Research on individualized Chinese teaching based on adaptive learning system

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Abstract. Language teaching in the smart education environment pays more attention to the personalised needs of learners, and adaptive learning systems can provide technical support to meet students' learning needs and realise personalised learning. Based on the principle of teaching according to the student's ability, this paper conducts research on adaptive learning systems, describes the construction ideas and practical application methods of the four panel models (i.e., domain model, learner model, cognitive diagnosis, and adaptive model) in adaptive learning systems in language teaching, and puts forward relevant suggestions on language teaching strategies against the background of the current language teaching and educational needs.

1. Introduction

As the supportive role of adaptive and other information technologies in the field of education becomes increasingly apparent, the teaching concepts of teachers in various disciplines have begun to change to intelligent teaching, and the quality of teaching has been significantly improved, and information technology is continuously promoting the innovation of teaching methods. The CPC Central Committee and the State Council issued "China Education Modernisation 2035", which puts forward "the construction of intelligent campuses, and the coordinated construction of integrate d intelligent teaching, management and service platforms. The use of modern technology to accelerate the promotion of talent training mode reform, to achieve the organic combination of large-scale education and personalised training."[1]

As an important manifestation of educational informatisation, intelligent education penetrates into teaching practice and further promotes the process of new curriculum reform. Under the environment of wisdom education, language teaching has ushered in a new opportunity for development. Compared with traditional teaching, personalisation is one of the distinctive features of smart education, which emphasises the provision of personalised learning services for students according to their individual differences and needs[2]. Adaptive learning is a technology-enabled intelligent teaching means, the core of its attention is also the individual differences and individual needs of learners, which is considered to be an important way to achieve personalised learning[3]. Adaptive learning system has the characteristics of speed, intelligence, sharing, fairness, etc., and its use in language teaching can effectively break through the current dilemma of the traditional language teaching mode, solve many existing teaching problems, and promote the development of language teaching in the direction of higher quality.

2. Adaptive learning

2.1. The origin of adaptive learning

The earliest form of instruction empowered by technology was the Teaching Machine (TM) [4]. After more than half a century of development, the Adaptive Learning Environment has evolved from the Computer Assisted Instruction System (CASIS) in the 1950s to the Intelligent Tutoring System (ITS) and Adaptive Hypermedia System (AHS), eventually forming the Adaptive Learning System (ALS), a personalised learning system. As shown in Figure 1.

![Fig. 1. The development of adaptive learning systems.](https://example.com/fig1.png)

Adaptive learning systems were first derived from Adaptive Hypermedia System (AHS), a concept proposed by Brusitovsk [6], which is characterised by the ability to meet the differentiated needs of individual learners in the process of operation, and to adapt to the learners' learning objectives, prerequisite knowledge and cognitive level [7], which in turn leads to the implementation of differentiated teaching strategies and activities, adaptive presentation of...
learning resources, and decision-making on personalised learning paths.

In the 1990s, adaptive hypermedia systems entered a high-speed development stage, and adaptive learning systems represented by InterBook began to appear. Adaptive learning system is a new development of procedural teaching under emerging technologies and learning theories, in which computer technology, artificial intelligence, and constructivist learning theories play a major role in fuelling the development [8].

2.2. Adaptive learning system model

The research of adaptive learning system model started from the early hypertext system, and subsequent research added adaptive function on its basis and gradually developed into a real sense of "adaptive" learning system model, whose basic components are Domain Model, User Model, Its basic components are Domain Model, User Model, and Adaptation Model[9]. The domain model defines the learner's domain learning content and guides the overall learning process, which can be used as the domain basis for learning resource recommendation and learning path generation in the outer loop, and provides the basis for the assessment of the learner's knowledge mastery status and the update of the knowledge map in the inner loop, which is the basis for carrying out adaptive learning, as shown in Figure 2.

For each concept of the domain model, there is a counterpart in the user model. The user model is mainly used to describe the relevant characteristics of the user, such as interest preferences, knowledge, etc., and the user's preferences and level of knowledge are very different data, which affect the adaptability of the system in different ways [10]. Adaptive models make full use of instructional strategies and rules to select the content to be presented from the domain model based on the goals and needs in the user model [11]. The domain model, the user model, and the adaptive model work in concert to build the basic functional framework of an adaptive learning system.

3. Adaptive Learning System Framework Construction

Adaptive learning system is a kind of learning system that provides learning support suitable for individual characteristics with the differences in the individual learning process, and its technical core is to help teachers and students achieve better learning effects through personalised learning. On the one hand, the adaptive learning system is guided by the concept of personalised education [12] and the theory of multiple intelligences [13] and other educational concepts as a practical guide, throughout the personalised teaching, which pays attention to the individual differences of the learners, adjusts specifically according to the context, promotes the personalised teaching and helps students to develop their superior intelligences and drive the disadvantageous intelligences, and ultimately allows students to achieve an integrated and comprehensive development; on the other hand, the emerging technologies and Intelligent algorithms as its theoretical support, such as knowledge space theory [14], deep knowledge tracking [15] and knowledge mapping [16], assist in the establishment of personalised student models, the rational use of evaluation and feedback mechanisms, the integration of multimodal resources, the formation of user-oriented databases and knowledge networks, to provide personalised learning support for each student and to promote the theory of the ground to take root and innovative development. Figure 3 shows the conceptual model of educational knowledge mapping for adaptive learning systems.

The adaptive learning system operates under the synergistic effect of the domain model, learner model, cognitive diagnosis and adaptive model, which constitutes the complete functional system of the adaptive learning system. Its working model diagram is shown in Figure 4.
3.1. Domain Models
The domain model is the basis for the generation and dissipation of the learning system's motivation. Before the operation of the learning system, the domain model provides learners with learning objectives, and learners choose the desired learning objectives, which directly contributes to the initial motivation of the learning system. During the operation of the learning system, the learning engine adaptively selects the knowledge points, learning contents and learning activities in the domain model to form a personalised learning path and push them to the learners, which contributes to the continuous enhancement of the learning effect, and the gap between the learning objectives and the learning effect gradually decreases. The difference between the learning goal and the learning effect gradually decreases, and the motivation gradually fades. [17]

3.2 Learner Models
The learner model, as the core functional module of the adaptive learning system, is an important prerequisite for the system to provide various intelligent guided learning services [18], and its main function is to be used to record students' characteristics and learning data, enter the data into the embedding layer and the internal storage layer as a way of describing the students' learning status, and transfer the dynamic data into the knowledge tracking layer and the output layer so as to retain the learning history and advance the next step of Learning diagnosis.

3.3. Cognitive Diagnosis
Cognitive diagnostic models such as CD-CAT can quickly access students' knowledge point mastery and provide feedback through learning tracking test information, enabling teachers to provide targeted learning support for students. Taking in-class poetry teaching as an example, the adaptive learning system obtains the vector α(t) of students' mastery of poetry knowledge points through testing, and then automatically assigns targeted learning materials d(t) to students' weak points, obtains their achievement progress R(t), and so on, until students master all in-class poetry knowledge points.[19] The principle of operation is shown in Figure 5.

3.4. Adaptive Model
Adaptive recommendation algorithms are at the heart of adaptive modelling. Adaptive models apply recommendation algorithms to adaptively adjust learning paths and their corresponding learning content, learning activities, etc. Depending on the applied recommendation strategy, adaptive recommendation algorithms can be classified into three categories: collaborative filtering recommendation [20], content-based recommendation [21], and knowledge-based recommendation [22]. Due to the complexity of the relationships of knowledge points within domain knowledge and the multidimensionality of learner characteristics (level of knowledge, learning preferences, learning activities and the context in which they are placed, etc.), Ontology construction usually faces great difficulties. Hybrid recommendation is the synergistic use of the above three strategies for learning content recommendation, aiming at combining their respective strengths and overcoming the shortcomings of various recommendation strategies.

4. Suggestions for Optimising Teaching Strategies
The core literacy of the language discipline is gradually enhanced through active language practice and thinking practice in students' learning of the language programme. Based on the theory of knowledge construction and according to the conditions and characteristics of language literacy formation, expanding students' learning channels and classroom space with the help of information technology is conducive to students' mastery of the necessary language knowledge, enrichment of language accumulation, proficiency in language skills, enhancement of the quality of thinking, and optimization of learning habits. Allowing students to gradually learn to learn and develop their learning abilities in the practice of adaptive learning is an important direction of pragmatic efforts to improve students' language literacy.

4.1. Returning to the Perspective of the Learning Situation and Promoting Language Learning
Based on the learning situation, the information-based independent learning resources are used to effectively improve students' language literacy. The Adaptive Learning System provides a platform for the use of mapping, scaffolding and interactive learning, which stimulates students' potential for independent learning and
helps to improve their independent learning ability, which not only improves students' ability to think and solve problems on their own, but also allows them to improve their expression level and discernment in the process of communication, thus promoting the all-round development of the students.

4.2. Follow the constructive theory to enhance sustainable development

In the context of the classroom teaching system, teachers should make use of the application of big data to improve their own educational informatisation capabilities. Adaptive learning systems can incorporate advanced technologies to provide immediate feedback and guidance. Through the use of intelligent algorithms and automatic assessment tools, the system can identify students' mistakes and weaknesses and provide targeted explanations, hints and suggestions to help students correct their mistakes and enhance their understanding in a timely manner. The teaching programme can be further adjusted through the analysis of students' learning trajectories and the prediction of future trajectories, which is conducive to the sustainable development of education.

4.3. Push learning resources to ensure accurate diagnosis

The Adaptive Learning System establishes a mechanism for continuous assessment and adjustment. By collecting and analysing students' learning data, the system can continuously assess students' learning progress and adjust and optimise teaching strategies based on the assessment results. In order to meet the different learning styles and interests of students, the Adaptive Learning System can provide diverse learning resources. This includes resources in the form of text, images, videos, interactive simulations, and learning materials from different sources and domains. By providing diverse learning resources, the system can stimulate students' interest in learning and improve their engagement and learning outcomes.

By improving and optimising in the above aspects, the adaptive learning system can better meet students' learning needs and provide references for language teaching strategies in new perspectives.

5. Concluding remarks

In conclusion, this paper takes the perspective of personalized teaching as the entry point, through the research on adaptive learning system and its model construction, innovatively proposes an adaptive learning system based on the four-model framework that can be applied to language teaching, aims to innovate the teaching method, and elaborates on the specific ideas and its application in personalized teaching from the perspective of system model construction, and puts forward suggestions for optimization of the strategies in specific teaching. This paper helps the development and practical application of adaptive learning system in language teaching.

References


