A Study on the Application of Intelligent Educational Robot in Teaching of "Communicative German" Course

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Abstract—In recent years, intelligent robotics, driven by artificial intelligence, is gradually entering schools and classrooms, empowering learning and innovation, spawning a new teaching and learning ecosystem. Meanwhile, the application of intelligent educational robots in the teaching of spoken foreign languages is also increasingly attracting attention. Based on this, the construction of a new teaching environment supported by intelligent educational robots, designing teaching models and carrying out teaching practices are important for teaching German as a foreign language in universities. It is found that through teaching practice, educational robots can increase the interest of teaching, stimulate students' interest and initiative, optimize the teaching process, and greatly improve the effectiveness of teaching.

Keywords—Intelligent Educational Robot; Communicative German Course; Teaching Application

1 INTRODUCTION

The New Media Consortium of America noted in its Horizon Report (Higher Education Edition), released back in 2016: "Robots have been integrated into our work and life from various angles".[1]In 2017, the "New Generation of Artificial Intelligence Development Plan", issued by the State Council, defined the strategic objectives of the development of a new generation of artificial intelligence in China: "To use intelligent technology to accelerate the reform of talent training mode and teaching methods, and build a new education system that includes intelligent learning and interactive learning."[2] Many scholars have conducted fruitful explorations in the field of educational robotics. While foreign researchers mainly study educational robots in language, science and technology [3], domestic educational robots are divided into 12 categories, such as children's entertainment and education companions, family intelligent assistants, classroom robot assistants and robot teachers [4].

Robot-assisted education refers to the application of robots in the teaching process, assisting teachers in completing teaching tasks, and using the intelligent functions of robots to communicate and interact with learners, to achieve the purpose of personalized teaching. As a new carrier of information technology education, intelligent educational robots are increasingly becoming an important part of the intelligent learning environment. However, in the field of foreign language teaching, educational robot-assisted education still remains at the stage of theoretical exploration and practical application research is lacking.[5] In the teaching

of spoken foreign languages in China, most students lack the opportunity to interact and communicate in foreign languages in real-life situations due to the limitations of the teaching environment. Educational robots enable real-time human-machine dialogue or remote communication between learners and native speakers in real-world scenarios and can largely make up for the lack of interactive communication among students in the current foreign language teaching in China.

Based on the roles of educational robots in teaching spoken foreign languages, this paper takes the course of Communicative German in universities as an example, attempts to teach with the support of intelligent educational robots and explores the effectiveness of intelligent educational robots in teaching spoken German.

2 CLASSIFICTION OF THE ROLE OF EDUCATIONAL ROBOTS IN TEACHING SPOKEN FOREIGN LANGUAGES

According to the technical design of educational robots and their application in oral teaching, their roles can be divided into 4 categories: a "teacher" who directly teaches foreign language speaking skills; "teaching assistants"; a "companion" for students' language learning; a "telecommunication intermediary" that allows teachers and students to communicate with others through remote control.

With the rapid development of artificial intelligence and language processing technology, educational robots have been able to play the role of teachers in teaching, instructing and supervising students. While teaching through the whole process, it can also recommend books for learners, answer questions and evaluate the learning effect and give feedback by asking questions to the learners.[6]

The robot acts as a "teaching assistant" for the teacher, assisting the teacher in the transmission of knowledge and teaching content. Classrooms that incorporate educational robots tend to be more engaging for students in the way they are presented, and also allow for a more three-dimensional and intuitive presentation of knowledge.

As "companions" for students, robots often have anthropomorphic features and advantages. Students interact with the robot to master the knowledge points, easily gain an immersive learning experience in the learning process and then express and realize their real ideas.

By controlling the telepresence robot with a joystick or sensor, teachers and students can interact remotely with native and nonnative speakers. Teaching topics and learning tasks can revolve around subjects, people and socio-cultural activities in a distant place, to provide authentic and rich cultural background and language context for spoken foreign languages teaching.

3 TEACHING DESIGN AND PRACTICE

3.1 Construction of Teaching Environment

In a classroom supported by an intelligent educational robot, a "guidance-feedback"

interaction is formed between the teacher and the students, and between the robot and the students. The classroom starts with the teacher sending an application request to the robot, which responds to the request and provides feedback on the results. For example, teachers can send requests to the robot to keep track of students' real-time learning progress and emotional state, etc. The robot processes and analyzes the data based on student feedback and then presents it to the teacher.

In the digital classroom, the teaching media is a digital environment consisting of software and hardware, and teaching content is not limited to textbooks or digital teaching materials. It also includes multimedia materials such as video and audio, as well as rich Internet resources, etc. Both the teacher and the educational robot take on teaching and learning tasks, along with the robot's synergy with the digital environment. From this, a model of the teaching and learning environment of the classroom can be constructed, as shown in Figure 1.
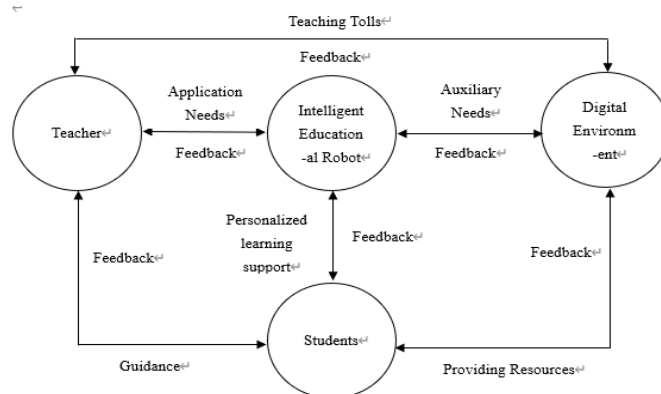

Fig.1 The Model of Teaching and Learning Environment

In this environment, the educational robot acts as a "teacher" and needs to take on some of the teaching tasks, but the assignment of teaching tasks needs to be clarified in advance by the human teachers. Furthermore, educational robots also need to work with the digital environment to accomplish the task of providing resources. Students can give feedback directly to the teacher and the robot, or they can give feedback to the digital environment first and then to the educational robot. Educational robots can provide personalized learning assistance that is difficult to acquire, allowing teachers to move away from repetitive tasks and focus on guiding students' thinking and honing their overall skills.

3.2 Design of Teaching Model

The course "Communicative German" is taught in an online multimedia classroom and mainly focuses on pronunciation training and conversation practice. Since it is difficult for teachers to create realistic communicative scenarios when teaching this course in class, there are difficulties in mobilizing the classroom atmosphere, making the learning process interesting and improving the teaching effect. The educational robot can not only replace the teacher to repeat the pronunciation training and make accurate evaluation of students' pronunciation, but also call up videos of conversations from real communication scenarios, even join in the conversation as a "language partner". In this way, the teaching process could be effectively

enriched.

According to the functional characteristics of educational robots and the actual needs of the course "Communicative German", a three-stage teaching model of "task-driven, goal-oriented, dual-teacher collaboration and comprehensive improvement" was designed, as shown in Figure 2.
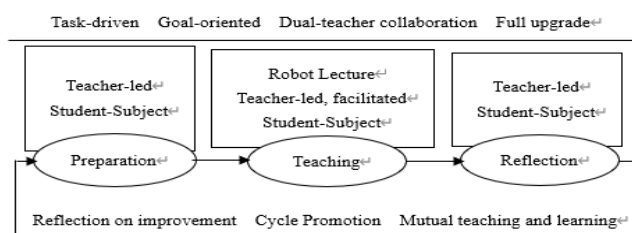

Fig.2 The Three-stage Teaching Model

In the pre-class preparation stage, teachers play the role of a "director", plan and design the classroom teaching, such as teaching content analysis, learning situation analysis, learning objectives determination, and learning task design. They analyze human-machine strengths, divide human-machine work, develop forms of human-machine collaboration and also design robotics teaching style and teaching ideas, prepare teaching materials, write robot programs and set parameters, etc. Students are the main subject of the whole teaching process. In this stage, they should pre-study certain materials, and sort out the difficulties and doubts during the pre-study process.

In the teaching phase, the robot is the main speaker, while the teacher leads and assists the robot. Robots render learning situations, take attendance, review old lessons, introduce new lessons, teach knowledge, lead readings, collaborate with teachers, interact with students, and participate in group dialogue exercises. Teachers, by collaborating with robots, monitor the classroom, and gain insight into each student's learning. Students listen to robotics lectures, watch media materials, interact with the robot, reflect on mistakes and correct them.

In the post-class counseling and reflection stage, teachers analyze teaching records, and sort out unprocessed knowledge points and students' doubts. Furthermore, they update the robotics teaching database, modify the human-robot collaboration program, teaching program and robotics program, and correct homework, online review and answer questions. After students complete their assignments, they carry out activities such as online questions, reflecting on the teacher's comments and transferring knowledge and skills. And then, the improved measures, methods and attitudes will be used in the next round of learning to achieve the purpose of circular promotion and mutual teaching and learning.

3.3 Teaching Practices

According to the four roles of intelligent educational robots in teaching spoken foreign languages, the author has made the following attempts in the teaching practice of the course "Communicative German":

The teacher role of the educational robot is mainly applied to the teaching session of

pronunciation training, using the educational robot's own speech recognition, synthesis and evaluation functions. First, the teacher talks to the robot, introduces the new lesson with a Q&A session, and clarifies the learning objectives, tasks and important and difficult points, with the robot exaggerated, comical sound effects and performance, to stimulate students' interest in learning. After that, the robot will explain the pronunciation techniques of vowels a, e, ö and consonants b, p, d, t with multimedia materials such as pronunciation diagrams. The teacher demonstrates in real time with the robot and emphasizes the importance of pronunciation. Afterwards, the robot reads the words containing the above letters, changing the rhythm and tone appropriately, with movements and expressions, and issues the reading task. The Teacher listens carefully to students' pronunciation, finds problems and provides timely guidance and comments. The robot continues to demonstrate the tongue twisters for the relevant letter sounds and issues individual and group reading tasks. Finally, the robot conducts a class test, makes a real-time evaluation of students' pronunciation, summarizes the main content of the lesson, and issues post-lesson self-assessment questions.

The role of teaching assistant is mainly applied to the vocabulary stage: After the teacher introduces the topic of the lesson, the robot starts to tell a story or brings up a dialogue video on the Internet with the German words to be learned embedded in the story and the video, then asks questions and guides the students to answer them, in order for students to understand the targeted German words. Then students will gradually become familiar with and memorize these words through exercises such as vocabulary sorting and word selection. In addition, the author is constantly trying to apply some of the functions of the ROBOSEM robot[7] to the "Communicative German" course: when the teacher walks or the student makes a sound during classroom teaching, ROBOSEM can automatically turn to the teacher or the student and automatically identify the learners based on their voices or QR code tags attached to their clothes, retrieve their study files and record their test scores.

Robotic learning companions serving as an artificial student, work with the students through dialogue or collaboration to complete learning activities. In the "Communicative German" course, the most common form of such learning activities is role-play or dialogue exercises. In the role-play practice, the teacher first sets up the scenario and designs the roles, with the robot as one of the legitimate party in the given situation. Next, the robot and the student work together to complete a conversation in the scenario, when finished, the robot and the student switch roles and repeat the conversation. In the final stage of the course, the basic vocabulary and sentence patterns are consolidated through a mini-test given by the robot. The dialogue exercise is to a certain extent, conducted freely in nature in a way that students don't have to copy the book to complete a dialogue with the robot, but rather they should write their own dialogue based on the situation already set. Students can talk to the robot as independent questioners, while in turn, the robot can respond in a conversational manner based on the built-in program and the questions asked by the students.

Successful use of the educational robot as a remote communication intermediary would require a partnership agreement with a German university and other networks to connect the two classrooms via the robot. Due to the great difficulty of implementation, the author has only made preliminary ideas so far. Students can use the camera and microphone on the robot's head to transmit their images and voices to the monitor and audio equipment on the head of the telepresence robot in a German university classroom, and have video conversations with the teachers and students there. In addition, both students in Germany and

China can control the movement of the robot with a joystick or sensor to see a specific picture.

3.4 Feedback on Teaching Effect

At the end of the semester, the author examined the environment, mode and effectiveness of teaching, the three dimensions, through a questionnaire. A total of 30 copies were distributed and collected. They are valid. The survey results show that all students prefer the teaching model supported by educational robots and feel that they can concentrate on learning in such a teaching environment, and that other technology can replace the robot to achieve the function of speech teaching, but can't achieve the effect of robot teaching. However, 16.7% of students believe that the teaching arrangement is not flexible and the process is not smooth enough; 23.3% felt that the teacher did not work well enough with the robot and that the robot program occasionally lagged; only 33.3% thought that this mode of teaching was more effective in promoting independent learning after class.

4   CONCLUSIONS

By applying intelligent educational robots to the Communicative German course, the author found that educational robots can optimize the teaching mode, improve teaching methods, enhance students' learning effectiveness, and increase students' interest in learning. However, there are some problems and challenges during the teaching practice, such as the novelty effect and AI technology wisdom limitations.

Although most studies have found educational robots to be effective in motivating learners, one of the reasons for this may be the novelty effect. It refers to the increase in interest and effectiveness of learning due to curiosity aroused at the initial stage of exposure to a new technology, and yet the gradual decline of such a feeling of novelty as the technology continues to be used would lead to a corresponding decline in interest and effectiveness.[8] To effectively overcome the novelty effect, teachers should prioritize the design of instructional activities and content rather than focusing solely on the application of robotics itself.

The ability of existing AI technologies to understand language is mainly obtained through large corpus training, and the understanding of learners' communication intentions by some educational robots relies on manual predefinition. In authentic open-ended spoken communication, the robot may not be able to accurately understand all new linguistic forms, topic content, and communicative intent to provide effective feedback on these new forms and content. Furthermore, robots lack emotion. Students were unable to feel the emotions of the robot as they interacted with it, leading some students to prefer to interact with a live teacher. In the future, the emotional factor in human-robot communication should be given due consideration in the development and design of educational robots.

Continuous innovation of teaching mode supported by intelligent educational robots and the improvement of teaching effect will become an important direction for the research of spoken foreign language teaching reform. Besides, advanced applications such as dynamic data collection, real-time evaluation, and intelligent pushing in lectures by robots are yet to be further explored.

REFERENCES

[1] Jing H, Liu D, Gao L (2016) New Media Alliance's Horizon Report (2016 Higher Education Edition) Interpretation and Insights in Journal of Distance Education, 2: 3-10.

[2] (2017) No. 35. Notice of the State Council on the issuance of a new generation of artificial intelligence development plan.

[3] Sharkey Amanda J (2016) Should we welcome robot teachers? Ethicsand Information Technology, 4: 283-297.

[4] Huang RH, Liu DJ, Xu JJ. (2017) The development status and trends of educational robots. Modern Education Technology, 1: 13-20.

[5] Gong LL. (2020) Recent advances and insights in international research on robotics education in K-12 in the last decade - based on a systematic literature review approach. China Distance Education, 3: 25-34.

[6] Ruan S et al. (2019) BookBuddy: Turning digital materials into interactive foreign language lessons through a voice chatbot. In:Proceeding of the Sixth (2019) ACM Conference on Learning @ Scale. New York: pp.1-4.

[7] Park S J et al. (2011) Teaching assistant robot, ROBOSEM, in English class and practical issues for its diffusion. Proceeding of the 2011 IEEE Workshop on Advanced Robotics and Its Social Impacts. Half Moon Bay, CA: IEEE, 2011.8-11.

[8] Liu S, Liao H & Pratt J A. (2009) Impact of media richness and flow on e-learning technology acceptance. Computer & Education, 52(3): 599-607.