Investigating Educators'Appropriation of Robots for Autistic Children in Special Education Settings in France: Work in Progress

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***Abstract*—This short paper is aiming to present our work in progress about a study to investigate the cognitive process of teaching for young learners with ASD in special education settings. Because research has largely examined the different cognitive processes involved in planning, instruction, and reflection separately and often in lab-controlled settings, our work in progress is searching to investigate attitudes of educators in special education settings (dedicated for children with ASD) towards robots as a category of tools in natural conditions and the impacts of their attitudes on their effective behaviours. From a theoretical point of view, this work in progress is based on the 4A Model for "Acceptability, Acceptance, Adoption and Appropriation", created to describe and predict relationships between attitudes and appropriation of complex technologies such as robots. From a methodological point of view, this work in progress is based on a mixed approach, combining interviews and focus groups conducted with several professionals working in different special education settings for children with ASD, and observations in situ to collect objective data about real activities performed by the educators with the children in the special education settings. Finally, it is suggested that future researchers examining educators' thoughts and actions employ mixed methodologies, such as case study, that examine the cognitive processes holistically and in the natural teaching/education environment, thereby linking actual behaviors with the cognitive processes that produced them.**

***Keywords*—robot, autism, educators, acceptability, professional**

I. Introduction

France has approximately 700,000 people with Autism Spectrum Disorders (ASD), including 100,000 children. Rapid progress in technology, especially in the area of robotics, offers tremendous possibilities for innovation in treatment for individuals with ASD. Advances in recent years have enabled robots to fulfill a variety of human-like functions, as well as to aid with the goal of improving social skills of individuals with ASD [21] [25] [26]. The process of teaching for young learners with ASD is complex and multidimensional. Teaching behaviors and actions are shaped by numerous cognitive decisions made by the educators before, during, and after instruction. The work in progress presented in this paper examines educator cognition across the broad field of education and, more specifically, when robots are used in special education settings. To date, research has largely examined the different cognitive processes involved in planning, instruction, and reflection separately and often in controlled settings. It is suggested that future researchers examining educators' thoughts and actions employ mixed methodologies, such as case study, that examine the cognitive processes holistically and in the natural teaching/education environment, thereby linking actual behaviors with the cognitive processes that produced them.

A lot of existing ASD and Human-Robot Interaction (HRI) studies have predominantly studied children interacting with robots in lab-based settings [19] [27] [28] [29] [30] [33] [34]. Even if several interesting findings are issued from these studies conducted in controlled lab-like settings, moving robots from the lab into the real classroom (i.e., in ecological settings), where teachers apply the teaching program unsupervised, is no straightforward task [10] [14] [15] [16]. So, embedding robots into existing autism contexts and pedagogical practices requires in-depth understanding of specific contexts and practices, and of the adult users who will support robot-based programs. Understanding the views of professionals such as educators is therefore essential, as they are key decision-makers for the adoption of new technologies, and would be the ones to directly facilitate any future use of robots [20]. The integration of a robot in a given social environment (such as an education setting) can potentially redistribute roles and influence the interaction of all individuals in that context [35]. A school, as an organisation, obeys rules and norms imposed by pedagogical principles, which are crucial for teachers/educators, parents and children. The use of a robot in a school context therefore requires that it applies these principles.

If some studies have sought teachers and professionals' views to explore implementing robots within real and regular educational settings [12] [17] [31], very few studies have investigated that so within special education settings. For instance, in a larger study, Hughes-Roberts and Brown [13] conducted interviews and focus groups with 20 teachers in special (though not autism-specific) education settings in the UK, incorporating a demonstration of a humanoid robot, NAO. If some relevant data have been obtained about the activities performed by the educators with the children with ASD, it was unclear whether these educators considered, overall, robots to be relevant, appropriate and acceptable for themselves. In the same way, Huijnen et al. [16] [18] took a related approach, combining focus groups, and co-creation sessions

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with autism stakeholders and professionals (including teachers and other school-based roles, all in the Netherlands) to develop 10 specific “intervention templates” for the humanoid robot, KASPAR. Once again, several relevant results have been obtained about the activities and the potentialities for the children with ASD, but no information has been collected about the attitudes of educators towards robots (usability, acceptability) and the potential impact on their work and their job.

Even if a lot of relevant results are issued from these existing studies, very few researches only give a partial picture of the information researchers need to know to work toward robot deployment with learners with ASD within special education settings. This is for five key reasons:

- First, children’s specific needs and the strategies used to support them can be very distinct from those educated within mainstream settings [11]. Greater knowledge is needed about the utility of robot-based programs for these particular children in their own specific, specialist contexts.
- Second, all these existing studies have essentially asked educators to answer questions or discuss ideas in relation to demonstrations of existing robots [6] [13] [14] [15], i.e., limiting with respect to discussing perceptions and applications of robots as a category of tools, or for generating novel use cases.
- Third, much existing research has either used surveys and questionnaires [7] [8] [9] [14] [15] [16] to ask educators to respond to topics and ideas that have been pre-identified by researchers.
- Fourth, none of these studies have been conducted in France while several studies demonstrated that cultural differences exist (e.g., [3] [8] [18] [22] [23]).
- Fifth, from a theoretical point of view, all these existing studies are based on Technology Acceptance Model (TAM) or Unified Theory of Acceptance and Use of Technology (UTAUT) model, which are mainly focused on attitudes and opinions collected by using questionnaires and interviews. But some studies [9] [10] have shown that the main factor of the acceptability for educators is the professional experience (i.e., their effective behaviours) and have also show that TAM and UTAUT models are not sufficient to predict effective behaviors of educators.

For all these reasons, our work in progress is aiming to investigate more precisely attitudes of educators in special education settings (dedicated for children with ASD) towards robots as a category of tools (i) for describing and predicting effective behaviors and (ii) for generating innovative use cases. In Section 2, we will present the methodology and theory that will enable us to carry out our study. We will thus describe the model on which our study is built. In Section 3, we will take up the issues at stake in this research, setting out the specific and general expectations.

II. Theoretical and Methodological Background

From a theoretical point of view, our work in progress is based on the 4A Model [4] [5] for ”Acceptability, Acceptance, Adoption and Appropriation” (Figure 1). The 4A Model has the following characteristics:

- If attitudes and opinions are central in ”traditional” TAM and UTAUT models used in HUman Computer Interaction (HCI), relationships between attitudes and behaviors are not really described. The 4A Model is specifically centred on these relationships between attitudes and effective behaviours.
- Among technologies, robots are very specific (e.g., embodiment, autonomy, dynamics, social dimensions). The 4A Model has been specifically created to better understand the human factors implied in adoption and appropriation of robotics systems.
- According to TAM and UTAUT models, the use of a technology is directly and positively related to the acceptance. For the 4A Model, to use a technology such as a robot is not necessary a consequence of acceptance: in some professional situations, the worker can have the obligation to use the system even if s/he does not accept the system. The 4A Model allows to collect precise data about this kind of situation where the use if not correlated to acceptance.
- The temporal dimension of appropriation is central in the 4A Model, to follow the dynamics of adoption and appropriation and to follow the evolution of attitudes across the time.
- Five, form a theoretical point of view, all these studies are based on TAM or UTAUT models, which are mainly focused on attitudes. But, some studies [9] [10] have shown that the main factor of the acceptability for educators is the professional experience and have also show that TAM and UTAUT models are not sufficient to predict effective behaviors of educators.

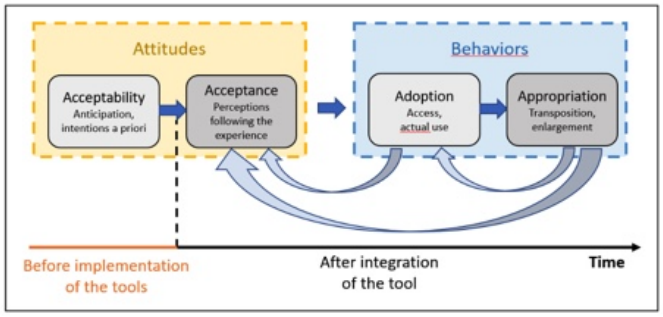

Figure 1. Our 4A Model to describe and to predict adoption and appropriation of technology, from [4] [5].

From a methodological point of view, our work in progress is based on:

- Interviews and focus groups conducted with several professionals working in different special education settings for children with ASD, to collect subjective data about

attitudes and opinions according to the educators in natural conditions/contexts.

- Observations in situ to collect objective data about real activities performed by the educators with the children in the special education settings.
- This mixed approach will provide additional information to better understand the potential human and organisation factors related to negatives or positives attitudes towards robots, and to better predict the future behaviours related to these attitudes.

III. Conclusion

As we said in the introduction, research is highlighting the benefits of using robots for autistic children, in particular to develop their skills needed for social inclusion. However, these benefits have been observed in the laboratory and are sometimes difficult to replicate in the school environment (i.e., in ecological environment). Validity and transfer from laboratory to ecological settings are probably the biggest problems in psychological and psychiatric research on autism. And yet, the challenge of supporting autistic children arises in this environment, in conjunction with the intervention of educators and teachers [2]. Because, the number of high-tech applications in the training of children with autism increases every day, it is crucial to investigate the representations and acceptance of professionals and educators that play a vital role in their ability to use robots optimally, adapting them to the challenges they face. The aim of our study is to shed light on the the organizational, technical (robot-specific) and psychological factors that determine robot integration. More broadly, our study is aiming to offer recommendations for adapting education settings to facilitate the use of a robot in order to promote the inclusion of children with autism. Because this work is actually in progress, we will present the first results during the conference.

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