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Personalized E-Learning Mode for Computer Major Student: Experimental Teaching based on Big Data Platform

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Abstract

Online learning is an inevitable trend of the development of network education, by making full use of the existing network resources; we can develop a personalized online learning system. In this paper, the author analyzes the personalized E-learning mode for computer major student and makes an experimental teaching test. It is the core and key point of the research on educational technology that adaptive and personalized online learning system could automatically identify the characteristics of learners, and recommends appropriate guidance, learning resources and practice. Through the experimental teaching of computer professional students, the result shows that adaptive learning analysis platform can effectively improve student achievement.

Keywords: *E-Learning, Experimental teaching, Big data platform, Adaptive learning*

1. Introduction

Online learning is the inevitable trend of network development, which is a form of distance education, online learning is a kind of modern computer technology [1]. Network application in practice, make full use of existing network resources, to develop beyond time limit, break through the traditional teaching mode, highlighting the personalized online learning the system, not only can optimize the network education resources, universal education, improve the overall quality of the people, but also can greatly reduce the cost of education, improve teaching quality, to meet the individual characteristics of learners' needs [2]. It can bring huge economic benefits and social benefits to the country and education, and promote the rapid development of network education the digital word technology, increase and improve the quality of teaching significance, has a very wide social value [3]. Big data era of online learning, to achieve a comprehensive record, tracking, grasping and visual learners with different learning characteristics, learning needs, learning and learning behavior for different students and establish learning model for different types of learners to create personalized learning path.

However, with the development of artificial intelligence, information technology and education theory, the online learning platform designed in advance to arrange the learning process and content has been unable to meet the individual needs [4-5]. Personalized learning has become a hot spot and has been studied by many experts. In the domestic and foreign educational technology research and application in the field of adaptive and personalized online learning system of automatic recognition of learner characteristics and recommended to adapt to the guidance, learning resources and practice, become the core and key research[6]. At present, such as Sakai, Moodle, Blackboard personalized teaching management system is very popular in the world, according to the different needs of the main body of the development of an automatic recommendation function of personalized online learning system is the trend. Personalized online learning system and the interaction between the environment, is a member of the system more open, multi-level, involving ginseng and intelligent decision support system is an open complex

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intelligent systems. In the system, the basic information, browsing behavior, long-term interests and short-term interests are the key elements of a class of complex variables.

2. Personalized Recommendation System based on Big Data Platform

2.1. Big data content

Data is the carrier of information and the source of knowledge. The explosion of data means that the scope of human records, the scope of measurement and analysis of the scope of the expansion of the boundaries of knowledge in the continuous extension [7]. The data is more and more strong visibility, accessibility and usability, characteristic and law of the development of more and more detailed, accurate, comprehensive and timely reflect the individual's thinking, behavior and emotion and things, to more effectively enhance the human productivity and the quality of life of service. Along with the development of mobile the Internet is to meet the big data, to understand big data can be discussed from two macro and micro level, of which the majority of scholars at home and abroad related research big data from the macro level, which is defined as the need for new treatment mode in order to have more decision-making power, insight discovery and process optimization ability the massive [8-9], high rates of growth and diversification of information assets, with the characteristics of 4V, such as Volume, Velocity, Variety Veracity , Some scholars believe that the other two V:Value and Visualization.

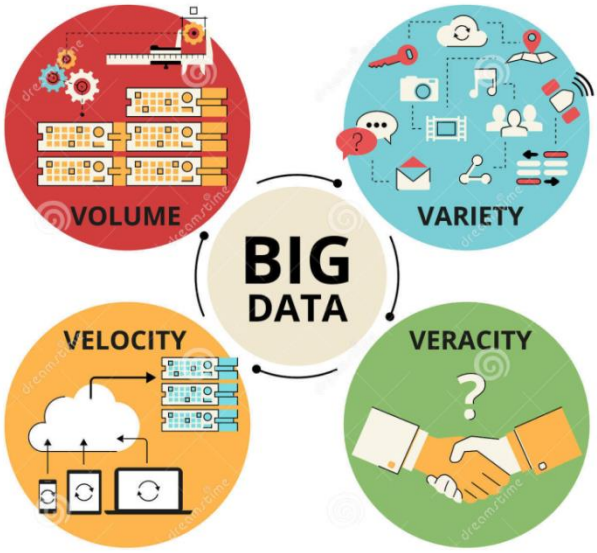

Figure 1. Big data features

We believe that from a macro point of view is not enough to realize that big data applications and application value, especially in the field of education, but also from the micro perspective to understand the connotation of big data, it is a kind of value outlook and methodology [10]. Big data, its focus is not on its representation of large capacity, but in the analysis of the overall data and potential value. Big data analysis in education should be measured with new thinking and technology on performance of micro learning process, from multiple dimensions, such as the degree of effort, learning attitude, intelligence level, field capacity, interaction and collaboration of deep mining of valuable data, reveal its hidden learning behavior model and present by the way of visualization, a realization of teachers according to the learners' learning behavior analysis of the knowledge base and cognitive ability for learners to customize personalized learning programs, the implementation of the teaching intervention, promote teaching and

learning; on the other hand, systematically recording, tracking and master learner characteristics, learning needs, learning and learning behavior is different the type of learning adaptability push the teaching resources and learning path, promote the individual understanding of the learning and teaching of knowledge structure, the development of personalized supplies. In fact, teachers and students, all school every word and action, all things can be transformed into data. When every student can learn to use computer terminal, including lectures, reading, writing notes, homework, blog, experiment, discussion, participation in various activities is a source of data on education. Corresponding to these students in the use of these courses online learning, interaction, mutual aid, these will be the big data. Due to the existence of blind spots people's feeling, intuition cannot be trusted, rational thinking is limited, even if the brain has a remarkable memory, it is not surprising the information processing ability, so it is the learning needs of students so as to push them the most appropriate learning resources, also is evaluated according to the educational behavior of students. We need big data to record and self quantification based on research and analysis of their online learning behavior, out of illusion, true understanding and improve themselves.

Figure 2. Big data platform

In the United States, the British higher education, some academics have already proved that the big data detection based on the analysis of students' reading online course materials, assignments, and communicate with students in tests and exams, know the warning information leads to bad learning performance, put forward the improvement suggestion, given some intervention guidance, to ensure that students in the most effective the most efficient way of learning, which can improve the students' attendance, the dropout rate, improve academic performance, improve teaching. Harvard and MIT study data analysis EDX course platform information, study the world of learner's behavior pattern, increase the behavior evaluation and learning induced components, easy to build a better online platform, make the most of learners, use the above. In addition, some foreign companies to explore the application value of big data in education, America's dream box learning and Newton company, has created and released by big data of the adaptive learning system, to provide personalized learning services to hundreds of thousands of students. To provide authentic learning data to them, let the school to enhance the learning effect of students through these data and reduce the cost of teaching. New York's Mcgraw Hill company, London Pearson group to jointly develop the "curriculum spirit" system, students can progress tracking, and show the participation of students and academic achievements such as a large amount of data. Canada "eager to

learn" for enterprises in the field of higher education students launched the "students" system, systematic analysis of each student's learning online data, timely diagnosis of the problem, put forward some suggestions for improvement, and to predict the student's final examination.

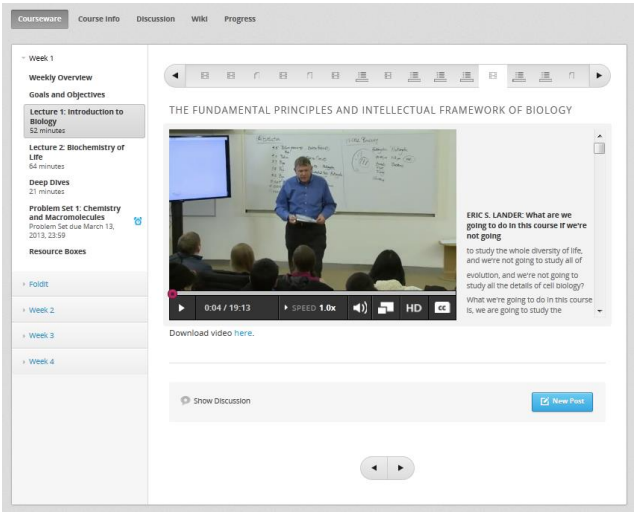

Figure 3. EDX courses platform

2.2. Personalized recommendation system

With the continuous development of network technology, users in the face of the ocean of information cannot get really useful information, the efficiency of the use of information is reduced, which is the phenomenon of information overload. In order to solve the problem of information overload, personalized recommendation system is a potential solution. Based on the user interest and information needs of the recommender system, the user will be in line with the interests of the information and products recommended to the user, so as to achieve personalized service. Personalized recommendation system since its emergence has received extensive attention and application, which is the most typical application field of electronic commerce, embodies the good prospects of development and application.

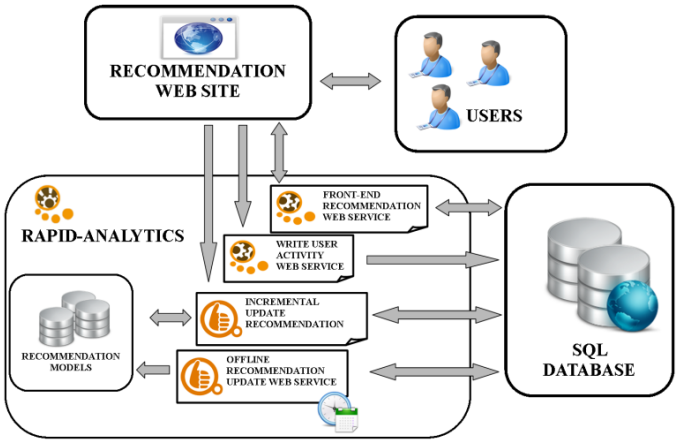

Figure 4. Personalized recommendation

Recommend the system model, including the user modeling module, the proposed object modeling module and the recommendation algorithm module. Personalized information storage user model users, recommendation feature information model database object storage system, recommendation system to match feature information of the two models are used to calculate the corresponding recommendation algorithms, shoe recommends object that the user may be interested in, so as to achieve the purpose of personalized recommendation. A formal definition of recommendation system: recommended object model for the collection of user models for collection, selection of utility function μ(c,s) is used to recommend to the user level calculation object, to a large extent, the recommended algorithm determines the performance of the recommendation system, is the core and key part. Recommendation algorithm mainly includes content-based recommendation algorithm and collaborative filtering recommendation algorithm.

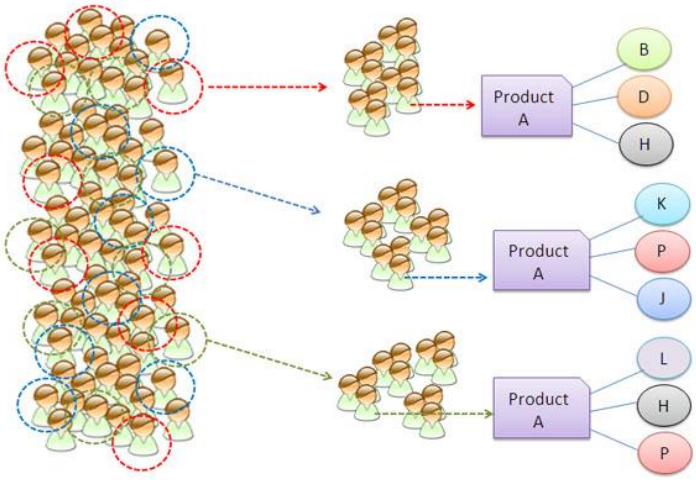

Figure 5. Collaborative filtering recommendation

By comparing the similarity between the learner's interest model and the curriculum resources in the system library, the author proposes a new method for the learners. Among them, there are many methods to calculate the similarity between the learner's interest model and the curriculum resources:

$$Similarity(S,C) = \cos(w_s, w_c) = \frac{\sum_{i=1}^{k} w_{i,s} w_{i,c}}{\sqrt{\sum_{i=1}^{k} w_{i,s}^2} \sqrt{\sum_{i=1}^{k} w_{i,c}^2}}$$

The calculated similarity values are sorted according to size, and the most preferred object is recommended to the learner. With the advent of the era, the development of mobile devices and wireless communication technology, online learning will usher in more and more users in the context of the development of many network universities and the development of distance education. At present, it is a popular online teaching management system in the world.

- ***Sakai:*** Sakai is an online collaborative course management system, learning management system, and the virtual learning environment, users are mainly distributed in the United States and Europe, by a number of educational institutions adopted; curriculum construction based on space support standard curriculum and content reorganization and integrated database can only test with

real time (Q & A) and virtual laboratory that can carry out guidance and detailed record and tracking of learning behavior.

- ***Moodle***: it is a virtual learning environment, the application of most universities in our country by using this platform, users can according to the needs at any time to change and adjust the content of the interface, can classify and search the curriculum, learning courses according to their own needs
- ***Blackboard:*** it is a digital teaching platform, developed by the American company; digital teaching refers to digital teaching, teachers and students can form in multimedia and network platform for the exchange of a variety of courses; online teaching management system, is a curriculum integrated network centric "teaching" and "learning" teaching environment; you can set up the network curriculum on the platform, learners can choose to learn the curriculum content of courses and independent learning; different between learners and teachers and learners can according to the teaching and learning need to discuss and exchange.

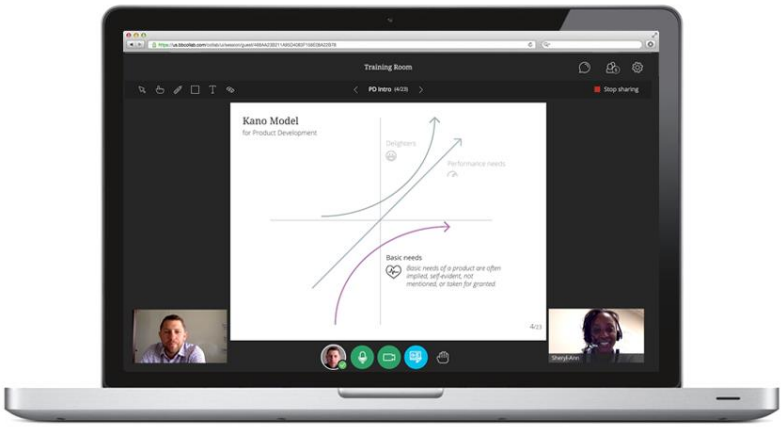

Figure 6. Blackboard teaching platform

3. Personalized Online Learning Platform

3.1. Adaptive learning process

The dominant and recessive data analysis data, construct the model of learner characteristics, and to provide a learning path, adaptive learning objects, and teachers can also according to the learners' learning behavior and learning needs, the implementation of personalized guidance and intervention, the whole process is interactive learning between learners and learners, and system the teacher, however, failed to interaction between learners and learners of learners is not conducive to the discovery of new knowledge, so the personalized learning system based on large data also need to take into account the use of collaborative filtering technology to push learners and have the same or similar preference characteristics of learning information, namely the whole learning process not only to achieve the control of learners learning, self-regulated learning, teachers' guidance and personalized intervention, to achieve the system according to the user. The characteristics of the adaptability of the physical resources to promote learning and push with similar interest in learning preferences of learners in the learning process to produce information to learn.

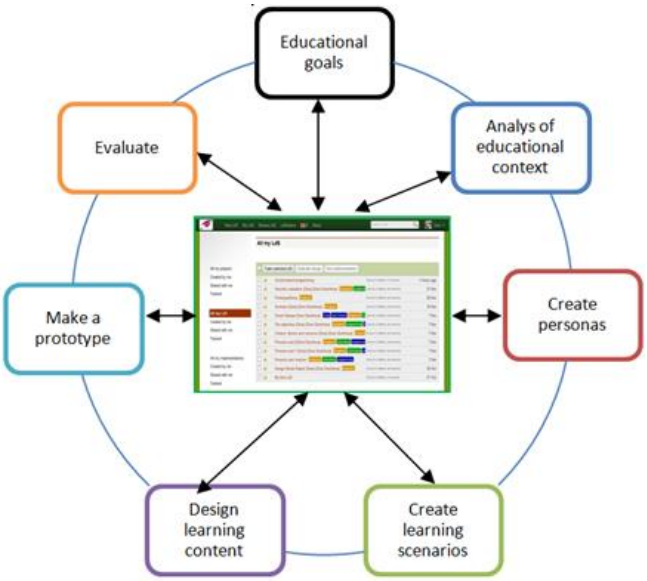

Figure 7. Adaptive learning structure

Based on the large data personalized adaptive learning structure is composed of 7 parts, which fully illustrates the ways and methods of learning. Learning can be achieved according to the dashboard visualization information (such as the characteristics of learners, learning results and learning needs) self organization learning, develop and implement learning plan, choose learning strategies, learning resources, self-evaluation of learning, helps improve learning initiative and initiative of students can be realized; the use of Bayesian network, collaborative filtering technology, item response theory and Felder-Silverman learning style model and culture model to determine the Hough Stender learning styles, preferences, knowledge level, learning the learner characteristics, adaptability and visual presentation of personalized learning path, learning resources, peer information, tools, help develop the students' self-efficacy; teachers can achieve the management of user information, according to the visual information panel, adjust Teaching strategies, the implementation of personalized guidance and teaching intervention, help to master the learning rules of students, optimize the learning process, improve the learning effect, improve the quality of education.

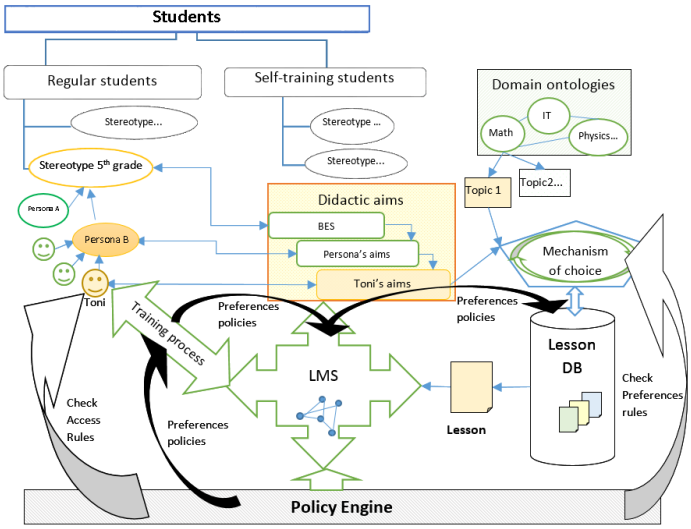

Figure 8. Adaptive learning for students

3.2. Online learning analysis model

From the structure of personalized learning process based on large data, we can see that it is necessary to consider the individual characteristics of students, but also to consider the valuable information from the massive data. Therefore, this study combined with the project research and development of adaptive learning system to individualized autonomous learning, personalized recommendation, personality psychology and computer science as the theoretical basis, from the data and the environment, benefit person, method and target and other 4 dimensions to build personalized online learning model,

(1) data and environment: Data environment is mainly the adaptive learning system, social media (such as blogs, social networks, micro-blog, Wikipedia, podcasts, *etc*.) and traditional learning management system (such as Blackboard, Moodle, *etc*.) and open learning environment (such as MOOCs), after learners and learners, learners and teachers, learners and resources directly and the indirect interaction generated after the massive data (including structured data and non structured data and semi-structured data), most data from the adaptive learning system in reading and writing, evaluation, resource sharing, test data and interactive activities generate data, big data for prediction, learning, learning behavior, intervention treatment personalized learning provides an important basis. At the same time, the need to consider the open, fragmented and heterogeneous data environment to generate data for effective polymerization, to meet the learning needs of learners, learners achieve active construction of knowledge resources, promoting learners' autonomous learning online.

(2) benefit person: According to the role of different stakeholders, including students, teachers, intelligent tutors, educational institutions, researchers and system designers, including the top 4 impact. For students, consider the self organizing learning, also need to have the ability to protect user information, to prevent data from being abused, pay attention to privacy and ethical issues; for teachers, according to the teaching intervention strategy, learner information adjustment; for the intelligent tutor, according to the characteristics of learners, such as learning styles, preferences, knowledge level so, the personalized recommendation of learning resources and learning path; for educational institutions, analyzed the potential risk warning and intervention of the students, improve the students' final exam, the usual attendance, dropout rates, enrollment rate, *etc.*

(3) method: In order to complete the record, track and grasp the different learning characteristics, learning needs, learning and learning behavior, and for different types of learners to create personalized learning, the analysis is mainly based on statistics, knowledge visualization, personalized recommendation, data mining and social network analysis and data learning. The main statistical methods using correlation analysis and regression analysis to determine the influence of learning related factors in interactive behavior and performance and build a structural model, play a role in early warning; the use of visualization technology to make learners more easy to understand knowledge resources, promote learners to actively construct knowledge and knowledge migration; Personalized Recommendation Techniques include content recommendation technology and collaborative filtering technology based on the realization of system based on learner characteristics personalized push learning resources, learning path; the commonly used data mining technology with prediction, clustering, association rule mining, for collecting, processing, analysis of learning behaviors, extract valuable information, understand what the students have mastered and no matter what, then the implementation of the teaching intervention, so as to improve teaching; using the method of social network analysis, can The formation of interpersonal network, not only can understand the learners how to study in the network to establish and maintain relations so as to provide support for their own learning, but also can determine which learners got inspiration from which there had

a companion, cognitive difficulties learners where, what is the influence of situational factors on the learning process. Of course, the most important is to consider the integrated use of these technologies, through large data designed to improve student achievement to provide personalized learning support analysis system, and to ensure that the system has good performance, availability and scalability.

(4) target: Big data analysis can be found and learning based on learning behavior of information hidden, for all levels of users, to achieve the goal of the main monitoring / analysis / forecast, intervention, intelligent tutoring / evaluation / feedback, adaptive and personalized recommendation and reflection and formulate corresponding measures. Among them, adaptive and personalized recommendation is the two most important goals, to achieve two main needs of learners in network learning environment: one is the control of learners learning that learners actively adapt to distance learning, learners achieve self organize, develop and implement learning plan, choose learning strategies for self assessment of learning; the second is adaptive learning, is a kind of system resources to the initiative into learning mode, predict learning style, preferences, knowledge level, learning culture learner characteristics, the implementation of appropriate teaching strategies, Individualized adaptability and visual learning path, learning resources, peer the tool, *etc*.

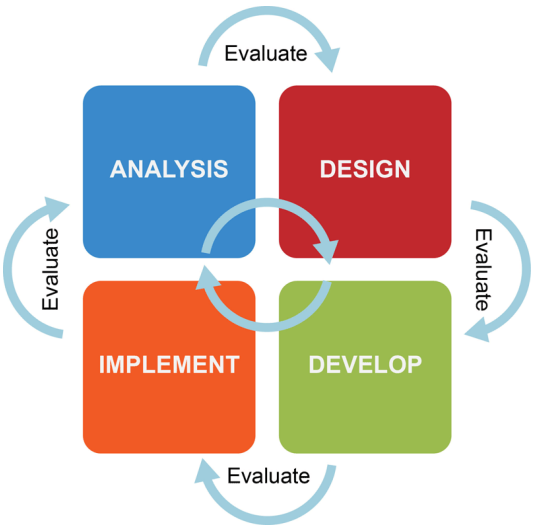

Figure 9. A Online learning analysis model

4. Personalized Adaptive Online Learning Experiment Teaching

4.1. Adaptive learning for students majoring in computer science

The learning content to the knowledge map visualization presented to students, can achieve effective organizational knowledge, to comply with the study based on the visual processing habits, the logical relationship between clear representation of knowledge and knowledge, reduce the cognitive load of learners, learners promote meaningful learning, and knowledge of long term memory active construction and migration. At the same time, the structure of knowledge visualization can make learners explore, curiosity and understanding of cognitive needs, making their interest and attention, conscious tendency to solve problems, resulting in a need for cognition, stimulate curiosity, active learning desire, C++ program design as an example, when learning a knowledge point. Learners can choose from the knowledge structure map, can also choose to click the left from the tree of knowledge system of adaptive learning, the system will be based on learners' learning styles and characteristics of cognitive ability adaptability push the best learning

resources, learning example sequences, a sequence of learning activities expressed in the learner's learning style and suitable for learners to practice and test, which can be used for adaptive learning and self organizing learning. In addition, the system also uses the right way to learn the knowledge of knowledge points of the knowledge, the knowledge and related knowledge, the formation of new knowledge and original knowledge, knowledge of the association will be displayed, and help learners to construct knowledge learning.

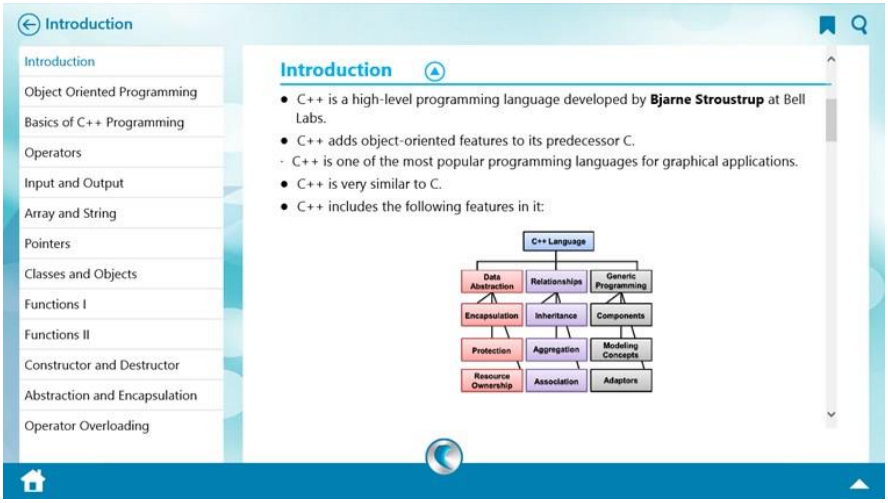

Figure 10. The learning process visualization

This study uses data analysis of instant tracking learning process visualization and quantitative study, can make in an intuitive form to learners, peers and teachers in wisdom, to make it more clearly to see the dynamic change process of cognitive learning, to understand their latest study status, know the final distance the goal of learning gap, stimulate intrinsic motivation of learning, self understanding, self development, self planning, improve students' met cognitive ability and self-efficacy. As shown in the figure, a panel of visual information including the learners' learning time, learning times, learning record and learning ability, adaptability evaluation based on item response theory, on the other hand, learners' social relationships through a link, to facilitate learning through social circle sharing achievement or help, get emotional support and information support. You can also choose to view the peer learning process information. According to the theory of social comparison, peer information is an example effect, which can enhance learners' intrinsic motivation.

4.2. An empirical study on the effect of learning

In the big data analysis support overall record, track and grasp the different learning characteristics, learning needs, learning and learning behavior, and learning paths for different types of learners to create personalized, dynamic adjustment factors for the implementation of the teaching contents, time and methods of intervention teaching can enhance students. The learning efficiency. To test this idea, at the same time in order to verify the effectiveness of the proposed adaptive personalized online learning model based on large data analysis, the adaptive R & D project team oriented "service" learning system platform, and selected 100 students as the research object for "C++ program design" course of study, it will be randomly divided into two groups, experimental group (adaptive learning) and control group (non adaptive learning), every 50 people, there is no significant difference between the two groups of students' cognitive ability. At the same time, according to the pre-test and the components for poor students (0-4)and excellent students (5-9), after two months of learning process, all students in the experimental

group and the control group were measured after knowledge, part of the data analysis results are shown in the following table.

Table 1. Data analysis to study results

variable	control group		Experience group	
	Poor students	Excellent students	Poor students	Excellent students
Pre test	4.0	5.1	4.1	5.9
Post test	6.4	7.3	7.9	8.2
Learning time	2085	1625	1560	14650
Wrong number	59	27	18	9
times try to solve	43	65	24	18

From the data in Table 1 can be seen in the experimental group of poor students learning achievement promotion effect is obvious, the results from the pretest posttest 4.1 increased to 7.9, compared to the best student performance is not obvious, outstanding students of the experimental group and the control group in the study result and there is no significant difference, the reason lies in the difference analysis students completely according to the personalized recommendation system of adaptive learning path and appropriate difficulty learning materials for learning, and student autonomy is relatively strong, not completely believe in recommendation system, sometimes path choice, learning resources. Therefore, the personalized adaptive learning analysis model based on large data is more useful for the guidance of poor students. In addition, the data in the table of the learning time, the number of abandoned problems and try to solve the problem the number of students in the experimental group than the control group students, higher efficiency, the main reason is that the students in the experimental group, the system will be based on the analysis of behavior and knowledge of the data on students' learning, more accurate judgment the students' cognitive ability, appropriate difficulty and adaptability of personalized push with the cognitive level of students, so most of the problems can be answered without giving up the students accurately, or attempts to solve.

5. Conclusions

The data created by each learner is part of the "big data", each of which is the producer and consumer of the big data. The analysis for the learning process of the era of big data has a strong practical value, in the analysis of large data support, learning resources, learning personalized push quality analysis will be a feasible solution, the realization of personalized learning demands a new way in the era of big data. The proposed personalized online learning based on the big data analysis model has basically realized the depth of mining learning behavior, and to reveal the relationship between mode and the trend of hidden data, understand the learners' growth trajectory, the status quo of learning knowledge, which is helpful to grasp the rules of learning of learners, facilitate more comprehensive student evaluation and personalized intervention guidance, "in order to realize the development of students" evaluation to optimize the learning process, is conducive to the improvement of learning ability and learning interest, cultivate thinking ability, to provide personalized services to their aptitude. In short, the effective personalized learning needs to record the learner's learning process based on large data, analyze the learner's thinking habits, and combine the immediate learning scene, and promote the appropriate learning resources

Acknowledgments

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