

# CAN ROBOTS IMPROVE STUDENT CONFIDENCE IN A LARGE CLASSROOM?

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## INTRODUCTION

**Student engagement** is becoming increasingly important in (higher) education, especially for younger generations, whose demand for an interactive classroom experience has grown (Handelsman et al., 2005). Student engagement is defined partly by **student participation** and interaction (Rocca, 2010). Studies have shown relations between participation and **increased motivation, attention, memory and learning** (Weaver & Qi, 2005).

One of the factors that decrease participation is a lack of participation confidence.

This has been thought to be due to the fact that students have a fear of speaking before a large group, are afraid to stumble over words and appear unintelligent. This phenomenon is summarized by the term **"classroom apprehension"**. Classroom apprehension is felt at least occasionally by around 70% of students (Bowers, 1986). Classroom apprehension increases with more people present (Smith, 1992): in a large classroom, participation is lower than in smaller classrooms.

A lack of confidence in the classroom leads to students asking less questions. This is a problem, as asking questions not only signal confusion and misunderstanding of lesson material (Dillon, 1981), which allows teachers to teach more effectively, but also helps students broaden their understanding of a subject. **Improving participation confidence thus might improve the amount of questions asked, which in turn facilitates better learning and understanding of a subject.**

Decreasing classroom participation and increasing participation confidence can be done in multiple ways, but one of the most effective is by providing **feedback to a student**. A supportive climate diminishes classroom apprehension and encourages participation (Rocca, 2010). Feedback is easily provided in one-on-one sessions, but providing personal feedback to each student might be very hard for a teacher, especially in a large classroom setting.

The introduction of a social robot, who gives **personal feedback to students in a non-disruptive manner**, might be beneficial for the overall goal of increasing student engagement.

## BACKGROUND

We found, as did Belpaeme et al. (2018) and Lehmann and Rossi (2019) that there is a **gap in literature regarding the field of educational social robots**. Most of the relevant literature is about the use of robots with children or in preschool contexts and not with university students or in lecture hall contexts. Also the use of robots in education is mainly driven by technological feasibility rather than by didactic theory or psychological dynamics in education. A lot of robotic studies used in education are about the performance of the robot and less about the effects it has on the people interacting with these robots. Performing this study will **contribute to broaden the field more towards students**. Different use cases of robots used in education are discussed below. Starting with the different robot roles, second, robots that stimulate engagement in class and finally robots that provide feedback.

There are **three different roles for robots** used in education: as a tutor or teacher, as a peer and as a novice (Belpaeme et al., 2018). Several studies reported about **robots stimulating students' engagement** in class. Masashi, Ryoichi & Hiroaki (2020) proposed a system to solve the problem that students don't raise their hands and actively ask questions during the lecture by using a humanoid robot who asks the questions. Their idea is that with the help of a robot the burden for students who do not usually ask questions can be lowered.

Different studies have been addressed who found that **feedback given by robots** can improve participation confidence. Park et al. (2011) found that students in the robot-instructor condition showed greater attraction towards the instructor when received positive feedback. A study by Gao et al. (2018) found that people preferred more general feedback or support over more personal and adaptive feedback. Lehmann and Rossi (2019) proposed an inactive robot assisted didactics approach where the robot becomes the mediator between the teacher and the students.



## RESEARCH QUESTION + HYPOTHESIS

**RQ: "To what extent does a robot improve students' confidence to ask questions in class by providing positive feedback, compared to a situation without a robot?"**

**H1:** The social robot's behaviour and feedback will improve the amount of questions asked during class.

**H2:** The social robot's behaviour and feedback will decrease the level of anxiety of students.



## METHOD

**2 Sessions**  
Robot/Not Robot  
Large classroom with at least 50 students

**Physiological Measures**  
Empathica E4 wristband  
-Galvanic Skin Response (Everyone)  
-Heart rate

**Psychometric Measures**  
-State-Trait Anxiety Inventory (Self-assessed)  
-Hamilton Anxiety Scale (Interview)  
12 random students.

### Robot Behavior:

- Robot introduced as peer student
- Students can ask questions to the robot, anonymously if they want, to the robot and the robot will ask the teacher when the opportunity comes.
- Robot may approach students to encourage them to ask questions.
- Pepper robot will be used for convenience.

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