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# Students' Attitudes towards the Possible Future of Social Robots in Education

Sofia Serholt and Wolmet Barendregt

***Abstract*— User's attitudes and perceptions of robots are increasingly being explored using a variety of methods. Considering the views of key stakeholders, and allowing such views to shape technology, is a prerequisite for the future of robotics. Yet, eliciting such views in a situation where participants have no frame of reference is no easy task. In our field of educational robotics, we are currently exploring ways in which to highlight potential ethical concerns and attitudes held by students and teachers. In this paper, we present the results of a questionnaire study conducted with 45 students in Sweden during a workshop called *Robots in School: Fun or Scary?***

## I. Introduction

As the possibilities of robots in society are being increasingly explored in various areas such as healthcare and education, users' attitudes and perceptions of these ubiquitous technologies are being brought to the forefront [1-8]. In our field of educational robotics, where we are currently involved in designing, developing and evaluating robotic tutors able to be sensitive to students' affective states in learning situations, we are exploring ways in which to highlight potential ethical concerns of key stakeholders, such as teachers and students.

A recent Eurobarometer on public attitudes towards robots revealed that although EU citizens are generally rather positive towards the use of robots in society, only 3% of the participants believe that robots should be used for educational purposes [9]. Moreover, the participants were also inquired about in which areas they considered that robots should be banned, where 34% thought that robots should be banned within education, indicating the importance in the field to study perceptions and attitudes further. Yet, it seems that the focus in previous studies is often placed on gaining users' acceptance rather than eliciting design sensibilities that may allow for the shaping of the technology according to users' needs. This concern is further emphasized by Šabanovic, who recognizes the importance of including potential users in early design decisions so that robotic technologies are "socially robust, rather than merely acceptable" [10].

In this paper we present the results of a questionnaire conducted within an ongoing workshop-event held thus far with 45 students between the ages of 11-16 years old from various schools around Gothenburg, Sweden. The purpose of the questionnaire is to explore the opinions of students surrounding possible ethical dilemmas that may or may not arise when implementing affect sensitive robotic tutors within educational settings. Moreover, we hope to shed a light on how such opinions may lead to design implications for the future of the field.

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## II. Method

In our current study we aim to elicit students' attitudes and concerns surrounding robot-aided learning within educational settings. Yet, eliciting such views in a situation where participants have no frame of reference is no easy task. As such, the researcher must provide a frame of reference. "While with existing technology users' responses are informed by direct experience, with future technology their responses are informed by the way in which this is represented" [11]. Such difficulties we have experienced during some of our prior studies with teachers in schools [12, 13].

As part of the International Science Festival Gothenburg, classes of schoolchildren were invited to register their participation in a workshop called *Robots in school: Fun or scary?* Grades 4-9 were legible for participation, and a total of 7 classes were scheduled. The workshop design described below was piloted at a separate school prior to the studies. Three workshops have been carried out thus far, and we plan on extending this data set further.

### A. Participants

The participating school classes were two classes of 9th-graders and one class of 5th-graders. In total, 45 students participated, of which 17 were in 5th grade and 28 were in 9th grade. There were 26 boys, 17 girls, and 2 students who did not answer the question about gender.

### B. Workshop Design

The workshop consisted of four stages: an introduction to the project's robot, a video, a focus group activity, and an individual questionnaire. Each of these activities will be described subsequently.

#### 1) Introduction to the robot

The workshop started with a short introduction of the research project, followed by a presentation of the Nao torso robot from Aldebaran Robotics. The robot was programmed to introduce itself, perform a dance, and to interact with the students through speech and face recognition, sensitivity to touch, as well as random behaviors. Students and their teachers were also allowed to ask questions.

#### 2) Video

Thereafter, a 7-minute video was shown consisting of two parts. The first part was about robots in society currently, as well as an illustration of the technical background to affect recognition, including a segment from

a Wizard of Oz study carried out with an English student interacting with our robot. This part of the video aims at demystifying the current state of the art as used in the project. The rationale behind this lies in Bryson's [14] voicing of researchers' obligation to educate people about their moral obligations towards robots. The second part of the video comprised segments from the motion pictures Robot and Frank and I, Robot, respectively. The former was used to give a "feel-good" illustration of how the future of robotic care might look like, possibly inducing feelings like friendship and closeness, whereas the latter was used to induce more threatening feelings about the future with robots. These threatening feelings, concerning e.g. robot responsibility, robot morality and overtaking human-kind were also voiced in focus groups discussing the ethical aspects of the use of robotics in the ETICA project [15]. Since priming effects[1] may occur based on part of the video that is experienced last, the two segments were shown in alternating order, e.g. either the segment meant to elicit positive feelings or the segment meant to elicit negative feelings was shown last.

*3) Focus group activity*

Immediately after watching the video the students were divided into focus groups consisting of 3-5 students each. Although this is a relatively low number of participants for usual focus group studies it is a group size that is common for group work in schools. We therefore judged this number as appropriate.

Similar to a study with children by Woods, Davis & Dautenhahn [16] the students in the focus groups were first asked to choose a picture of a robot that would visualize their ideas around an appropriate school robot from a set of nine pictures. Thereafter they were asked to describe why they had chosen this particular picture. The nine pictures in the robot image portfolio were gathered from the Internet and selected to include a variety of features based on the following defining criteria: a) movement (wheels, legs), b) facial features (eyes, mouth), c) overall appearance (humanoid, android, technobot, animal), and d) gender. All pictures showed real robots, not fictive ones.

Thereafter the groups were asked to discuss and write down their thoughts around the following four questions:

1. What should a robot in the classroom be able to do?
2. What should a robot in the classroom be forbidden to do?
3. What would be fun if a robot could do/would be?
4. What would be scary if a robot could do/would be?

The posters that the groups created in this way (see Figure 1) were then discussed during a plenary activity in which students were asked to explain their reasoning to the other groups.

[1] We are aware of the ongoing debate about the robustness of priming effects, as voiced by Kahneman, but deem it beneficial to take the possibility of priming effects into account.

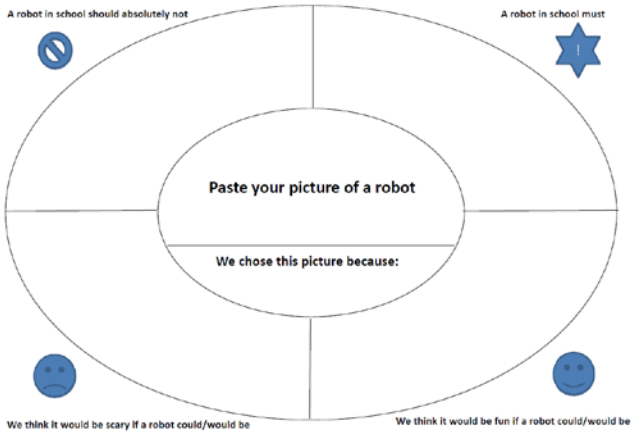


**Figure 1 Poster used to support the focus group activity**

*4) Questionnaire*

The questionnaire was designed to include a set of different criteria on ethical issues and areas of concern surrounding robots. These issues were drawn from two separate sources, of which the first was the Negative Attitudes Towards Robots Scale (NARS) [4], and the second was a collection of normative issues compiled in a deliverable by the EU-project ETICA [15]. The normative issues by ETICA were determined through literature analyses and focus group sessions surrounding several future technologies, such as affective computing, robotics and artificial intelligence.

The purpose of the questionnaire was to gain insights into which robot capabilities are deemed beneficial or problematic from students' points of view, in order to raise design issues as well as an ethical discussion. Based on the abovementioned sources, we selected the following areas of concern as starting points for our own work:

1. Anthropomorphism or human resemblance,
2. Attitudes towards robots able to display emotions,
3. Attitudes towards interacting with robots,
4. Autonomy and decision-making,
5. Dependence,
6. Concern for younger children,
7. Privacy,
8. Affect recognition,
9. Responsibility gap or accountability,
10. Replacing humans or overtaking jobs.

These areas were selected firstly because they directly correspond to the development undertaken by our research project. Secondly, we concluded that it was especially relevant for educational contexts.

When surveying children, it is important to give special consideration to the construction of questionnaires so that they are tailored according to the social and cognitive development of the target age group [17]. It is important that the language is simple and direct, and that ambiguity is avoided. Also, children are more likely to respond in socially desirable ways, so prescribing value or posing questions in certain ways may easily sway them.

It is furthermore not advisable to present too many response options. In some cases, five point scales may be valid for older children, whereas with younger children,

response options should be limited to a maximum of three [17]. As such, we chose to refrain from the more conventional use of five point scales in favor of merely *yes*, *no*, or *I don't know/I don't want to answer*. Considering that this particular study comprised students ages 11-16, we chose to make the questionnaire more adapted for lower ages, and maintain this design for all participants. The questions translated from Swedish were as follows (the numbers in parentheses represent the themes mentioned above):

1. Do you think that robots with human characteristics should be allowed in schools? (1)
2. Do you think that robots should show emotions? (2)
3. Could you talk to a robot? (3)
4. Could you ask a robot for help with your schoolwork? (3, 5)
5. Could you be friends with a robot? (3)
6. Could you talk to a robot in front of your friends? (3)
7. Would you like a robot to grade your assignments? (4)
8. Could you trust a robot? (5)
9. Do you think that preschool children should be able to have robot teachers? (6)
10. Do you think that robots should decide things in society? (4)
11. Would you like a robot to record things you do and say? (7)
12. Would you like a robot to be able to analyze your feelings based on e.g. your facial expression and heart rate? (8)
13. Do you think that robots should be held accountable if they do something wrong? (9)
14. Do you think that robots should be able to replace teachers in schools? (10)

## III. Results

As described in the previous section, the workshop design contained several activities, such as focus group work, a plenary discussion, and a questionnaire. However, since the analysis of the group work is still in progress, we have decided to only discuss the results of the questionnaire in this section.

In the table below, the percentage of students who selected each response option is based on the total of 45 students who participated in the study.

TABLE I. Questionnaire results

| Questions | Response options | | | No response |
|---|---|---|---|---|
| | ***Yes*** | ***No*** | ***I don't know/I don't want to answer*** | ***No answer*** |
| 1 | 86,7%* | 8,9% | 4,4% | 0% |
| 2 | 71,1%* | 20% | 6,7% | 2,2% |
| 3 | 95,6%* | 2,2% | 2,2% | 0% |
| 4 | 93,3%* | 4,4% | 2,2% | 0% |
| 5 | 66,7%* | 15,6% | 15,6% | 2,2% |
| 6 | 80%* | 6,7% | 11,1% | 2,2% |
| 7 | 20% | 64,4%* | 15,6% | 0% |
| 8 | 42,2% | 22,2% | 33,3% | 2,2% |
| 9 | 17,8% | 77,8%* | 4,4% | 0% |
| 10 | 0% | 97,8%* | 2,2% | 0% |
| 11 | 22,2% | 60%* | 17,8% | 0% |
| 12 | 75,6%* | 15,6% | 6,7% | 2,2% |
| 13 | 53,3% | 28,9% | 15,6% | 2,2% |
| 14 | 13,3% | 75,6%* | 11,1% | 0% |

* = $p<0.05$

Students responded significantly more positive than negative towards using robots with human capabilities in education. Also, the majority of the students are seemingly comfortable with a robot both showing and interpreting emotions. However, when it comes to the areas of autonomy and decision-making, responses indicate that students are generally rather negative towards granting robots freedom to grade their assignments or make decision in society (questions 7, 9 and 11).

Furthermore, over 50% of students considered that robots should be held accountable for their mistakes, and very few answered that they thought that preschool children should be able to have robot teachers. Finally, the issue of privacy and storing of personal information was considered unacceptable by the majority.

## IV. Discussion

The questionnaire study yielded some interesting results surrounding what students may consider to be acceptable behaviors and capabilities for a robot to work within educational contexts. In this discussion we would like to reflect in more detail on some of the findings from the questionnaire. Further analysis of the qualitative data from the focus groups will give a better picture of students' natural concerns regarding the use of robots in school.

First of all, the students seem to be positive towards interacting with robots that both display and understand emotional signals, making them in some way behave similar to human agents. However, the students do not want to give these robots the agency to decide and determine things, neither regarding grades nor other things in society. In this respect they seem to consider the robot merely a tool. It is also interesting to notice that whereas real-time affect recognition was deemed acceptable, the attitude towards recording of students' behaviors and utterances was more negative. So, the robot is allowed to use its perceptive capabilities during the interaction but should not record this data, meaning that others could have access to it.

Second, although the students are positive towards their own use of robots with these human characteristics in the classroom, they are generally negative towards preschool children interacting with robots. One possible explanation is that they are concerned about younger children's capabilities of seeing the robot in the same way as they do: a useful tool. It also might be the case that the students react so strongly because there might be a caretaking aspect involved. Since at least in Sweden, preschools offer both caretaking and education, the notion of preschoolers having robot teachers can easily trigger ethical concerns about caretaking robots. This topic has for example been researched by Sharkey and Sharkey [18] who state that in regard to the question whether it is ethically acceptable to use a robot as a nanny substitute or as a primary carer: 'If our analysis of the potentially devastating psychological and emotional harm that could result is correct, then the answer is a resounding 'no'.

Of course, it can also be the case that the students interpreted the question as being about replacing human teachers. Seeing as teacher replacement is something that the majority of the students were very negative towards, they may have feared that this particular question concerned such endeavors. We thus need to delve deeper into this issue to clarify why students have such a clear opinion about preschool children's use of robot teachers.

Finally, several questions elicited many more 'Don't know' answers than others. Examples are the question asking whether the student would trust a robot (question 8), and whether robots should be held accountable (question 13). Both questions probably require students to have more experience with robots. One student wrote in a comment about trusting a robot: "I don't know since I do not know any robots yet". Since trust is something that needs to be built, this probably indicates that students think they need more experience with a robot before being able to decide. Concerning accountability one student answered that robots should not be held accountable and wrote "Those who have created the robot". This indicates an interesting point for further investigation, especially when robots become more and more self-learning. Who is responsible for the creation of a robot if it is not pre-programmed but adapts itself based on experiences?

## V. Conclusion

Although this questionnaire yielded some interesting results on students' views on the use of robots in education in relation to ethical questions such as privacy and accountability, it should also be analyzed in relation to the focus group discussions that took place during the workshops to gain a greater understanding of students' concerns. As such, the questionnaire provided a background to the frequencies of various concerns, whereas analyzing the material produced by the focus groups might provide insights relating to why they have these concerns, and how we can base our design and ethical decisions on such concerns in the future. We will hold similar workshops with children in the UK and Portugal and with teachers, which will hopefully give us a better understanding of all stakeholders' attitudes towards the introduction of social robots in classrooms in the near future.

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