional data statistical presentation methods are also provided [8]. The design of functional modules of this system will further promote the digitalization, refinement and visualization of ideological and political education, and realize the characteristics of diversified functions, convenient operation, acceptability between teachers and students, and targeted teaching. In addition, the update of data ensures the accuracy of system knowledge. However, as an education system, there are still many imperfections. How to realize the role of all-round education and ideological guidance needs further thinking and exploration by ideological and political educators [3].

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