# A Study on the Application of Artificial Intelligence in the Blended Teaching Mode—Take College Japanese Course as an Example

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**Abstract.** The vigorous development of modern education and information technology has provided foreign language teaching with high-quality teaching resources as well as diverse modern teaching methods and teaching tools. In this study, a new blended teaching mode that meets the actual needs of the current College Japanese course is constructed by using the multifunctional online teaching platform from three aspects: pre-class, in-class, post-class. A REINFORCE algorithm is employed to recommend suitable learning materials for students by assessing their learning status and needs. The specific methods of blended teaching are summarized in the hope of providing a reference for further innovation of AI-based teaching technology as well as for improving the effectiveness of Japanese language teaching in the future.

**Keywords:** blended teaching · college Japanese course · Artificial Intelligence · teaching mode · REINFORCE algorithm

## 1 Introduction

Blended learning that combines online and offline learning comes from the development of distance education technology. Since the beginning of distance education, radio, television broadcasting, satellite communication and other distance education technologies have appeared. With the advent of the Internet, personal decentralized online learning such as synchronous interactive distance learning has gained popularity. In the 21st century, online learning began to suffer from low learner desire and reduced opportunities for experiential learning through social activities. The term "blended learning" emerged when people began to call for a combination of face-to-face teaching methods to compensate for these shortcomings of online learning. In higher education, the most commonly used definition of blended teaching refers to the integration of traditional teaching methods such as face-to-face lectures and online teaching [1]. In early studies, the term blended learning, which combines offline face-to-face instruction with computer-based or online learning, was used as a blended learning concept [2, 3]. Since

then, the effects of blended learning have been noted in a number of studies targeting university faculty and students, allowing the concept of blended learning to begin to attract widespread attention [4].

In the era of booming information technology, Artificial Intelligence (AI) are gradually being applied to the field of language teaching and learning and play an important role in assisting the teaching process [5–7]. AI technology is considered to be of great importance in the field of foreign language teaching, being more specific and advanced than other technologies, enabling computers to perceive, predict and plan what the human brain can do, the widespread use of mobile intelligent terminals has further facilitated the development of modern teaching modes driven by AI technology [8]. Blended teaching has become a popular teaching approach in foreign language teaching in recent years, and teachers can design and develop more personalized and varied teaching mode with the application of AI technology. From the perspective of the application of AI technology in blended teaching, this study will explore the deep integration of information technology that blended teaching mode suitable for College Japanese course, in terms of curriculum design, platform application, evaluation system and implementation effect.

## 2  Design of Blended Teaching Mode

The goal of blended teaching mode of College Japanese course is to combine traditional face-to-face teaching mode with online teaching mode, which maintains the original characteristics of the traditional teaching method while taking advantage of the online teaching. The online and offline blended teaching is generally divided into two types, one is the combination of offline group classes with online teaching activities outside of class, and the other is the addition of online teaching activities in offline classes. The current College Japanese language courses are mainly conducted in the former form.

In this study, the designed teaching mode of the College Japanese course is divided into three teaching sessions: pre-class, in-class and post-class, as shown in Fig. 1. In order to realize a blended teaching mode that can link online and offline course through pre-class, in-class and after-class teaching sessions, an online College Japanese course was established though Chaoxing learning platform. In this work, a reinforcement learning based method for recommending learning material to students based on their learning status was proposed.

We first transform the recommendation task to a Markov Decision Process (MDP) problem. Assume that we need to teach $T$ classes, then each episode has $T$ steps. According to the recommendation task, we define the problem as a four-tuple $<S, A, \gamma, R>$ MDP as follows:

$S$ is the state space. The learning status of a student at $t$- th class is defined as $s_t \in S$.
$A$ is the action space. In this task we classify the materials needed in the classroom into $n$ types and define $a_t$ as the proportion of $n$ types of materials for lesson $t$.
$\gamma$ is the discount factor.
$R$ is the reward. In this work, we need to improve the learning performance of a student, thus we designed a reward function as students' online autonomous learning time after class.
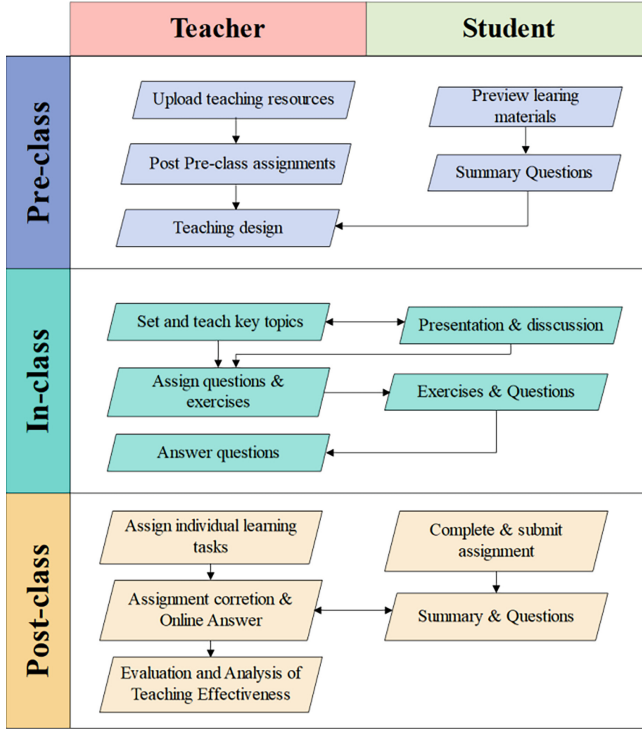
**Fig. 1.** Teaching mode for College Japanese course

Here, we employ the REINFORCE algorithm and design a Policy Net as shown in Fig. 2. The input to Policy Net is the state $s_t$ of step $t$, and the output is the action $a_t$ selected based on the current state. We designed a neural network based on two Fully Connected (FC) layers with hidden state size 128 and a ReLU function which can learn more complex pattern than $Q$ table. The final output layer we use a Softmax function to output $a_t$, the proportion of each different teaching material for the next class.

The REINFORCE algorithm [9] employs a Monte Carlo approach to estimate $Q^{\pi_\theta}(s_t, a_t)$ as
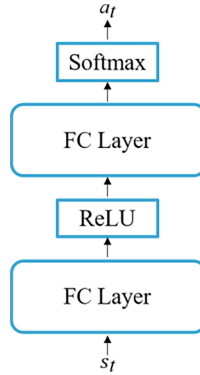
$$G_t = \sum_{t'=t}^{T} \gamma^{t'-t} r_{t'} \tag{1}$$

thus the gradient of objective function $J(\theta)$ is:

$$\nabla_\theta J(\theta) = \sum_{t=1}^{T} \nabla_\theta \log \pi_\theta(a_t|s_t) G_t \tag{2}$$

Then, we can update parameters $\theta$ with gradient ascent as:

$$\theta = \theta + \alpha \nabla_\theta J(\theta) \tag{3}$$

Where $\alpha$ is learning rate we set 0.001 in this work and the Fig. 3 describes the update process.

$$a_t$$

$$\uparrow$$

| Softmax |

$$\uparrow$$

| FC Layer |

$$\uparrow$$

| ReLU |

$$\uparrow$$

| FC Layer |

$$\uparrow$$
$$s_t$$

**Fig. 2.** The structure of Policy Net

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**Input:** Policy Net $\pi_\theta(a|s)$
**Output:** Parameters $\theta$ of Policy Net
1: Initialize $\theta$ at random
2: **for** episode from 1 to E **do**
3:     Generate episode trajectory $\tau = \{s_1, a_1, r_1, s_2, a_2, r_2, \ldots, s_T, a_T, r_T\}$ based on policy $\pi_\theta$
4:     **for** $t$ from 1 to $T$ **do**
5:         $G_t \longleftarrow \sum_{t'=t}^{T} \gamma^{t'-t} r_{t'}$
6:     **end for**
7:     $\nabla_\theta J(\theta) \longleftarrow \sum_{t=1}^{T} \nabla_\theta \log \pi_\theta(a_t|s_t) G_t$
8:     $\theta \longleftarrow \theta + \alpha \nabla_\theta J(\theta)$
9: **end for**
10: **return** $\theta$

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**Fig. 3.** REINFORCE algorithm

Building and improving teaching resources for online courses and assigning preview assignments are the focus of the pre-class phase. Various types of teaching resources (including documents, pictures, audio, video) will be uploaded to the cloud server through the platform. Then, in the pre-class phase, teacher issues corresponding learning tasks such as preview assignments and related questions through the platform. The pre-class assignments are divided into course-related basic content and extra-curricular extended content according to students' actual Japanese language level. Teacher sets important learning contents as task points. Students can study online according to their own situation and complete the assignments and test questions. The platform automatically counts the students' completion of the pre-class tasks and scores. Students' online learning data will be statistically fed back in real time, and the class participation and course organization will be analyzed through AI technology, to help teachers adjust the teaching contents and methods in real time. In the new designed blended teaching mode, the AI teaching response robots based on deep learning, machine learning, neural

networks and other technologies can be of great help. Based on students' behavioral data of browsing texts, images, videos and other resources online, feature extraction and deep learning recommendation algorithms based on artificial intelligence can intelligently recommend relevant learning materials to users based on their browsing behavior. For instance, the ultimate goal of oral Japanese teaching is to enable the students to speak proficiently, but the textbooks have considerable limitations in terms of contents, which constrain the teaching effect of teacher and also restrict students' acquisition and improvement of oral skills. The development and application of AI technology provide new means; the platform-based Japanese corpus can break the constraint very well. The AI-based platform can supply corresponding contents on the specific topic, so that students can get broader knowledge extension in the interaction with AI.

Furthermore, in case of grading for online exercise, manual scoring is usually susceptible to subjective factors that can lead to biased results. In contrast, the artificial intelligent scoring system can automatically give the score not just faster, but also more accurate and fair. With the support of intelligent learning platform and assessment system, students can find their knowledge weak links in time and give students a visual and clear picture of their learning condition. This makes students increase their interest in learning and a greater willingness to use the platform for in-depth independent learning. As long as students log in to the platform through their intelligent terminal, they can use their fragmented time to do systematic oral training and improve their oral communication skills anytime, anywhere. Compared with the traditional classroom teaching mode, teachers can integrate teaching and learning decisions according to the individual differences of students. The AI-enhanced education technology can study the individual differences of each user, and based on this, launched a personal learning mode that is different from each other. With the support of the intelligent learning and assessment system, students able to break down their intellectual weaknesses and improve their intelligent learning based on their individual characteristics.

The teacher can also use the analysis results given by the platform to understand how well students have mastered specific knowledge. Having a good grasp of student learning at the pre-class stage helps teachers to be better prepared for subsequent in-class sessions.

In the in-class phase, there will be online and offline course integration, from course introduction, text explanation, accompanying exercises to discussions and quizzes etc., where teacher actively interact with students online and offline. Teacher fully integrates online and offline knowledge, uses multimedia equipment to display various learning resources on the platform to students simultaneously, and to explain the key course content, and allows students to participate in real-time voting and quiz through mobile intelligent terminals, encouraging students to actively participate in teaching activities. By giving full play to students' subjective initiative and enlivening the classroom atmosphere, teaching becomes more lively and efficient. For problems encountered in the learning process, students can communicate online in real time or discuss in groups under the guidance of teacher. Teacher uses the abundant teaching resources on the platform can effectively improve the learning efficiency and their overall language application

skills in a rich and flexible blended teaching mode. In addition, the platform can automatically record and analyze the in-class performance data of students, so that teachers can make comprehensive and objective evaluations of students after class.

At the post-class stage, teacher returns to online teaching activities, assigns post-class assignments, conducts online discussions and answers questions, and focuses on sorting out difficult problems that learners tend to encounter in the learning process. Teacher can set more diverse forms of assignments through the platform, in addition to the basic assignments. Take pronunciation training as an example, the intelligent oral recognition and pronunciation assessment system which based on AI technology scores in multiple dimensions such as pronunciation, fluency, completeness, and intonation to help students test their learning results and correct their pronunciation accurately. In the interactive practice, the system can find the problem of students' pronunciation by intelligently recognizing the dynamics of the pronunciation correction system, so as to provide targeted guidance to solve the problems in oral expression. In addition, the system can recommend the next stage of learning by evaluating the student's Japanese level and learning needs, such as providing targeted conversation practice. It can target different weak links of students and meet their more refined learning needs. The powerful AI technology, combining the online course with intelligent human-machine, allows students to better grasp their learning pace through interactive mode. It helps students to adjust the learning plan according to their actual situation to achieve the best learning effect, which makes students enjoy learning with the platform and thus stimulates students' interest in learning. Compared with the past, this teaching and learning mode with the help of AI technology can quickly study the individual differences and practical problems of students and solve problems with much higher relevance than in the past. The visual display of the scoring system of the post-class assignments gives students an intuitive and clear picture of their learning status, which helps them to do their revision work much better. Students learn best by learning their own lessons and mastering the principles and skills, an important aspect that must be emphasized in the future of digital education.

The teacher can actively encourage students to collect and summarize the content on relevant learning topics, and to fully prepare for in-class presentations. Students are free to arrange the time, place, pace, and mode of study for the online course and complete the construction of knowledge according to their own wishes and needs. With the reference to the quantified student learning data from the platform, such as the frequency of completing online learning tasks, correct answer rate, and overall grades, the teacher can monitor, guide and evaluate students in a more detailed and accurate manner.

**Evaluation of Teaching Effectiveness**

Questionnaire survey was conducted to analyze students' attitudes towards six aspects of the course before and after the adoption of the blended teaching approach. The questionnaire mainly focuses on the students' interest in Japanese learning, their preference for the course and activeness in the course. Each question is scored on a 5-point scale. T-test analysis was conducted on the questionnaire data and the results are presented in Table 1.

The results showed that there was a significant difference in the mean values of the two questionnaires, and the mean values of each question in the questionnaire before

**Table 1.** T-test results of the questionnaire data

| Score | Question1 | | Question2 | | Question3 | | Question4 | | Question5 | | Question6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Before | After | Before | After | Before | After | Before | After | Before | After | Before | After |
| 1 | 2 (5.3%) | 0 (0.0%) | 4 (10.5%) | 0 (0.0%) | 2 (5.3%) | 0 (0.0%) | 1 (2.6%) | 0 (0.0%) | 2 (5.3%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| 2 | 5 (13.2%) | 0 (0%) | 12 (31.6%) | 8 (21.1%) | 5 (13.2%) | 2 (5.3%) | 7 (18.4%) | 3 (7.9%) | 10 (26.3%) | 5 (13.2%) | 6 (15.8) | 5 (13.2%) |
| 3 | 14 (36.8%) | 6 (15.8%) | 10 (26.3%) | 11 (28.9%) | 15 (39.5%) | 17 (44.7%) | 13 (34.2%) | 8 (21.1%) | 12 (31.6%) | 14 (36.8%) | 17 (44.7%) | 13 (34.2%) |
| 4 | 15 (39.5) | 14 (36.8%) | 9 (23.7%) | 11 (28.9%) | 13 (34.2%) | 10 (26.3%) | 14 (36.8%) | 14 (36.8%) | 14 (36.8%) | 9 (23.7%) | 12 (31.6%) | 10 (26.3%) |
| 5 | 2 (5.3%) | 18 (47.4) | 3 (7.9%) | 8 (21.1%) | 3 (7.9%) | 9 (23.7%) | 3 (7.9%) | 13 (34.2%) | 0 (0.0%) | 10 (26.3%) | 3 (7.9%) | 10 (26.3%) |
| Mean | 3.26 | 4.32 | 2.87 | 3.50 | 3.26 | 3.68 | 3.29 | 3.97 | 3.00 | 3.63 | 3.32 | 3.66 |
| (SD) | (.950) | (.739) | (1.143) | (1.059) | (.978) | (.904) | (.956) | (.944) | (.930) | (1.025) | (.842) | (1.021) |
| t-test | 6.989 | | 4.571 | | 3.800 | | 2.865 | | 3.706 | | 2.401 | |

**Note: n = 38, \*p < .05, \*\*p < .01, \*\*\*p < .001**
Question1: Are you interested in learning Japanese?
Question2: How is your current state of learning Japanese?
Question3: Do you like the course "College Japanese"?
Question4: What do you think of the current teaching mode of "College Japanese"?
Question5: Do you often interact with teachers and classmates during the learning process?
Question6: How do you think your Japanese learning effect is?

the adoption of blended teaching are lower than those after the adoption of blended teaching, indicating that after learning the blended teaching course, students' interest in Japanese learning and the autonomous learning enthusiasm in the course have been greatly improved.

## 3    Conclusions

This study makes a practical exploration of the blended teaching mode of College Japanese course, so as to achieve the purpose of optimizing and improving teaching effects. The new AI-based teaching mode places more emphasis on individual differences among students, and compared to traditional offline teaching mode. REINFORCE algorithm was applied for assessing their learning status. Teachers can teach in a more precise and efficient way to integrate and adjust teaching contents more flexible according to students' individual differences.

The results of the course analysis showed that through the practical application of new blending teaching mode, students have gradually formed a good habits of independent learning through "online classroom" and pre-class preview, could explore and polish their own learning skills, developed the ability to find, analyze and deal with problems. More importantly, through the advanced teaching platform, the information of both teachers and students can be timely feedback and exchange, and teachers can flexibly adjust the content and pace of the class. The teaching and learning efficiency has been significantly improved; students have gradually formed a set of solid and effective learning methods. The application of information teaching platform improves student interest in learning, and also enhances the practical effect of teaching. With the emergence of AI and big data technology, it has become possible to provide a more scientific evaluation system for Japanese language education in terms of both reliability and validity. The intelligent judgment of AI technology provides an important help and reference for assessing students' Japanese language skills and abilities.

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