Research on Smart Learning System Model

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Abstract. With the development of computer science in our country, more and more intelligent products appear in people's daily lives, bringing convenience to people's lives. In the education industry, an intelligent learning system has also emerged. After learning the relevant knowledge of the construction of the intelligent learning system and the Apriori algorithm, this article builds the intelligent learning system based on the Apriori algorithm, and take the university physics department as an example to study and analyse the function and realization of the system.

Keywords: Smart Learning System; Apriori; Learning Evaluation

1. Introduction
With the release of the idea of "smart earth", intelligent concepts have gradually appeared in people’s sights, such as smart medical care, smart transportation, and smart cities. There has also been a wave of smart education in the education industry, which is also a kind of manifestation of education informatization, which has a great influence on my country's education industry.[1] Intelligent learning is the basis for the implementation of intelligent education, and its purpose is to make learners' learning styles develop in the direction of intelligence and individualization, so personalized teaching and teaching students in accordance with their aptitude is the only way to realize intelligent learning in our country.[2-4] The smart learning system is an information platform for smart learning and a necessary condition for smart learning. Therefore, this article takes the university physics course as an example to build a system to build a system with online course learning function, and analyze the learning style of students in physics learning during the learning process, understand the learning habits and preferences of learners, and provide suitable Learning resources, and analyze the learning process of the learner, so as to judge the learning state of the learner. The real intelligent teaching of university physics needs to avoid the deviation of learners' self-understanding in the process of learning physics, which leads to the decrease of learning efficiency. [5-6]

2. System construction

2.1. Analyze system requirements
(1) System goal
After researching and analyzing the relevant knowledge and technology of building a smart learning system, I try to design and develop a set of auxiliary learning system based on smart learning.
This article is based on the practice of university physics and conducts exploratory research on how to build a smart learning system. That is to say, this article will research and analyze the construction of smart learning system from both theoretical and practical perspectives.[8-10]

From a theoretical point of view, from studying relevant literature and sorting out relevant case studies, analyzing and summarizing the nature, course content and teaching objectives of university physics from two aspects of teaching and learning, in order to analyze the learning style of university physics and construct corresponding knowledge model and learner characteristic model, and find out the main factors restricting learning style, so that the theoretical knowledge mastered can pave the way for the subsequent construction of a smart learning system.

From a practical point of view, mobile with a complete subject knowledge base and basic online course functions is a necessary condition for a mobile learning platform. The system needs to analyze the learning style and preferences of students when learning physics during the learning process. And according to learners' learning preferences, they can provide adaptive learning resources to track learners' learning in real time, including but not limited to the degree of knowledge mastery and the length of learning time. The system needs to meet the wisdom of university physics teaching concepts, and it needs to effectively prevent students from being biased in choosing learning resources due to insufficient self-awareness, resulting in a decline in student learning efficiency.

2.2. System function requirements
There are three user roles in the system: learner, teacher and manager. The main function of learners is to investigate their learning styles through questionnaires, view their own learning habits, communication and acquisition of learning resources; teachers can view learners’ learning preferences, evaluate learners’ learning conditions in the system, the main function of the administrator is to manage the information and permissions of learners and teachers, and update the data in time.

2.3. The overall result design of the system
From the previous demand analysis, we can see that the overall structure of the entire learning system is composed of five modules: learner feature library, learning resource library, learning knowledge base, learning diagnosis library, and learning behavior diary library. The overall structure framework is shown in the figure below:
Recommendation of learning path algorithm based on Apriori

Learning analysis technology and mining data in big data are necessary conditions for achieving smart learning. The main function of learning analysis technology is to screen and analyze the large amount of data generated by learners during learning, so as to improve learners' academic progress, conduct an assessment and analyze its future learning direction to find potential problems. Data mining and analysis enable teachers to effectively master the teaching process and laws, and use this as a reference to make appropriate adjustments to educational activities, educational management and educational management. Data mining refers to the mining of effective information in a large amount of data, such as students' implicit learning behaviors, students' homework completion, etc. The most commonly used data mining method is association rules, which are mostly used to explain the relationship between data and data in the database. Regularity, and expressed by frequent item sets and association rules. The Apriori algorithm is a classic association rule algorithm proposed by Rakesh Agrawal and Ramana-Krishnan Srikan at the end of the 20th century. It is the core of the association rule mining algorithm.

3.1 Algorithm analysis

The Apriori algorithm, which is a layer-by-layer search iteration, is a way to search for the n+1 item set with the nth item set. The mining of association rules is mainly distributed in two steps: first, rely on support to find all frequent item sets, that is, quota; then use confidence to mine the association rules, that is, strength. The above support refers to both A and B, expressed as $P(A \cap B)$, and
confidence is expressed by \( P(B|A) \), that is, the probability of A and B occurring at the same time is \( P(AB) / P(A) \).

The basic idea of the algorithm is: first, scan the entire database, and calculate the occurrence coefficient of each item; second, find all item sets whose support is equal to or greater than the set minimum support; third, those that meet the conditions The item sets are combined to form a new item set frequent 1-items set L1; fourth, L1 connects itself and generates a candidate item set, counts the candidate item set, compares it with the minimum support, and compares the frequently qualified items Set 2-itemsets to L2; fifth, perform calculations in turn, find frequent 3-itemsets L3 through L2; sixth, loop the above operations until no more frequent item sets can be found; seventh, generate the above steps The association rules are calculated for all frequent item sets.

3.2 Application of Apriori algorithm in learning system
The realization of ordinary online learning platforms mainly relies on students' self-learning, and the connection between curriculum resources is not strong. Students are blind in their learning and cannot find the required resources quickly and efficiently, which affects students' learning enthusiasm. To this end, the Apriori algorithm is used to mine learners' learning information and interests, and intelligently recommend relevant learning resources to students, and make learning planning for students. The basis for the realization of knowledge recommendation is the student's learning path sample data set. The Apriori algorithm is used to mine the students' course learning and frequently browsed knowledge points pages to infer students' learning habits and interests. From the frequent learning data of students, the learning needs are analyzed, and frequent item sets are found from them to realize personalized learning resource recommendation. The most important item before data mining is data collection. The following table shows the records of students' visits to knowledge points.

| Student ID | Learning sequence (thing) |
|------------|---------------------------|
| St1        | Standing wave (M1), half-wave loss (M2), optical path and optical path difference (M3) |
| St2        | Wedge (M4), standing wave (M1) |
| St3        | Wedge (M4), standing wave (M1) |
| St4        | Standing wave (M1), half-wave loss (M2), optical path and optical path difference (M3) |

The data conversion table is the transaction database D. When there are 4 examples, the value of D is 4. The college physics textbook includes the upper and lower volumes, and there are many chapter knowledge points. Therefore, the letter number method is used to mark the knowledge points of each chapter. Chapter letters and numbers mark each objective knowledge point in the chapter. For example, the optical chapter is represented by M, then M1, M2, M3 represent the objective knowledge point of the optical chapter, so that the database can perform statistics and analysis. According to the calculation steps of the algorithm, suppose the minimum support in this example is 2 (\( \text{min}_\text{sup} = 2 \)), and the minimum confidence is 65%.

(1) Scan all things, count the occurrence coefficients of all item sets, clarify the C1 set, and extract the frequent item sets L1 according to the set minimum support, as shown in the following figure 2:

| Scan D statistics candidates | \( C_1 \) | Comparison of support count and minimum support peak |
|-----------------------------|-----------|---------------------------------------------------|
| Item sets                   | Support   | Count | Support peak |
| \{M1\}                      | 3         |       |              |
| \{M2\}                      | 2         |       |              |
| \{M3\}                      | 2         |       |              |
| \{M4\}                      | 2         |       |              |
| \{M5\}                      | 1         |       |              |

| Item sets | Support calculation |
|-----------|---------------------|
| \{I_1\}  | 2                   |
| \{I_2\}  | 3                   |
| \{I_3\}  | 2                   |
| \{I_4\}  | 2                   |
| \{I_5\}  | 2                   |

| L1        | Item sets | Support calculation |
|-----------|-----------|---------------------|
| \{I_1\}  | 2         |                     |
| \{I_2\}  | 3         |                     |
| \{I_3\}  | 2         |                     |
| \{I_4\}  | 2         |                     |
| \{I_5\}  | 2         |                     |
Figure 2. Candidate item set $C_1$ and frequent item set $L_1$

(2) $L_1$ is connected with itself to form candidate item set $C_2$, and the counted existence times are compared with the minimum support to generate frequent item set $L_2$, as shown in the following figure 3:

| $C_2$ is generated by connecting $L_1$ with itself | $C_2$ | Comparison of support count and minimum support peak |
|-------------------------------------------------|-------|--------------------------------------------------|
| Item                                             | Support calculation |
| $\{M_1; M_2\}$                                  | 2      |
| $\{M_1; M_3\}$                                  | 2      |
| $\{M_1; M_4\}$                                  | 1      |
| $\{M_2; M_3\}$                                  | 2      |
| $\{M_3; M_4\}$                                  | 0      |

$L_2$

| Item sets | Support calculation |
|-----------|---------------------|
| $\{M_1; M_2\}$ | 2     |
| $\{M_1; M_3\}$ | 2     |
| $\{M_2; M_3\}$ | 2     |

Figure 3. Candidate item set $C_2$ and frequent item set $L_2$

Until no new frequent item sets can be generated, the algorithm execution ends.

The results show that the relationship between $M_1$, $M_2$, and $M_3$ is very close. When students learn standing wave knowledge points, they may also learn knowledge points of half-wave loss, optical path, and optical path difference. The more sample data the students have in their learning activities, the more accurate the study of the students’ learning habits and characteristics, the more accurate they can be to analyze the students’ homework and test information, and find the knowledge points that students have weaker grasp. Using the Apriori algorithm in the college physics teaching system can provide students with personalized technical support to meet the learning needs of different students, thereby improving the quality of students’ learning.

3.3 System architecture design

MVC is a classic software design pattern. Its three core design modules are Model, View, and Control. It combines several business logics in the same component, logic, interface and data separate the organization. Figure 4 shows the functions of the three modules and the relationship between them.

Figure 4. Schematic diagram of MVC design pattern

4. Smart learning evaluation

A major problem that needs to be solved in the education field is learning evaluation. It will directly affect the research and development of educational theory. It is a direct way of judging learners’
learning achievements, so that learners can reflect on their own learning.

4.1 Developmental learning evaluation
In recent years, the education sector has been influenced by humanism, constructivist learning theories and multi-intelligence education theories, and a new type of education evaluation culture has emerged. This evaluation culture pays more attention to the overall value of the person, breaking through the previous model of evaluating students with their scores. As independent life individuals, their personality is unique. They should not be evaluated solely by academic performance, but should be based on the individual, give students a complete evaluation. Developmental evaluation has diversified characteristics: The first is the diversification of evaluation forms. Learn about student quota learning from multiple channels, such as learning tasks, display results, etc.; the second is the diversified evaluation content. The content of the evaluation is not only the concrete embodiment of the teaching goal, but also the guarantee of the realization of the teaching goal, paying close attention to the mastery of students' knowledge points and the reflection of students' learning behavior; the third is the diversification of the evaluation subject. Not limited to a single teacher evaluation, students can also evaluate each other; the fourth is the feedback of the evaluation results, and the student evaluation will be fed back to the students in an appropriate way.

4.2 Evaluation of understanding learning
Comprehensible learning evaluation takes learners as the main body and devotes all their hearts to learning, which is a "holistic" learning method. In today's era of knowledge economy, it is not enough to memorize factual and procedural knowledge, and more attention is paid to profound understanding. The knowledge acquired through fragmented learning is not systematic. The need to integrate the concept of fragmentation into a system is the pursuit of informatized learning. Comprehension evaluation pays more attention to students' understanding of core knowledge points, and then helps students to carry out learning activities from the entire teaching structure. It starts from the beginning and the end of the learning process and makes continuous evaluations. It not only occurs in a teaching link, but also it runs through the entire teaching process.

5. Conclusions
With the birth of the concept of wisdom, many smart products have gradually appeared in our daily lives and work. In the education sector, a wave of smart learning has emerged, and many universities have also built smart learning systems. Starting from the needs of the system and the goals that need to be achieved, this paper constructs the general framework of the system. In order to enable the system to provide learning assistance for students, the Apriori algorithm is used in the system to mine the association rules between subject knowledge and students' learning behavior, and apply it to university physics subjects for practice.

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