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**AYSE TUNA**

Trakya University, Turkey

## **A SURVEY ON THE USE OF HUMANOID ROBOTS WITH MULTILINGUAL INTERACTION ABILITY IN FOREIGN LANGUAGE TEACHING**

### **Abstract:**

Studies show that humanoid robots can be quite useful for many teaching goals since they can be updated with the most current teaching techniques and knowledge, teach one-on-one, and do not get tired no matter how many mistakes students make. Although learning a foreign language is harder for adults, some students struggle to learn a foreign language, too. However, with their distinct features, humanoid robots with multilingual interaction ability can help students learn a foreign language. In this study, we review state-of-the-art humanoid robots that are used in foreign language teaching, present novel approaches in the roles of humanoid robots used for foreign language teaching, investigate research challenges, and state future research directions.

### **Keywords:**

Humanoid robots, Multilingual interaction, Foreign language, Teaching.

**JEL Classification:** I20

## 1 Introduction

Humanoid robots look, move, and act like a human and have the ability to provide real-time feedback. Unlike computers, tablets, and smart phones, humanoid robots are social, can create a personal connection with the students and help resolve several issues related to confidence shyness, reluctance, and frustration that may arise in a traditional classroom setting. Different from most teachers and instructors, humanoid robots are endowed with endless patience, do not get tired no matter how many mistakes a student makes, and are able to customise the teaching of each student. Since they can give each student unfettered attention and have no concept of personal space or awkwardness, humanoid robots can be superior learning companions, especially for students with different learning styles or learning disabilities. For instance, children with autism spectrum disorder often require one-on-one instruction but teachers are a limited resource. In addition, they can give all students top-notch, up-to-date education with the latest knowledge. Although in most classroom settings humanoid robots are mostly used for specific and repetitive tasks, such as vocabulary, attendance and behaviour imitation, researchers in the field think that many other possibilities exist. Hence, humanoid robots are utilised or being experimented in classrooms as teachers or teaching assistants in many countries (Chen and Chang, 2008).

Many researchers have shown that children treat robots as important players in the classrooms and are willing to listen to the instructions given by the robots and answer the robots' questions although they generally do not ask for help from the robots when they do not understand something. Different from their teachers, the children think of the robots as helpers, who do not punish them if they make a mistake. The biggest limitation of the humanoid robots in the classroom setting is that in situations where the robots are unable to understand and interpret the children's intentions, a lot of the interaction disappears. Because, most humanoid robots cannot be autonomously situated in the classroom setting mainly due to technological limitations such as inaccurate speech or emotion recognition. On the other side, some types of humanoid robots allow telepresence that may resolve this problem. Using the telepresence ability, a kind of interfacing mechanism that allows the teacher to control the humanoid robot with minimal training, the teacher can remotely connect to the classroom through the humanoid robot and participate in the classroom by being virtually present through the robot's display mechanism, typically is embedded in the robot's torso.

With their multilingual interaction skills, some types of humanoid robots can enhance cross-cultural communication if they are programmed to behave and respond in a culturally accurate manner. These robots can be used to create learning environments for students to practice real-life conversations and be applied to a wide range of foreign language teaching programs. Accordingly, in this study, we review humanoid robots that are used in foreign language teaching and present novel approaches in the roles of

humanoid robots used for foreign language teaching. The remainder of the paper is as follows. Related work is presented in Section 2. Section 3 presents research challenges and state future research directions. Finally, the paper is concluded in Section 4.

## 2 Literature Review and Classification

With their ability to provide real-time feedback and their physical shape, humanoid robots can successfully create a personal connection with the students and help resolve issues related to frustration, reluctance, shyness, and confidence. As it is known, children having difficulties to communicate with others do not get the education they need. This is more severe for children who do not have the official language of the country they live as their mother tongue. Humanoid robots with appropriate interfacing mechanisms that allow facilitating their integration in classrooms can be used to address this problem. On the other hand, to succeed in the classroom settings, humanoid robots need to monitor all that is happening, realise natural language processing required for effective communication, and detect the emotional state of each student. As well as foreign language teaching, humanoid robots can be used to teach sign language to hearing impaired students. Although sign language plays an important role for hearing impaired people and enables them communicate easier, teaching it is a difficult task (Akalin and Kose, 2013).

Humanoid robots are used for different purposes in foreign language teaching. In (Alemi, Meghdari, and Ghazisaedy, 2014a), the use and effects of humanoid robots for high school students on the vocabulary learning and retention of English were investigated. The authors proved that the use of humanoid robots is very influential in creating an efficient and enjoyable English learning environment. The authors also measured the students' anxiety and attitude towards humanoid-robot assisted learning and proved that there was more positive attitude and lower anxiety towards English learning in the humanoid-robot assisted learning. They also proved that the use of humanoid robots creates great fun in the learning process, helps the students learn more effectively, and boosts the students' motivation. On the other hand, although humanoid robots generally bring easiness and more joy to the learning situation and promote learning, the materials that can be used in the learning sessions are limited and it is not easy to directly apply humanoid robots to foreign language teaching for adult learners. Hence, a product called "Repeat Robot" is under development (Hemminki and Erkinheimo-Kyllonen, 2017). Moreover, initial experiments indicate that since humanoid robots are useful in foreign language teaching and presents better results compare to the traditional human-based language teaching, human-robot cooperation is necessary (Meghdari et al., 2013).

If students with high-functioning autism are to be engaged in language classes, special strategies including a specific order of seats and routine greetings are highly useful (Wire, 2005). Because of their interest in technological tools, for such students, the use of

humanoid robots is one of the most promising alternatives. The results of a study carried out in 2015 (Alemi, Meghdari, Basiri, and Taheri, 2015) showed that students with high-functioning autism have the ability to learn a foreign language and humanoid robots can be successfully applied in foreign language teaching.

Traditionally, in foreign language teaching, a teacher plays the role of the commander, and the students are the actors and they have the right to give commands during the learning activity (Chang et al., 2010). On the other hand, some teachers and students may not be willing to play the role of actors that follow the students' commands. Hence, humanoid robots can be used for this role as well as enhancing the students' engagement (Xie, Antle, and Motamedi, 2008). Humanoid robots might also be useful for other popular foreign language teaching approaches such as task based language teaching. In task based language teaching, humanoid robots can play the role of stimulator or manager and this way reduce the problem of classroom management. They might reduce the problem of English avoidance, too (Kanda and Ishiguro, 2005). Basic functions of humanoid robots for different roles in foreign language teaching are given in Table I. Considering their common skills, for foreign language teaching, humanoid robots can be used in five different modes as listed in Table II.

**Table I.** Basic functions of humanoid robots for different roles in foreign language teaching (Chang et al., 2010)

Role	Function
Tutor	They help students in remembering vocabulary (Saerbeck et al., 2010).
Peer	Humanoid robots acknowledge that the students pronounce a word correctly (Han and Kim, 2009).
Learning tool	By playing with them, students learn certain phrases (Mubin et al., 2012).

**Table II.** Modes for foreign language teaching (Chang et al., 2010)

Mode	Description
Storytelling	Humanoid robots can play stories in female or male voices. While playing stories, they can provide sound effects or perform comic actions for increased engagement.
Oral reading	Humanoid robots could lead the students to repeat aloud vocabulary and sentences. By female/male voice transitions, they allow the students to practice speaking in the roles of different characters.

Cheerleader	Humanoid robots can help teachers lead certain games in which the students play individually or they are divided into groups. In competitive games, humanoid robots also help the teachers play the role of not only a fair judge but also a coach who gives the students advice and encourages them by dancing and shouting for joy.
Action-command	Humanoid robots can ask the students to perform certain tasks and the students can ask the robots to do the same things. The robots automatically obey the children's instructions and this way the students might be encouraged to practise their speaking skills.
Question-and-answer	Humanoid robots can instruct the students to develop their communicative competence so that the students can use the language to communicate, comment, and talk about their feelings.

### 3 Research Challenges and Open Research Issues

One of the drawbacks of using humanoid robots for foreign language teaching is that in most countries, there is strong hesitancy in admitting the integration of humanoid robots in classrooms. However, humanoid robots should be perceived as learning tools, not teachers, and the main aim of most researchers in robotics is to design humanoid robots that can function as an engaging and motivating educational tool (Lee et al., 2008). Since they do not trust the technical capabilities of humanoid robots, most teachers prefer full control over the humanoid robots and prefer them to take on restricted roles in classrooms. In fact, main reason of the reluctance of the teachers is the uncertainty of how to incorporate humanoid robots in the classroom setting successfully and efficiently.

Since children are interested in social interaction, humanoid robots designed to be used in classrooms must be able to communicate socially and help to create human-like interaction. In this regard, humanoid robots need to recognise faces, detect basic emotions from facial expressions, adapt their behaviour to their feelings and display a wide range of expressions and emotions if they are going function as inspiration and engaging tools. However, these kinds of behaviours require significant research in robotics. For instance, humanoid robots' voice is generally unnatural and humanoid robots cannot adapt to situations by changing their voice's tone or pitch. Due to their common technological limitations such as inefficient speech recognition and inaccurate emotion recognition, humanoid robots are generally not autonomously situated in classrooms.

It has been shown that although novel instructional tools can facilitate foreign language learning in various ways (Yang and Chen, 2007), they are not easy to interact with and are difficult to customise (Chang et al., 2010). In addition, adopting them alone does not improve learning significantly (Hegarty, 2004). Moreover, learning content carried by such

tools should fit with the students' level. Finally, there are some practical issues related to humanoid robot-assisted foreign language teaching. Humanoid robots in the classroom sometimes might create a risk of chaos. However, this can be prevented by the experienced teachers by structuring and organising the activities. Also, it is time consuming set up and turn on humanoid robots in the beginning of the lessons and the background noise can create some speech recognition problems.

If a humanoid robot is used in learning activities, the role of the teacher is directly linked to the role that the robot plays (Mubin et al., 2013). If the humanoid robot acts as the main focal entity in learning activity, the teacher takes on the role of a facilitator (Alimisis, 2012). If the robot takes on a passive role then the teacher should transfer base knowledge.

To sum up, although humanoid robots are the best tool for some repetitive learning tasks of foreign language teaching, holding students' attention alone is almost impossible for them and it is better to use them as a complementary tool in the classroom setting.

## 4 Conclusion

Although many studies propose a variety of educational roles for humanoid robots and humanoid robots can be updated with the most current knowledge and teaching approaches in the field and can be programmed to know exactly what inspires students to learn, particularly useful for one-on-one teaching, if they are going to be used in the classroom setting, they must be able to read the students' reactions to ensure a good communication flow. On the other hand, since they still lack human emotional intelligence, though they can be excellent teaching assistants or learning tools in classrooms, they cannot replace human teachers.

In this paper, we reviewed state-of-the-art humanoid robots used in foreign language teaching and presented novel approaches in the roles of humanoid robots used for foreign language teaching. Moreover, we investigated research challenges and stated open research issues. As presented in the paper, though most humanoid robots are successfully used for some educational goals in classrooms, they lack the spontaneity, intuitiveness and emotional intelligence of humans; therefore, they will not replace human teachers in the near future but help the human teachers to carry out selected repetitive functions.

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