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This research project is supported by Science Foundation of Beijing Language and Culture University (Supported by “The Fundamental Research Funds for the Central Universities”, approval number 20YJ020011).

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**The Construction
of Adaptive Learning System**





Aracne editrice

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ISBN 978-88-255-2745-2

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Ist edition: December 2020

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Abstract

Self-adaptive learning system is a hot issue for application of artificial intelligence in the current education. Traditional online learning system always provides the same teaching methods and learning resources for every learner so that individual differences and learners' individualized demands are often ignored, thereby they fail to accurately or quickly find the necessary learning resources and feel confused when they are facing the massive learning resources. This condition leads them lose directions or even experience cognitive overload in the online learning. Such situation makes a great impact on the quality of online learning.

With the increasing number of the Chinese learners, there are some problems in teaching Chinese as foreign language "TCFL". Compared with other types of learners, language learners are very different in their countries, mother tongues, ages, purposes, learning ability and habits. In the era of the shortage of outstanding Chinese teachers, the traditional teaching mode fails to satisfy the demand for the development of TCFL.

In essence, self-adaptive learning system supports the online individualized learning. It can provide support which in agreement with the personal features according to learners' individual differences including learning interest and preferences.

Therefore, the combination of self-adaptive learning technology and TCFL is in line with the current trend of educational reform. And it is also an effective way for TCFL to break through the bottleneck and walk out the predicament. In this part, the research tries to design and implement the self-adaptive learning system of TCFL's grammar based on the characteristics of language learning. The research mainly includes the following aspects:

This paper systematically summarizes the grammatical knowledge of the complex sentences, classifies 12 types of complex sentences, extracts grammatical features of 90 complex sentence as secondary key

grammar point, and makes use of teaching materials and reference books for each secondary grammar point. In addition, it identifies the knowledge base of the complex sentence by annotating detailed information such as examples, similar and related confusing words. Based on the knowledge base, it extracts every secondary grammar point from the sentences included in the teaching materials and corpus. In addition, a total of different types of 1,032 exercise questions with grammar knowledge are prepared for a grammar exercise question base to conduct a comprehensive and accurate assessment for grammar knowledge.

Based on the characteristics of language learning and the construction of other self-adaptive learning systems, this paper designs and implements the self-adaptive learning system of grammar for teaching Chinese as a foreign language by means of combining the technology of self-adaptive learning and the technology of teaching Chinese as a foreign language. We construct a user model that records the learner's learning behavior and reflects the learner's cognitive level and set up the adaptive mechanism that gives recommendations and exercises to learners based on the user model, as well as present some learning information including the cognitive level in a visual way. Thus, we finally find out a user-friendly, easy-to-use learning system.

As the first attempt of self-adaptive learning technology used in teaching Chinese as a foreign language, we hope that we can provide some useful experience for the development of teaching Chinese as a foreign language, and expand the application of self-adaptive learning technology.

Key words: TCFL, Self-adaptive learning system, Complex sentence, Grammar.

Introduction

Background for Topic Selection

With the continuous development of science and technology, the wide application of computer-based information technology in various fields including education and educational technology has become increasingly important in teaching activities. Thanks to the emphasis on educational technology, the academic community has been continuously deepening research in universal attention and emphasis on the use of multimedia, how to use modern media to optimize the teaching process, how to use modern media to innovate teaching and teaching environment, the present construction of systematic and structured understanding of educational technology and the application in improvement of teaching, the combination of computer technology and teaching has been continuously expanded. In the era of big data, deep learning has become a hot topic in various researches, and the study and analysis on big data has been popularized in different disciplines and practices. Self-adaptive learning technology has been considered to be the latest achievement in the field of information technology. How can it combine with teaching activities has become the latest and hottest topic of education technology research.

In the learning system for self-adaptive learning technology, learners can customize their own learning plans and content based on their own learning habits and objectives. At the same time, the system can design a more structured and systematic learner model according to the learners' basic information and learning behavior, offer learners more appropriate learning content based on personalized model with learners' characteristics and help formulate learning strategies as a way to effectively improve learners' efficiency. When a learner uses the self-adaptive learning system, he often makes continuous improvement in learning level and learning ability. Meanwhile, the system also gains and analyzes learners' related information. Self-

adaptive learning technology not only makes learners gain the initiative in learning, but also it accurately offers learners accurate instruction whenever and wherever they learn in accordance with their mastery and learning ability as a “good mentor” for learners. Therefore, self-adaptive learning technology must be the important direction of education technology development in the future.

As shown in Table 1, since 2011, the Horizon Report has listed learning analysis technology as an education technology adopted within the coming four or five years, and in the Horizon Report issued in the following years, the importance of learning and analysis technology became more prominent. In 2015, the learning and analysis technology for self-adaptive learning was included in the technology that would be adopted within the coming four or five years, and in 2016, it was considered to be the education technology adopted within the coming one year together with the learning analysis technology. Learning analysis technology is also known as “the third wave of education technology development since the introduction of self-learning management system”, which shows the rapid development and importance of current learning analysis and self-adaptive learning technology.

Table 1. Education Technologies Enumerated in the Horizon Report within the Last Five Years.

Adoption time	2011	2012	2013	2014	2015	2016
Within 1 year	Electronic textbooks Mobile terminal	Mobile application Tablet	MOOC Tablet	Flipped classroom Learning analysis	Bring your own device Flipped classroom	Bring your own device Learning analysis and self-adaptive learning
Within 2–3 years	Augmented reality Game-based learning	Game-based learning Learning analysis technology	Game and gamification Learning analysis	3D Printing Games and gamification	Maker Space Wearable Technology	Augmented reality and virtual reality Maker space
In 4–5 years	Gesture-based calculations Learning analysis	Gesture-based calculation Internet of Things	3D Printing Technology Wearables	Quantify yourself Virtual assistant	Self-adaptive learning technology Internet of Things	Emotional computing Robot

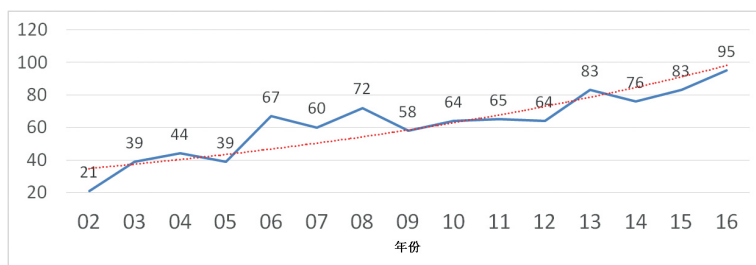


Figure 1. Quantitative statistics of research related to self-adaptive learning in the past 15 years.

Although the term of “Self-adaptive Learning Technology” appeared in the Horizon Report in 2015, the related research has been carried out for a long time. The author searched the “Self-adaptive Learning” in HowNet and made a simple statistical analysis on the relevant papers in the past 15 years, as shown in Figure 1.

It can be seen that since 2002, a certain number of researches on adaptive learning have been conducted and increasing year by year in recent years. However, in the process of researching relevant papers, the author found some problems. Few studies of self-adaptive learning are related to language teaching, and even less are related to the teaching of Chinese language. With the improvement of China’s comprehensive national strength and its increasing international influence, the international status of Chinese language is increasingly growing, and Chinese learners are increasing year by year. However, in the context of global craze for Chinese language, the traditional teaching mode of Chinese as a foreign language reveals some problems. Learners of Chinese language come from different countries, have different native language backgrounds, and their learning styles and proficiency are also different, it is indeed unrealistic to conduct targeted teaching that respects students’ individual differences. In addition, there is a large shortage of teachers of Chinese as a foreign language, especially the outstanding teachers. In the current teaching mode, learners can only be categorized according to their skills in Chinese language or several common learning needs, such as business, preparatory studies, and speed-up educational program. This obviously cannot meet the individual needs of learners. When talking about distance education, Yu Shengquan pointed out that “distance

education separates individual student from the student group and puts him in a more personal situation. However, for this group of students with individualized learning, we have to impose such a group teaching model that is based on the same competency, synchronous teaching process, synchronous testing and evaluation process, which is obviously unreasonable.

Therefore, it is very necessary to explore the new mode of teaching Chinese as a foreign language by means of self-adaptive learning technology. This paper tries to set up a grammar knowledge database for TCSL by taking grammar as the breakthrough point, select the complex sentence teaching in Chinese grammar as an example, with the use of textbooks and corpus and based on a systematic review of grammar knowledge of complex sentences, thus establishing a self-adaptive learning system for TCFL, and making some useful explorations for the combination of TCFL and self-adaptive learning technology.

Significance of the topic

Extension of the fields of self-adaptive learning system

The learning content of the current self-adaptive learning system or platform is mostly about science and engineering. First, because self-adaptive learning technology is developed based on the development of new information technology, and people with a background in science and engineering are more likely to contact and implement the system; Second, there is a strong logical relationship between the knowledge of the science and technology discipline, and the sequence of learning and the difficulty of knowledge are easily defined, so that the knowledge can be systematically sorted out. Comparatively speaking, although the knowledge of language teaching has some logical relation, it's scattered. There are few logical relationships between knowledge points, and there are some disputes about the learning order and difficulty of knowledge points. The entire discipline lacks the logic system compared with the science and engineering disciplines. Therefore, as self-adaptive technology is applied in language teaching, it is necessary to consider the characteristics of language

teaching itself seriously, and find the similarities between language teaching and self-adaptive learning. Setting up self-adaptive learning system for language learning has been important for the application of self-adaptive learning techniques in different kinds of disciplines, which can further expand the application of self-adaptive learning technology and deepen the theoretical basis of self-adaptive learning.

Significance to Grammar Teaching for Chinese Learners

The application of educational technology in teaching Chinese as a foreign language is also developing rapidly. A variety of online teaching models and resources have emerged for different teaching purposes and needs. However, previous studies have mainly focused on the traditional multimedia technology-assisted Chinese language teaching and the construction of teaching resource database. Although there has been a certain awareness of differentiated teaching, such as type and country, the learner's different characteristics cannot be fully considered. What we need to solve is not only how to enrich the teaching modes and expand the teaching resources, but also to address what kind of learner is suitable for the mode, and what kind of learning resources meet different learners' need. The ideal digital resources should satisfy the individual needs of each Chinese learner, thereby stimulating their motivation and firing their enthusiasm for learning and fully reflecting the learner-oriented approach, and ensuring the efficient improvement of learners' communicative competence in Chinese. The real value of education technology lies in effectively improving learners' learning efficiency with the assistance of information technology rather than simply providing educational resources that lack systematic guidance. We shall provide the corresponding teaching resources in accordance with full understanding of learners' needs and use the self-adaptive learning technology to make these resources more effective so that they can be used by suitable learners at the right time as a way to maximize their value and make learning more effective. The significance of self-adaptive learning lies not only in the ability to develop a learning mode that is in line with individual characteristics of learners, but also in cultivating learners to adopt appropriate learning strategies and develop good learning habits so as to facilitate learners' effective and lifelong learning.

Review of Related Research

Definition of Self-adaptive Learning System

Brusilovsky earlier proposed the definition of self-adaptive learning system: self-adaptive learning system is a system that collects data from student interactions, create learner's models and overcome the problem of "no significant differences" in traditional education. The Education Informatization Office of U. S. Department of Education proposed that the self-adaptive learning system can dynamically change content, content presentation methods and learning strategies based on information about learners' feedback during the course. Xu Peng of Northeast Normal University believes that the adaptive learning system is a system that provides learning support suitable for individual characteristics during the learning process. It creates a personalized learning environment through a comprehensive analysis of learning style and mastery of learners so that they can learn at any time and any place. Huang Boping believes that adaptiveness is reflected in connectivity, content, and culture. Connectivity means that part of the learning content is connected internally. The learner can get access to the learning content by means of a variety of ways, and the system is presented in different ways according to the learner's model. Content refers to providing additional information based on the learner's model as a way to make up for the lack of knowledge and to hide unnecessary information; Culture means that we consider learners' different backgrounds, motivations and tendencies, and update teaching tasks accordingly. Song Yunxian thinks that the self-adaptive learning system is designed based on artificial intelligence technology. It is a learner-centered, computer-mediated learning technology system for comprehensive research topic. The system covers related fields of knowledge, teaches strategies and methods, and simulates the learner's knowledge and the thinking process of the teaching expert. The ultimate goal is to simulate the role of the human teacher to a certain extent, adjust the learning content dynamically with teaching methods and subject knowledge according to the learner's objectives and needs, and effectively create conditions for learners.

Relatively speaking, the definition of self-adaptive learning system from foreign countries is more concise, emphasizing the provision of

personalized services through the collection and analysis of learners' data in the learning process. The domestic definition adds learning styles, mastery levels, etc. based on the learners' own background, and builds a more comprehensive analysis model. In all, the emphasis is on the learning system's recording of learners' information and learning behaviors, and the use of learning analysis techniques to achieve real-time personalized education.

Foreign Related Research Review

Foreign study on self-adaptive learning started earlier. In 1996, Peter Brusilovsky and his colleagues from the University of Pittsburgh developed the first self-adaptive teaching system and created the AH&H (Adaptive hypertext & hypermedia) website (<http://www.win.tue.nl/ah>) to introduce relevant research results. After that, many countries have done a lot of work on self-adaptive learning system research. At the theoretical level, the concepts, basic theories, characteristics, models, key links, development history, and structures of self-adaptive learning systems have yielded rich results. Based on this fact, many self-adaptive learning systems have been developed to provide personalized services.

Brusilovsky *et al.* have developed self-adaptive systems such as Inter Book (1996), ELM-ART (2001), Knowledge Sea (2002), and Annotat Ed independently or in cooperation with other universities. Inter Book will create a personalized model of user knowledge for every registered user, and apply this model to provide self-adaptive navigation support and self-adaptive help for users, in which self-adaptive navigation is represented by chain marking with colored lights. ELM-ART is an intelligent and interactive web-based teaching system and has achieved good results in teaching activities at the University of Trier in Germany. The system provides all online learning resources in the form of user-adaptive and interactive textbooks, offers students personalized knowledge navigation, serialization, personality analysis, problem solving based on instance, and other functions. ELM-ART has added a method for obtaining user information through exercises, and each page corresponds to an exercise group. If the answer is correct, it can increase the exercise. If the answer is wrong, it can decrease the exercise until the user gets enough points. The user