

# An Adaptive Learning Method Based on Knowledge Graph

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**Abstract:** *Massive learning resources make online learners in the dilemma of "knowledge maze", while manual planning of learning paths is inefficient and difficult to meet the personalized needs of learners. Targeted personalized service, propose an adaptive learning method based on KG(knowledge graph), build a student model and adaptive learning platform based on KG by using education big data, cloud computing and a new generation of artificial intelligence technology, and transform theoretical content into practical applications, so as to help teachers timely master the rhythm and focus of teaching, improve teaching methods, optimize teaching quality, and achieve precision education, differentiated teaching, personalized learning A new teaching system with intelligent services. This method can provide some theoretical support for educational applications such as precision teaching, intelligent learning diagnosis, and efficient education resource organization in the adaptive learning system.*

**Keywords:** *KG; Adaptive learning; Differentiated teaching; Personalized learning*

## 1. Introduction

With the maturity of the Internet and artificial intelligence technology, it has promoted the rapid development of informatization and modernization of the education industry. Under the background of big data era, it is an important research topic to use modern technology to efficiently mine valuable information in massive data to meet learners' adaptive learning needs. Adaptive learning is a precise and personalized learning based on learners' learning style, knowledge level, cognitive ability, interest preferences and other characteristics. It aims to collect and analyze the data information transmitted by students' two-way interaction with the system in autonomous learning activities, and establish the characteristics of learners' models based on the analysis results, so as to improve and solve the "no significant difference" problem that is difficult to solve in traditional education [1,2]. In essence, adaptive learning systems are ubiquitous learning environments that support personalized learning. Provide learners with the most appropriate resources, the best learning path and the best learning strategy through real-time dynamic data analysis [3,4]. The adaptive learning system is an online learning platform, which provides personalized services for everyone in real time based on the learner model, such as personalized learning paths, personalized learning resources and personalized learning strategies, analyzes the feedback results based on the dynamic big data generated by the two-way interaction between learners and the system, and combines the domain knowledge model [5]. The development of new generation AI technologies such as deep learning, knowledge mapping (KG) and enhanced learning is driving "Internet plus education" into a new era of "intelligent education". As the core driving force to promote the development of artificial intelligence, KG has provided new capacity for education and teaching in the era of education informatization 2.0. KG is an important part of artificial intelligence and an important basis for the advancement of artificial intelligence from "perceptual intelligence" to "cognitive intelligence". It describes concepts, entities and their relationships in the objective world in a structured way, provides the ability to better organize, manage and understand subject knowledge, models and methods, and makes online teaching support and service capabilities closer to the needs of personalized teaching and personalized learning. Countries attach great importance to adaptive learning research[6,7]. Education KG has broad application prospects in intelligent processing of education big data, semantic aggregation of teaching resources, intelligent teaching optimization, construction of learner portrait model, adaptive learning diagnosis, personalized learning recommendation, intelligent education robot, etc. The learning path recommendation algorithm based on knowledge graph is attracting the attention of researchers in this field. Shi et al. [8] proposed a learning path recommendation model based on multi-dimensional knowledge graph framework, designed a multi-dimensional knowledge graph framework, stored learning objects in multiple classes separately, and proposed six main semantic relationships between learning objects in the knowledge graph. The proposed model can generate and recommend

qualified personalized learning paths to improve e-learners' learning experience. Sun Hongxu [9], focusing on KG, transformed theoretical content into practical application, designed an adaptive learning system, which realized adaptive learning and personalized growth of learners. Through this system, we can understand learners' own personalized learning characteristics and learning performance, and adjust learning behaviors and methods according to the learning path generated by the system. Finally, the refined progress of the education industry will be achieved, and the real teaching will be determined by learning. Li Wan [10] proposed a scheme to model all objects in the education field as KG, fully mining the data in the education field with the help of KG's powerful knowledge representation and reasoning ability, and proposed a multi label classification algorithm based on attention mechanism to solve the problem of imperfect relationship between topics and knowledge points. The tagging of topics was regarded as the knowledge points related to the classification task prediction, and an adaptive learning system was designed and developed. The system has online learning and testing functions and visualizes the relationship between knowledge points in different disciplines. At the same time, it uses the multi tag algorithm based on attention mechanism to integrate and label relevant resources in the system, and uses the adaptive learning path generation algorithm to recommend appropriate learning paths for students, making the system more intelligent. Gao Jiaqi et al. [11] proposed an automatic generation method of learning path based on KG, which divides the generation of learning path into two steps: knowledge point path generation and learning object path generation, and can serialize knowledge points and learning objects involved in the curriculum according to knowledge point attribute characteristics and their relationships, learning object attribute characteristics, learners' knowledge mastery and cognitive characteristics. Zhu et al. [12] proposed a multi constraint learning path recommendation algorithm based on knowledge map, which solved the problem of balancing limited learning time and multiple learning objectives. Through statistical analysis based on questionnaires, they verified two assumptions of e-learners' preferences for different learning paths in four different learning scenarios (initial learning, usual review, pre exam learning and pre exam review). This paper describes the design and implementation of a multi constraint learning path recommendation algorithm. Huang et al. [13] proposed an algorithm that combines extended activation theory with knowledge classification and ranking technology. The algorithm can generate an approximately optimal navigation learning path (NLP) based on the target knowledge unit (TKU) and its knowledge map (KM). The basic task of the algorithm is to filter redundant information and rank candidate knowledge units, and use secondary ranking strategy (SSS) to rank candidate knowledge units to obtain appropriate NLP. The experimental results show that this method is feasible in improving learning efficiency and user satisfaction. In order to achieve personalized education development driven by knowledge, Yang Juan et al, It has constructed an educational KG with semantic structured organization of subject knowledge points, efficient management of massive learning resources, and automatic perception of learners' cognitive ability.

## 2. KG based adaptive learning method

Use big data and cloud computing technology to flexibly obtain the computing and storage capacity of the education big data platform, build a knowledge model, a student model, an interface model and an adaptive recommendation engine, thereby building a student-centered adaptive learning platform, which supports students, teachers and teaching management users to log in through mobile or wired access terminals to obtain adaptive learning services Teaching data acquisition/teaching participation services, domain knowledge transformation services, etc. The research content is divided into three parts: student model construction, discipline knowledge map construction and adaptive learning platform architecture design.

The model of adaptive teaching system refers to the AEHS model. The core modules of this model are domain knowledge model, learner model and teaching model. The establishment of these three models involves the research and application of pedagogy theory, psychology theory and informatics theory and technology, including item response theory, classical testing theory, multiple intelligence theory, ontology modeling technology, machine learning, evidence theory, etc. The research process is shown in Figure 1.

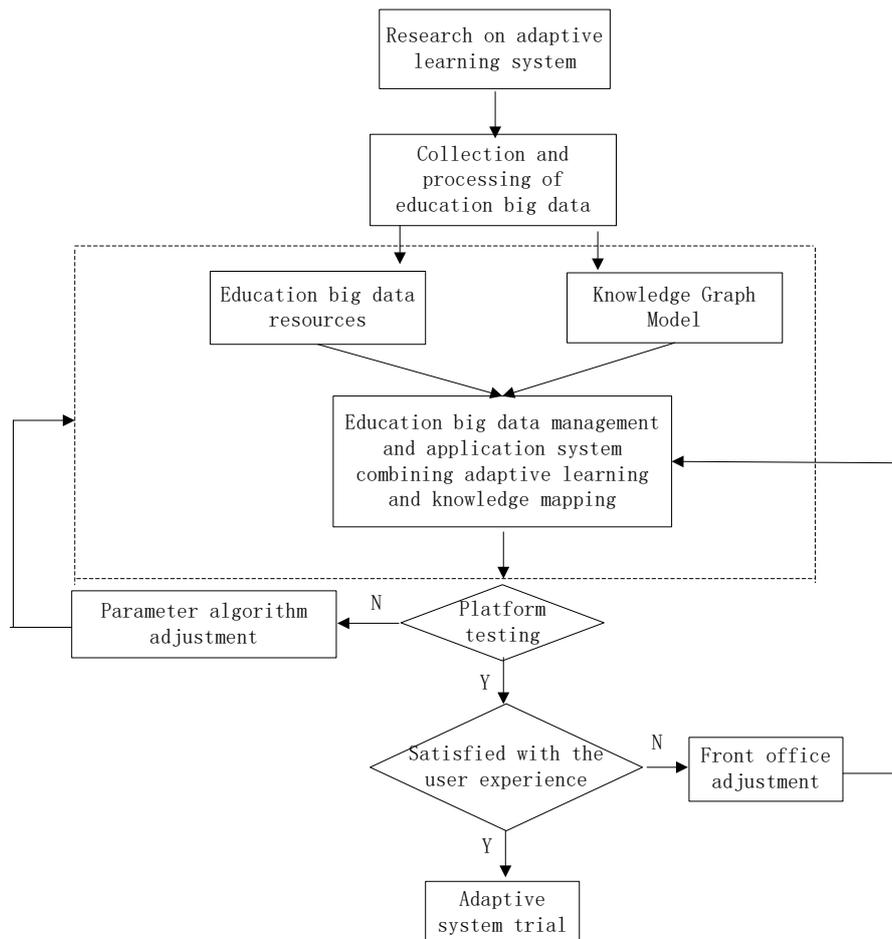


Figure 1: Flow Chart of Adaptive Learning Research Scheme

The main research contents are as follows:

(1) Literature review and investigation. Through collecting and consulting a large number of knowledge maps and authoritative literature on adaptive learning, we can understand and master the achievements, strategies and measures of relevant majors at home and abroad in adaptive learning; At the same time, by investigating the current situation and existing problems of information majors in different levels of colleges and universities in the construction of adaptive learning, think about the current problems and causes of students' learning in private colleges and universities, and propose targeted solutions and methods.

(2) Comparative analysis and reference. This paper combs and analyzes the practices and successful practices of adaptive learning at home and abroad, and compares their ideas, practices, experiences and lessons in adaptive learning. At the same time, in combination with the actual situation of teachers, students and teaching resources in private colleges and universities, select the typical model closest to the actual learning of students in private colleges and universities to analyze and improve.

(3) Practice inspection and continuous improvement. Relying on Xijing University and the Second Classroom of the Academy, we will carry out trial and test, make continuous improvement on various work, and further form a college students' adaptive ability training system that can be promoted based on the application of knowledge maps.

### 3. Summary

Through research in the field of adaptive teaching at home and abroad, we have deeply understood and learned from the adaptive teaching theories and technologies of western developed countries represented by the United States, fully digested and absorbed the pedagogical theories, psychological theories and informatics theories and technologies involved, and then based on the characteristics and needs of college students' adaptive learning systems, combined with KG, big data and cloud computing

technology, And in the process of research, combining with the actual situation and needs of Chinese college students, it puts forward its own research programs, methods and technical routes with its own characteristics. Based on the characteristics and requirements of the education big data management and application system, in combination with the pattern recognition related theories of the electronic information specialty, and in accordance with the scientific and rigorous principles. This research can provide reference and reference for the reform of higher education in China, and help colleges and universities to cultivate new talents who are in line with the development of society and science and technology.

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