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## Influence of computer-based education on education and design of online education system

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### ABSTRACT

In the process of development of modern science and technology, education technology has also been developed according to its own characteristics. In the development course of the modern education technology, computer-based education plays an important role. In this paper, the influence of computer-based education on education is researched according to the change of its influential factors on schools, teachers and students aimed at the characteristics of computer-based education. In this paper, the principal component analysis method is employed to extract the main influential indexes, the layered index evaluation system is established, and it is concluded that computer-based education has a profound influence on education. The design of online education system is also researched, on the basis of summarizing the overall design function and process, the design thought is explained and the design and realization methods of database are given, so as to provide theoretical reference of the development and scale application of online education system.

### KEYWORDS

Computer-based education; Principal component analysis; AHP analysis method; Online education system; Data design.



## INTRODUCTION

Computer technology was the main achievement of the third industrial revolution, which promoted the rapid development of automation and intelligence. With such a technology development trend, people have entered the times of information technology. The mode in education field has also welcomed reform with the development of computer technology, and computer-based education has entered campus and other education institutions. It is because of the connection of computer-based education that the modern education is greatly promoted in progress. In this paper, the influence of computer-based education on education and the design of online system are researched, so as to provide theoretical basis for the deepened development of computer-based education and online education system.

Aimed at the research on the field of computer interference education, many people have made efforts, and objective achievements have been made in recent years. Sun Shaoying et al. (2013) investigated many indicators including teaching condition, course setting, resource construction, teaching method, assessment method and teaching effect from the aspect of teachers and students with 21 full-time teachers and 245 students of remote education computer major from 8 campuses and 8 county-level teaching points of Jilin Radio and TV University, and proposed several suggestions on how to improve the teaching quality of remote education computer major<sup>[1]</sup>. Guo Weiyun et al. (2014) introduced the concept, function, development course and superiority with traditional teaching of computer-aided instruction, found that applying computer-aided instruction in the project master teaching can relieve the quality difference of project master student sources, and pointed out several problems that should be noted in the computer-aided instruction<sup>[2]</sup>. Jing Guodong (2013) demonstrated the connotation and characteristics of multiple intelligence theory and computer-aided instruction software, as well as the enlightenment of multiple intelligence theory to the development of multimedia computer-aided instruction software<sup>[3]</sup>.

On the basis of the predecessors' research, the influence of computer-based education on education and the design of online education system are researched, so as to provide reference suggestions for the reform of modern education of China.

## DEFINITION OF BASIC CONCEPT OF COMPUTER-BASED EDUCATION

Computer-based education (CBE) mainly includes computer-aided instruction (CAI) and computer management instruction (CMI), the relation of the two is as shown in the figure below:

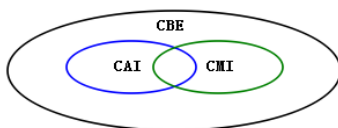


Figure 1 : Venn diagram of relation among CAI, CMI and CBE

Wang Peng (2013) pointed out that computer-aided instruction (CAI) is a modern instruction method based on computer technology and by means of text, graph, image and echoism,<sup>[4]</sup> in which the teachers use computer as an instruction media to carry out instruction activity, aid teachers to complete the instruction process, impart knowledge and exercise skills to students and promote students to achieve effective learning. CAI is the development trend of modern technology, which is appreciated by teachers and students with its friendly interface, flexible interaction, rich contents and diversified forms.

The current learning effect of students is also the reflection of instruction system function, teachers and students are the most important and active elements in the system, teaching media are tools to process and deliver the instruction information, and the channel and bridge to connect teachers and

students, students and students, while CAI acts at the role of instruction tool, and other factors influencing the instruction system also include instruction objective, instruction effect and instruction environment, the relation among various factors as are shown in TABLE 2.

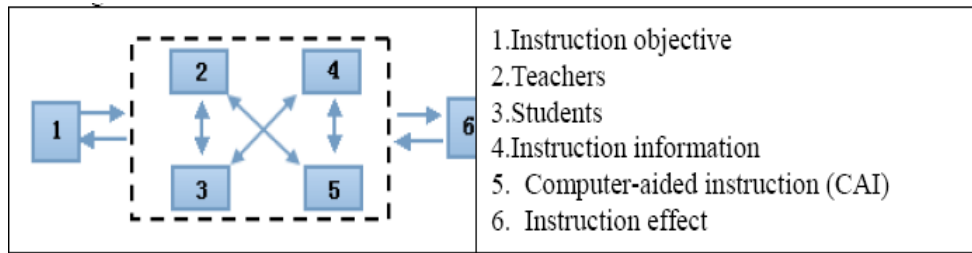


Figure 2 : Schematic diagram of relation among factors influencing instruction system

Controlled by program, computer can present various information to people, and can also accept various information input by the users, and judge the information input, and provide the targeted prompting information according to the judgment result, so after the software with instruction function is configured into the computer, the computer constitute an instruction system with students like human teachers to complete certain instruction task.

Generally, computer management instruction (CMI) is considered as the application of computer in the school management, in a narrow scene, CMI means the process of using computer to manage the class instruction.

The generation and development of computer-based education is the greatest leaping since the invention of textbook in the human education history, which changes people’s thinking mode, breaks through the traditional education mode, education theory, instruction method and means, being a great reform in the education field, promoting the process of education modernization and taking a great step toward education equality<sup>[5]</sup>.

Computer-based instruction generally includes F-assistance mode, D-2 direct mode and C-cyclic mode, as shown in Figure 3.

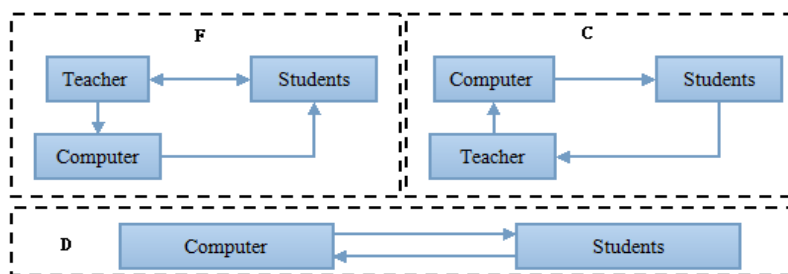


Figure 3 : Different modes of computer-based instruction

### INFLUENCE OF COMPUTER-BASED EDUCATION ON EDUCATION

Research target in education field, in this paper, school, teacher and students are selected, i.e. the influence of computer-based education on school, teacher and students. In this chapter, through the analysis on influence of computer-based education on these three aspects, the influence of computer-aided education on the development of Chinese education is evaluated<sup>[5]</sup>.

In order to find out reasonable evaluation factors, principal component analysis method is selected to screen the influential indexes, so as to achieve emphasized analysis.

#### Theoretical basis for principal component analysis

In the research on actual problems, there are totally  $p$  indexes influencing the research objective, which can be taken as the random variables and recorded as  $X_1, X_2, \dots, X_p$ , while the purpose of principal component analysis is to convert the problem of these  $p$  indicators into the discussion on the linear combination problem of  $p$  indexes to constitute comprehensive  $k$  new indexes which are mutually independent, in which  $k$  is less than  $p$ , and actually, it is a process of mathematical dimension reduction of more indexes through linear combination, and its mathematical expression is as shown in Formula (1):

$$\begin{aligned}
 F_1 &= u_{11}X_1 + u_{12}X_2 + \dots + u_{1p}X_p \\
 F_2 &= u_{21}X_1 + u_{22}X_2 + \dots + u_{2p}X_p \\
 &\vdots \\
 F_k &= u_{k1}X_1 + u_{k2}X_2 + \dots + u_{kp}X_p
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 &\Downarrow \\
 F = \begin{bmatrix} F_1 \\ F_2 \\ \vdots \\ F_k \end{bmatrix} &= \begin{pmatrix} u_{11} & u_{12} & \dots & u_{1p} \\ u_{21} & u_{22} & \dots & u_{2p} \\ \vdots & \vdots & \vdots & \vdots \\ u_{k1} & u_{k2} & \dots & u_{kp} \end{pmatrix} \begin{pmatrix} X_1 \\ X_2 \\ \vdots \\ X_p \end{pmatrix} = AX
 \end{aligned}$$

The coefficient sum of squares of each principal component in Formula (1) is 1, the principal components are mutually independent, and the variance decreases progressively, i.e. to it is needed to meet the relation as shown in Formula (2):

$$\begin{cases} \sum_{j=1}^p u_{ij} = 1; \text{Cov}(F_i, F_j) = 0; i \neq j; i, j = 1, 2, \dots, k \\ \text{Var}(F_1) \geq \text{Var}(F_2) \geq \dots \geq \text{Var}(F_k) \end{cases} \tag{2}$$

The steps of using covariance matrix for principal component analysis are as shown in the following:

STEP 1. Calculate the covariance and its characteristic value with Formula (3)

$$|\Sigma - \lambda I| = 0 \tag{3}$$

STEP2. Calculate the characteristic vector corresponding to the characteristic value of covariance with Formula (4)

$$\sum a_i = \lambda_i a_i \tag{4}$$

STEP3. The coefficient of the first principal component is equal to the characteristic vector corresponding to the first largest characteristic root of the covariance matrix, the coefficient of the second principal component is equal to the characteristic vector corresponding to the second largest characteristic root of the covariance, and so on.

STEP4. Calculate the accumulative contribution rate and give the appropriate number of principal components.

STEP5. Calculate the scores of  $k$  principal components selected, substitute the centralized value of the original data into the expression of  $k$  principal components to respectively calculate the scores of  $k$  principal components of various samples.

### Determination of analysis indexes of influential factors

The emerging and rapid development of computer-aided education change the purpose, contents, forms and means of school education, and the influence of computer-aided education on the school education does not remain unchanged, but is developed with the continuous development of computer-based education itself. In this paper, a specific analysis is made with the roles played by computer, namely learning target, learning tools, instruction tools and management tools.

Due to the particularity of computer-based education, teachers do not only needed to teach students how to use computer, but also require to guide the students' active learning, guide them to grow in a relaxed and happy environment, ask students to learn the ability of learning, thinking, solving problems, inventing and creating independently and comprehensively improve their quality under the condition of learning progress. In this paper, the indexes are set aimed at the transformation of teachers' concept with computer-based education<sup>[6]</sup>.

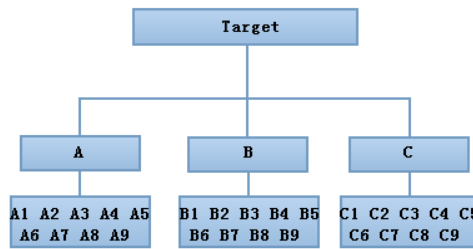
Students are always in the principal status in the whole education process, therefore, students are themselves are most influenced in the computer-based education. The development of computer hardware provides many learning tools for students, the application of which enables students to be more convenient and autonomous to obtain instruction resources under the open network environment. In this paper, the index is set from the aspect of effect of computer-aided instruction.

The condition of analysis indexes of main influential factors obtained with principal component analysis is as shown in TABLE 1.

TABLE 1 : List of analysis indexes of influential factors

Influential index on school A			Influential index on teachers B			Influential index on students C		
Role	Symbol	Index	Concept transformation	Symbol	Index	Learning effect	Symbol	Index
Learning target	A1	Education contents	Instruction objective	B1	Individuality development	Education level	C1	Knowledge reserve
	A2	Initiative		B2	Information quality		C2	Knowledge exploration
Learning tools	A3	Individuality	Teaching materials	B3	Data form	Learning ability	C3	Knowledge comprehension
	A4	Learning interest		B4	Multimedia		C4	Information retrieval
	A5	Learning ability		B5	Knowledge impartation		C5	Learning awareness
Instruction tools	A6	Instruction means	Teacher' roles	B6	Learning resources	Innovation ability	C6	Learning method
	A7	Instruction form		B7	Learning process		C7	Invention and creation
Management tools	A8	Transparency		B8	Cooperative learning		C8	Diffused thinking
	A9	Work efficiency		B9	Teaching research		C9	Learning interference

The index system of influential factors as shown in Figure 4 can be obtained from TABLE 1.



**Figure 4 : Index system of influential factors of computer-based education on education**

A1 in Figure 4 reflect learning target, A2-A5 reflect learning tool, A6 and A7 reflect instruction tools, A8 and A9 reflect management tools, B1 and B2 reflect instruction objective, B3 and B4 reflect teaching material innovation, B5-B9 reflect teacher’s roles, C1-C3 reflect education level, C4-C6 reflect learning ability and C7-C9 reflect innovation ability.

**Evaluation steps and result**

AHP analysis method can be applied to evaluate the change level of influenced indexes, and the quantitative evaluation result is obtained, the steps of AHP analysis method are as shown in the following:

STEP 1 Construct a judgment matrix of mutual comparison

The factors in each level can be simplified into the judgment comparison of a series of paired factors by contrast to the single sequencing of a factor in the upper level. In this paper, Saaty (1-9 rate scale) is introduced, an then it is written into a matrix form, as shown in the judgment matrix form in TABLE 2.

**TABLE 2 : Judgment matrix form**

	A <sub>k</sub>	B <sub>1</sub>	B <sub>2</sub>	...	B <sub>n</sub>
B <sub>1</sub>	<i>b</i> <sub>11</sub>	<i>b</i> <sub>12</sub>	...	<i>b</i> <sub>1n</sub>	
B <sub>2</sub>	<i>b</i> <sub>21</sub>	<i>b</i> <sub>22</sub>	...	<i>b</i> <sub>2n</sub>	
⋮	⋮	⋮	⋮	⋮	
⋮	⋮	⋮	⋮	⋮	
B <sub>n</sub>	<i>b</i> <sub>n1</sub>	<i>b</i> <sub>n2</sub>	...	<i>b</i> <sub>nn</sub>	

STEP2 Convert the initialized judgment matrix into a comprehensive judgment matrix

First, the initialized judgment matrix is subject to the calculation of mutual comparison value of each indicator according to the calculation method of geometrical mean, and converted into the final matrix, then, the final matrix is calculated according to the method in Formula (5) to get the comprehensive judgment matrix.

$$\begin{cases}
 A(S) = [a(S)_{ij}]_{n \times n} \\
 a_{ij} = k^* \sqrt[k^*]{\prod_{S=1}^k a(S)_{ij}}, S = 1, 2, \dots, k; i, j = 1, 2, \dots, n
 \end{cases} \tag{5}$$

STEP3 Calculate the characteristic matrix corresponding to the largest characteristic root of the comprehensive judgment matrix, and then normalize this vector to get the weight corresponding to each index;

STEP4 Check the consistency of comprehensive judgment matrix;  
The calculation method of consistency index CI is as shown in Formula (6)

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (6)$$

When the comprehensive judgment matrix is of complete consistency,  $CI = 0$ ; the larger CI is, the poorer the consistency will be. In order to determine the satisfaction membership of CI, the average random consistency index RI of 1-9-order matrix, as shown in TABLE 3.

TABLE 3 : Average random consistency index of 1-9-order matrix <sup>[4]</sup>

1	2	3	4	5	6	7	8	9
0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45

When the order number of comprehensive judgment matrix is more than 2, the ratio between judgment matrix consistency index CI and average random consistency index RI of the same order is called the random consistency proportion CR of the judgment matrix, when  $CR < 0.10$ , the judgment matrix has the satisfactory consistency, otherwise, it is needed to adjust the judgment matrix.

1) As a learning target, computer enriches the education contents, and has been more and more recognized by schools and education institutions by virtue of its strong data resources and good interaction; as a learning tool, it makes learning more active and individualized and improves the learning ability; as an instruction tool, it makes the teaching means and forms more diversified, and is helpful to improve the education quality; as a management tool, it enhances the transparency of school management, improves work efficiency and is beneficial for the construction and development of schools.

2) Influence on teacher. Computer-based requires teachers to apply the completely new education concept to the whole instruction process, so as to be beneficial for the innovation of teaching objective; in the information of times of information, teaching materials are no longer the purely paper books, but also include the electronic teaching materials and audio and video data applied for study; in the process of computer-based education, the teachers' role of just imparting knowledge is gradually diluted, while the role of how to guide students learn has been strengthened.

1) Computer-based education is a kind of education towards the future, an important approach to cultivate the students' awareness and improve their scientific and cultural qualities. It is both for the demand of occupation and life, and also the cultivation of thinking skills. In terms of quality-oriented education, online education can completely play the role of situational education, happy education, successful and credit education.

## DESIGN OF ONLINE EDUCATION SYSTEM

### Overall design

The online education system mainly provides an online instruction platform, with users including teachers and students, so during design, it is required to include two major functions, and the functions can be designed according to the teacher part and student part.

The functions needed by the teacher part is shown as follows:

- 1) Release information to students through instruction announcement.
- 2) Release teaching plan on line.
- 3) Release assignment on line.
- 4) Check assignment and score the students.
- 5) Have a real-time discussion with students through chatting room

The functions needed by the student part is shown as follows:

- Read announcement
- Complete course learning on line.

Complete assignment on line, including assignment download, assignment content upload and score inquiry etc.

- Raise questions to students in the form of discussion group.
- Have a real-time discussion with students through chatting room

The overall design needs to consider the functional link between teacher and students above, and the functional flowchart as shown in Figure 5 is established.

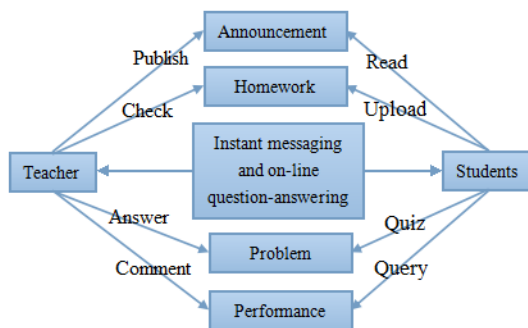


Figure 5 : Functional flowchart

**Design thought**

The online education system need designed in this paper is characterized by practicability, simple operation and good code readability, and the multiple pages of the system are to direct access the data and file system through ASP program, in addition, there are also some ASP programs visit the database through establishment.

The system structure is as shown in Figure 6.

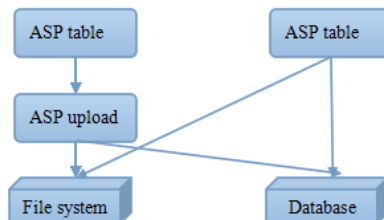


Figure 6 : System schematic diagram

**Design and realization of database**

The following items and data structure are listed according to the demand of online education system:

- Announcement information: title, release time, announcement contents, and announcement number etc.
- Teaching plan inquiry index: key words, description and content location etc.
- Doubt solving information: question title, question content, answering content, question time, display mark and answering mark etc.
- Student information: student name, student number, ranking, and assignment scores.

The announcement information is as shown in TABLE 4.

TABLE 4 : List of announcement information

Field	id	title	input date	detail	idnum	Flag_attention
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name						
Data type	Automatic numbering	Text	Date/time	Remarks	Figure	Yes/No
Note	/	Announcement title	Release time	Announcement content	Ranking number	Important information mark

The teaching plan inquiry index is as shown in TABLE 5.

**TABLE 5 : List of teaching inquiry plan**

Field name	id	Keyword	details	page
Data type	Automatic numbering	Text	Text	Text
Note	/	Key words	Description of key words	Target page URL

The doubt solving information is as shown in TABLE 6.

**TABLE 6 : List of doubt solving information**

Field name	id	title	Flag_show	Flag_answer	detail	answer	Time_qry
Data type	Automatic numbering	Text	Yes/No	Yes/No	Remarks	Remarks	Date/time
Note	/	Question title	Display mark	Answering mark	Question contents	Answer contents	Question time

The students' information is as shown in TABLE 7.

**TABLE 7 : List of student information**

Field name	id	Num	Name	Department	Score1	Score2	Score3	Score4
Data type	Automatic numbering	Text	Text	Text	Figure	Figure	Figure	Figure
Note	/	Student No.	Name	Class No.	Score of the first assignment	Score of the second assignment	Score of the third assignment	Score of the fourth assignment

The text for the background database uses Access, the database server and WEB server can be configured in the same computer, the specific configuration is as shown in the following:

- Create a new blank database, and name it 为newdata.mdb.
- Create establish board, keyword, problem and student in 为newdata.mdb.
- Create an ODBC data source, name it as newdata and point to 为newdata.mdb.

In the window "ODBC Microsoft Access, the data source name is "newdata", which will be referenced in ASP program. Click "Select..." button, select the location of newdata.mdb file in the window popping up, and other options remain unchanged. Click "confirm" to complete the ODBC data source setting of Access database.

## CONCLUSION

This paper mainly researches the influence of computer-based education on education and the design of online education system. In the research on the influence of computer-based education on education, principal component analysis method is used to extract the indexes of influence on school, teacher and students, and the AHP evaluation method of evaluation system to get the influence of computer-based education on education. Aimed at the research on the design of online education system, the overall design function process and the systematic structure of design thought are given, and on this basis, the database is designed, the announcement information table, teaching plan inquiry index table, doubt solving information table and student information table are given, and the setting method of ODBC data source is given.

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