Exploring the possibility of Robots as Teachers

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Abstract:
With the advent of Machine Learning, scientists and researchers around the globe are now getting closer tocreate machines that are as intelligent as human beings. As robot technologies develop, many researchershave tried to use robots to support education. Few studies have shown that robots can help students developproblem-solving abilities and learn computer programming, mathematics, and science. Because robotsutilize the imagination of younger people, they have been validated as useful aids for the teaching ofmathematics and physics. Furthermore, future research directions in the realm of robots for education hasbeen discussed in paper.

Keywords:
Educational robots, human-robot interaction, students with disabilities

Introduction
Robots are becoming an integral component of our society and have great potential in being utilized as an educational technology. The use of robotics by non-engineering, non-technical instructors has been termed a "robotic revolution" (Hendler, 2000).

A teacher's capability can be divided into two parts: The amount of knowledge they have, and the way they can express it. Expression is important because he/she needs to get to level of the student, i.e., beginning from the basics; with the knowledge of the student.

Firstly, the requirement for replacing a human teacher with a robot or a machine should be discussed. The first issue is the lack of communication ability of the teacher. This is a problem across many schools and universities. The second issue arises with the performance of the student. It is a fact to be accepted that every student is unique. Therefore, when a professor evaluates him/her, he/she will be able to find their highs and lows, and would help them by giving suggestions. But when the strength of the class is more, this task becomes strenuous.

Advantages of Robot teaching over Human Beings

Firstly, this machine is programmed with only one intention in mind; to teach a subject. Therefore, if a human teacher can fill the capacity of robots with intervening knowledge, it can act as efficient as a human teacher. The memory of a human being is large but it tends to focus on lots of things. When the same scenario is seen for a machine, it doesn't have a lot because it is programmed to do only one large task. So it can perform more effectively because it does not have a lot in its "mind". Secondly, when the interpretation of the students' weaknesses and strengths point comes in mind, for human teachers, this is a difficult task to do because it involves focussing on a group of people, individually. For example, when a professor evaluates a quiz in a class, he might or might not notice the variation in the marks for each student compared to that of the previous one. When this situation arises to a robot teacher, since it has the entire data stored in the memory in the form of tables, it can refer to them to assess the performance of the student. The robot, when notices a dip in a student's marks, it can check the table horizontally, comparing it to the student's previous performances, and vertically, checking the relativeness compared to the other students in the class. This helps the machine evaluate whether it is a tough quiz or a decline in the performance of the student. The machine can also correctly assess the time to hold an intervention in case the performance of the pupil deprecates.

What Role Does the Robot Have During Learning

The robot on the one hand, can take a passive role and be used as a learning tool/teaching aid. This would especially apply to robotics education. On the other hand, the robot can take the role of co-learner, peer or companion and have active spontaneous participation (where the focus was on cooperative learning with the Asimo robot). In summary, we can define three main categories of the role of a robot during the learning activity: tool, peer or tutor.

	Tutor	Peer	Tool
Language	The robot helps students in remembering vocabulary	When a student pronounces a word correctly, robot says well done	A student learns certain phases in a non native language by playing a game with a robot
Science	The robot adapts the arithmetic exercises based on the performance of the students	The robot and the students collaboratively work in a science class	Sensors in robot enable students to learn tough subjects like physics
Technology	The robot discusses the difficulty of programming task with students	It plays an animation sound when student successfully program the robot	Students use LEGO Mindstorms NXT to learn about programming

Table 1[4]: Comparing robots in different roles

Characteristics of robots

Those characteristics of robot which made it popular as an instructor

Repeatability

Robots perform easy, repetitious actions without complaining. This attribute helps not only teachers who reuse learning content but also children who need oral practice.

Flexibility
Robot flexibility allows teachers to adjust and design appropriate robot-supported instructional activities for relevant teaching and learning requirements.

Digitization
Robots are digital. Because of this attribute, a robot-supported language instruction database, can be developed to record teachers' experiences. This would not only help instructors to instruct more effectively but also assist developers in designing more functional robots for language teaching. Also, a robot can communicate with computers through a wireless channel such as Bluetooth or Wi-Fi. This enables a robot to interact with students via the support of software and materials in computers.

Body movement
Movements are an important attribute in language expression. Robots with gestures not only increase motivation but guide children by using appropriate gestures while speaking.

Interaction
One fundamental function of robots is their ability to interact with people. This feature allows robots to become teaching assistants and supports more realistic language expression.

Particular roles for robots with disabled students
Educational applications for robots can help students with disabilities in two main ways:
• The robots can be enabling in themselves – students can undertake a wide range of tasks that would have been otherwise denied by them because of their disabilities.
• Accessible interfaces to educational robots can lead to disabled students to have equal participation with peers in robot based leaning activities.

Examples of robot teacher

A fully functional, robot aided, science education programme for students with disabilities was developed by Howell [Howell, et. al. (1994)]. Examples of teaching material included experiments in biology, where seeds were grown under different conditions, and physics where properties of materials where tested. The project AURORA (Autonomous robotic platform as a remedial tool for children with autism) is also being used as a commercially available mobile robotic platform.

Sony AIBO ERS-7 Robotic dog

An AIBO named Woofie teaches the children vocabulary through a Simon-style memory game. Woofie stands on a table at eye level. Woofie speaks a sequence of animal names accompanied by their sounds, and the children repeat the sequence back to Woofie. The AIBO Quiz Builder and AIBO Questioner represent a promising model for integration into classrooms and use for research of HRI and e-learning theories in general.

NAO

The Career and Technical Education Academy in Hutchinson, Kan, has hired a new teacher, NAO. Nao was developed by the French startup company, aldebaran-robotics which describes the robot as an autonomous and programmable humanoid. Nao offers students interactive lessons; for example, rather than calculating the velocity of a hypothetical curve ball themselves, students can use Nao's help to apply the mathematical formula in a computer program. The company hopes high schools like the one in Hutchinson will incorporate its robots into their science, technology, engineering and mathematics curricula to jump start interest.

Conclusions

Robots have found great pedagogic reasons at education level. They provide great help to disabled students and also provide curriculum benefits, but, it still needs a human teacher to teach it, i.e. the machine should first learn the concepts of the subject to teach. Moreover, robots can be an expensive technology with costs ranging from about 100 ECU to 10,000 ECU. So we can say, since the use of robots in education is still in its infancy there are difficulties with staff training, technology reliability and a lack of quantitative studies showing the educational impact.

So, an activity is required to:
1. Raise awareness within the teaching professions as to the potential of robot Technology.
2. Low cost robots and associated software need to be made more widely available
3. A wide range of applications need be developed for a common robotic platform so that the investment in the technology is seen to have cost benefits across the curriculum and not just in a few specialised areas.
4. Teacher resources that integrate the robotic tools with curriculum material need to be produced, evaluated and marketed.

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