DEVELOPMENT OF A DIGITAL EDUCATIONAL ENVIRONMENT IN CHINA

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Summary

Current model design research in the field of personalized learning mainly includes three categories: personalized learner model, personalized learning resource recommendation model, and personalized learning path model. The development of a personalized student model mainly depends on the basic information of the student, his interests and preferences, learning style, behavioral characteristics, etc.; and all learner information and data are also used to develop and implement a personalized learning resource recommendation model and an individualized learning path model Essential framework. The learner model is developed through an in-depth analysis of the learner's main attributes, learning process and learning outcomes, and on this basis, a model of the learning path that fits the learner is planned and personalized learning resources are presented. Among the various developed models, the student model occupies the largest share. In the study of personalized learning, different models can be developed that correspond to the individual characteristics and actual needs of students, so as to be more in line with the concept of respecting the individual characteristics of students, thereby contributing to the high-quality development of individualized learning and the overall development of students. We also described the model with tables that are given in the article.

Key words: high-quality development, learning process, student model.

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1. Introduction

The development of learning analysis technology based on big data provides powerful support for building a highly practical personalized learning system, especially the popularization of online learning provides effective support for the research of personalized learning system. At the same time, a personalized learning system integrated with learning analysis technology can effectively provide students with more personalized support services according to the differences in students' knowledge levels, characteristics, experience and learning needs.

2. Motivational priorities

This study establishes a model of personalized learning system from the perspective of personalized learning theory and learning analysis, which mainly includes four parts: learner model, teacher model, personalized recommendation model and evaluation model, as shown in Figure 1. The current research on model design in the field of personalized learning mainly includes three categories: personalized learner model, personalized learning resource recommendation model and personalized learning path model. The development of personalized learner models mainly relies on students' basic information, interests and preferences, learning

styles, and behavioral characteristics; and all learner information and data are also used to develop and implement the basic framework of personalized learning resource recommendation models and personalized learning path models. The learner model is developed by deeply analyzing the main attributes, learning process and learning results of the learners, and based on this, a learning path model suitable for the learners is planned and personalized learning resources are proposed. Among the various developed models, the student model occupies the largest share. In the research of personalized learning, different models can be developed according to students' personality characteristics and actual needs, thus more in line with the concept of respecting students' personality characteristics, thus contributing to the high-quality development of personalized learning and the overall development of students. The development of learning analytics technology based on big data provides strong support for the construction of a practical personalized learning system, especially the popularity of online learning provides effective support for the research of personalized learning system. At the same time, personalized learning systems incorporating learning analytics technologies can effectively provide students with more personalized support services according to their differences in knowledge level, characteristics, experience and learning needs. This study establishes a model of personalized learning system from the perspective of personalized learning theory and learning analytics, which mainly includes four parts: learner model, teacher model, personalized recommendation model and evaluation model *(Shen Linliang, 2018)*.

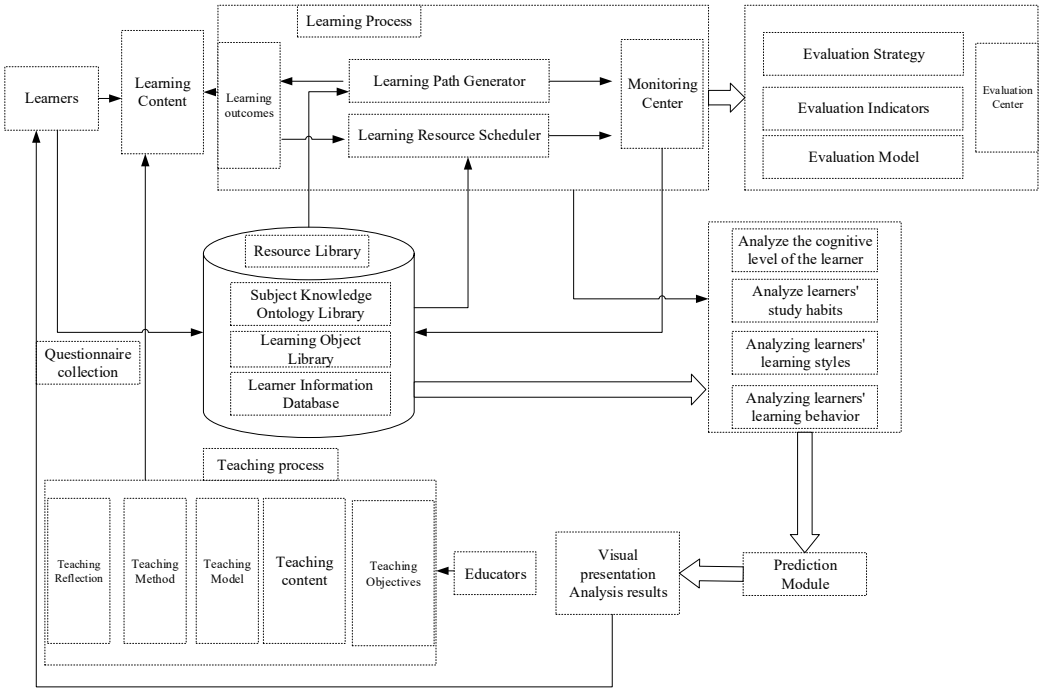

Fig. 1. Personalized learning model

Source: Ministry of Education of the People's Republic of China 2017

3. Stages of the investigation

Digital educational environment, students and learning process are closely integrated into the learning model, and new technologies such as big data are used to classify and sort the data of students in the learning process in the digital learning environment to obtain learning content, learning behavior and interaction Information, data mining, learning analysis and visualization of a variety of content to obtain characteristics such as cognitive abilities, learning styles, and learning attitudes. In order to build a comprehensive and comprehensive learning model, the ultimate goal is to provide personalized services based on the various characteristics of students to teach students according to their abilities, improve the quality and efficiency of learning, and improve the learning foundation of system support services to improve system reliability.

In the data layer of the model, according to with the learner information in the CELT S-11 learner model specification, combined with the actual situation in various learning and support systems in the digital environment, the learner information data of the personalized learner model is divided into four categories: First, individual description information, including personal information: student's name, gender, age, place of birth, etc.; administrative information: including the educational center, level, specialty and admission group to which the student belongs; safety information: incl. account numbers and login passwords for students in different systems, etc. Secondly, it is information related to studies, including academic information: necessary qualification requirements of students, results of entrance examinations and course evaluations, etc.; performance information: regular online learning status and process evaluation of each course; job information: students each Records of messages and arguments that were well received during online discussions and learning activities, as well as related learning achievements in the learning process, etc. The third is relational information, including interactive information between students and learning resources, peers, teachers, and systems. The fourth is preference information, including information that may facilitate human-computer interaction or personalized services, such as module access options, resource selection settings, etc. Among them, obtaining individual descriptive information can directly form individual attributes of the student's characteristics, that is, the initialization of a personalized model of the student. The other three types of information are dynamic and constantly updated as the online learning process progresses.

In the logical analysis layer of the model, the three types of dynamic information in the student information are analyzed hierarchically. The analysis process includes three levels of analysis, learning content analysis, learning behavior analysis, and interactive analysis. Each level of analysis includes different processes of sub-analysis. Learning content analysis includes resource content analysis, resource type analysis, learning goals analysis, learning assessment analysis, etc.; learning behavior analysis includes learning completion analysis, activity participation analysis, learning resource selection analysis, media selection analysis, etc.; interaction analysis includes interaction analysis, social network analysis, interactive peer analysis, communication content analysis, visitor behavior analysis, etc. After three levels of analysis, four personalized learner characteristics can be finally obtained, including individual attributes, cognitive abilities, learning styles, and learning attitudes. Among them, the analysis of learning content directly affects the determination of students' cognitive abilities, the analysis of learning behavior has a certain influence on the learning style and attitude towards learning, and the analysis of interactive behavior has a great influence on the attitude towards learning. Identifying these four learner characteristics will directly influence the application-level impact of personalized services.

At the application level of the model, according to the characteristics of the learner at the level of logical analysis, personalized application services for students are provided as follows:

(1) Personalized interface customization service. In the digital educational environment, the human-machine interface is a medium for the transfer and exchange of information between people and systems, and is also a comprehensive work environment for students to perform behaviors. The traditional human-computer interface does not have an analysis of the student's cognition and behavior, it presents the same form for all students and cannot adapt to the intellectual and personalized development of the system. The personalized interface is an extension of the traditional human-machine interface. It can automatically or non-automatically meet the different needs of individuals in terms of interactive content and expression according to the characteristics and needs of different learners in the process of computer-human interaction.

(2) Knowledge visualization service. The human brain is better at analyzing and processing visual images. Common forms of knowledge visualization include concept maps, mind maps, cause and effect, semantic networks, mind maps, and more. In an online education environment, the use of knowledge visualization can implement knowledge management, link different knowledge points or concepts in the curriculum knowledge, and represent them graphically. Learners can quickly understand the system knowledge structure based on the visualized knowledge and selectively choose the weak points of the knowledge to strengthen the learning.

(3) Personalized information retrieval service. Personalized information search services can be divided into active and passive. The first is the active and purposeful sending of information resources to students according to the needs of students; the second is to filter the information content according to the similarity of the keywords that the students are searching for to the interests and preferences of the students, or Similarity between the two determines the information about the push.

(4) individual service of recommendations regarding the content of educational material. In the digital environment, through the analysis of student characteristics, students' learning of knowledge points, advantages of educational resources, etc. are evaluated in order to recommend educational content in the knowledge base. If the student understands a certain knowledge point well, the system will push the next knowledge points; if the learner has not mastered a certain knowledge point or the learning effect is poor, the system will provide prior knowledge and current knowledge related to the knowledge point.

(5) Personalized learning path recommendation service. In order to achieve the learning goals of online education, students must master a series of sequential learning objects, which constitute the student's learning path. The learning path recommendation model mainly includes the links of learning-phase matching, learning meta-list, learning effect monitoring and learning portrait, etc. As shown in Figure 2, personalized learning path refers to the adoption of different matching strategies according to learners' learning status, personal ability and background factors, and the recommendation of personalized learning meta-list to learners, so as to improve students' personal learning efficiency. Currently, there are many methods for recommending personalized learning paths, including methods for sequencing learning objects based on students' knowledge levels and personalized learning path strategies based on group intelligence algorithms. This study sublimates the learning element sequence consisting of learning elements, uses personalized matching strategies for different categories of learners, and based on the recommendation model will be based on the learning pattern of learners and recommend the learning elements in the excellent learning pattern to the target learners. This can repeatedly reflect the learner's initiative and subjectivity. The generative advocacy recommendation

model is not recommending a complete learning path at once in the traditional sense, and secondly, recommending a learning element, and then recommending the next learning element to the learner according to its updated learning portrait until a complete learning path is recommended, which is more helpful to improve the accuracy of the recommendation and effectively improve the learning effect of the learner *(Huan Siu, 2012)*.

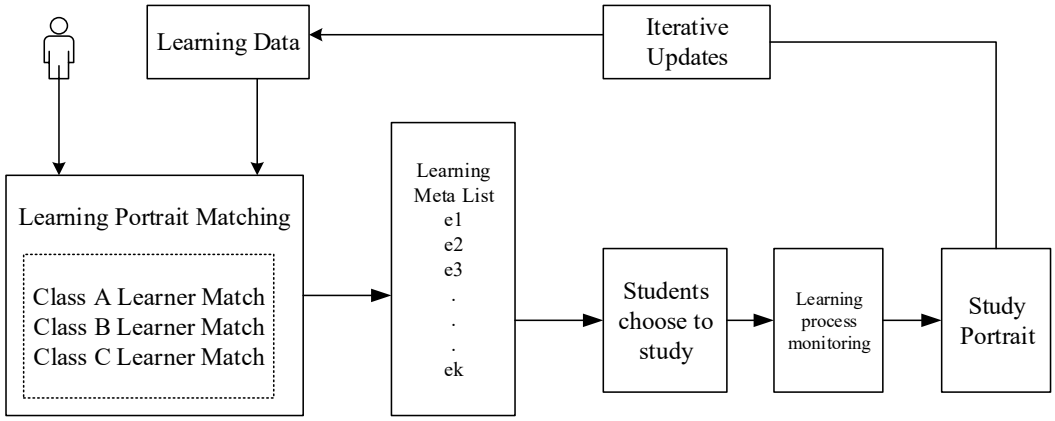

Fig. 2. Learning path generative recommendation model

Source: Zhang Daitakozh, 2001

With the development of Internet technology applications, education has also undergone changes: the educational activity of students is no longer limited to traditional classroom learning and partially turns into online learning in a digital environment. The hallmark of online education is to provide students with rich learning resources and accurate resources. Information is presented in various forms of expression. Students can independently monitor the progress of their studies. Changes in the teaching and learning process of students involve the implementation of personalized good land. Due to the individual differences of learners participating in online learning, personalized learning faces enormous challenges *(Qi Yunyun, 2019)*.

4. Empirical studies

With the support of the personalized learning platform, the corresponding data information is comprehensively obtained from students' learning characteristics, needs and preferences, and personalized learning paths are recommended to different students to dynamically adapt teaching strategies in order to meet students' personalized needs, which can enhance learning efficiency. In order to verify this idea, 120 software engineering students from university A, class of 2021, were selected as the subjects of this experiment with the support of China's personalized adaptive learning platform, and were divided into two groups, personalized learning group and traditional teaching group, with 60 students each. Meanwhile, based on the results obtained from the tests, the groups were divided into two groups, i.e., ordinary students (0~4 points) and excellent students (5~9 points), and after a 60-day learning activity, the students in both the adaptive learning group and the traditional teaching group were given a post-test of their knowledge points, and the results of some data analysis are shown in Table 1.

Table 1

Learning outcome analysis table

	Traditional Teaching Group		Personalized Learning Group	
	general student	Outstanding Students	general student	Outstanding Students
Before testing	3.8	6.7	3.8	6.8
After testing	5.9	6.9	7.1	7.4
Study time (minutes)	4244	3510	3066	2624
Discard the number of questions	94	54	30	16
Number of attempts to solve	140	182	58	52

Source: Qi Yunyun, 2019

According to the above data, the academic performance of the average students in the personalized learning group has improved greatly, from 3.8 to 7.1, while the academic performance of the excellent students did not improve much, and the academic performance of the excellent students in the personalized learning group and the traditional teaching group did not change significantly compared with before. The reason for this phenomenon is that most of the ordinary students follow the learning resources and learning paths pushed by the platform, while the excellent students are very independent and do not rely on the platform completely, and sometimes they choose their own paths and resources for learning. It can be inferred that the personalized adaptive learning approach is helpful for those students who are lagging behind in their academic performance. Moreover, as we can see from Table 1, the adaptive learning students performed better in terms of the number of attempts and discarded questions, suggesting that the adaptive learning group was more efficient, probably because for those students in the personalized learning group, the platform analyzed the students according to the specific information it obtained about them and pointed out their learning deficiencies more clearly, so that they could propose targeted knowledge points This allows students to accurately check the gaps and fill them in, which ultimately makes it easier for students to answer the tweeted questions without making them feel frustrated, thus increasing their motivation and learning efficiency.

5. Conclusions

The article defines the concepts of a digital learning environment, a smart classroom, and personalized learning, and also creates a model of personalized learning based on the construction of smart classrooms, digital learning resource platforms, and other digital learning opportunities and structural elements, as well as puts forward requirements for the implementation and strategy of personalized learning.

Provide blueprints, processes, and strategic proposals for implementing personalized learning in smart classrooms. Second, a generative model of recommendations for accurate and personalized learning paths based on learning portraits has been developed. According to the learning status of the learner, the model adopts a personalized recommendation strategy to recommend a list of learning items to the learner, and the learner actively selects the most suitable learning item for learning. A learning tuple is a learning tuple that includes learning content, learning activities, and learning effects, and its detailed recommended content can

meet the learning needs of students. The generative recommendation strategy corresponds to the characteristics of the dynamic change in students' learning level during the learning process and ensures the accuracy of the recommendation. Finally, a process evaluation model based on big data learning is built, and a strategy for implementing learning evaluation based on personalized big data learning is discussed and proposed. Big data-based assessment for learning can use students' learning abilities, knowledge acquisition, academic performance, and current learning challenges in conjunction with students' learning needs and learning preferences reflected in online and offline learning data information. provides a guide for learners to formulate learning methods, proficiency levels, learning styles and learning objectives that meet the needs of future learning. To clarify goals, guide direction, and provide a solid foundation for methods and strategies for individualized learning and student development.

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