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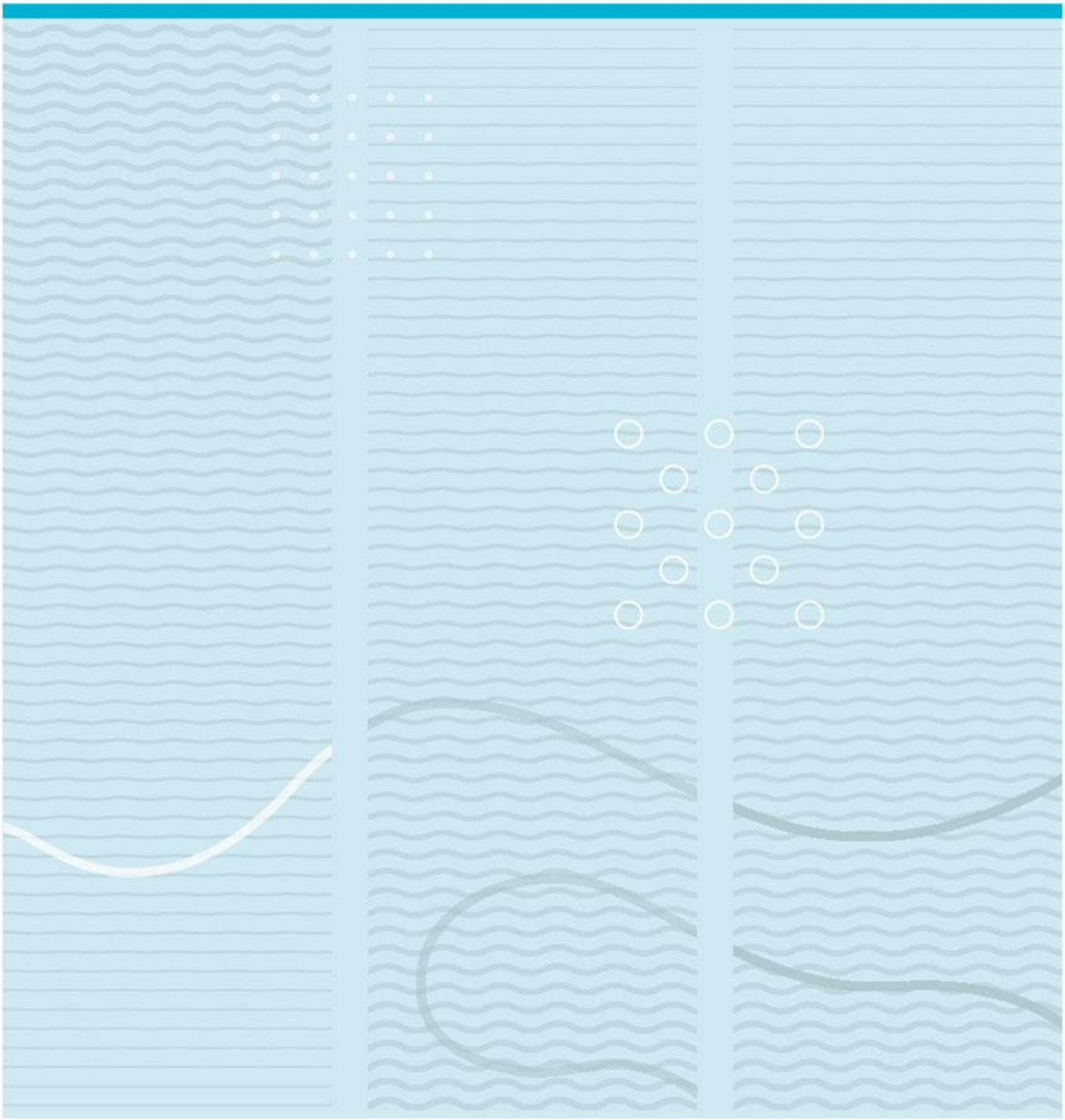
# Ethical implications of having a robot help teach a child with ASD



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This thesis is worth 30 study points

# Summary

Robotics has been widely used for assisting different aspects of people with disabilities, while less focus has been put on the ethical aspects and problems these technologies can lead to.

One of these use cases is to use robotics technologies to assist in teaching social skills to children with autism spectrum disorders. While this technology can help these children a lot, there might be some harm or drawbacks that should be considered beforehand. One of the main aspects that need to be focused on is ethical issues related to using these technologies for these children. This study aims to go in-depth into these issues by focusing on a case study and trying to pinpoint the main ethical issues that might arise when using robotics. So, we came up with a research question: "What are the ethical implications of having a robot to help teach a child with autism?"

To answer the research question of this study, we have adopted a qualitative approach and have collected data from two data sources. First, we conducted a literature review and collected all the relevant results from previous articles. Then, we continued by interviewing some of the researchers from the ROSA research group who are working on a project intending to provide children with autism with a robot to assist their social skill learning.

Finally, we have analysed data collected from the abovementioned sources and came up with some recommendations and solutions to ethical implementations in projects like ROSA.

We hope this study plays a role in opening some viewpoints and attracting more attention to the ethical issues when using different technologies.

Keywords: Ethics, Roboethics, Robotics, Robots, Children with ASD, ASD, Teaching Social Skills, Social Robots.

# Contents

# Foreword

We would like to convey our most incredible gratitude to our supervisor, Associate Professor Veralia Gabriela Sanchez, for her patience, support, and insightful recommendations and discussions. Her suggestions and comments greatly assisted the study process's development. Furthermore, Trenton W. Schulz, Senior Research Scientist at the Norwegian Computing Center (NR), deserves special thanks for his guidance and support throughout this research.

Thanks to the Norwegian Computing Center (NR) professionals and the “ROSA” project members who took part in our online interviews provided us with their insights and valuable information, making this study possible.

We would also like to thank anonymous reviewers for their insightful remarks on the final draft of this article.

Last but not least, we want to express our gratitude to our families and friends for their love and support, faith, and motivation during this process.

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# 1 Introduction

Robot ethics is a multidisciplinary topic that explores the ethical implications of robotic technology or ethical theories in using robots. As a result of the development of robots, more research regarding ethics is required, so this research will focus on ethical considerations with the implementation of intelligent robots to support children with Autism Spectrum Disorder (ASD) in education. To go through this subject, first, we need to understand the definitions of ASD and social robots. In the following sections, we will first define these terms, then a short description of a research group, Norsk Regnesentral (NR), will be described. Then we will describe this master's thesis project and the research questions.

## 1.1 Autism Spectrum Disorder

Autism is a lifelong developmental disorder that can be diagnosed by the appearance of a broad area of cognitive disabilities (Columbia, 2000).

The World Health Organization (WHO) defines ASD as not one specific disorder but a diverse range of different degrees of difficulties with social interaction and communication. Some characteristics of individuals with these disorders are, among other things, difficulties with the transition from one activity to another, a focus on details, and unusual reactions to sensations. The abilities and needs differ in people with ASD from person to person. Most people with ASD suffer from epilepsy, depression, anxiety, attention deficit hyperactivity disorder, and challenging behaviors such as difficulty sleeping and self-injury (Drake, WHO, 2017).

In other words, individuals with ASD perceive the world around them differently. This difference in perception also includes other people's perception and their behaviors. All of these can lead to some learning difficulties and social communication problems for those who fall into ASD. Children with autism problems may also have challenges with receiving and giving social cues while communicating with their classmates and teachers, which might lead to difficulties in fitting in with their surrounding society and learning new skills (Tanevska et al., 2016)

ASD is mainly known for characteristics such as poor nonverbal conversation skills, uneven language development, repetitive or rigid language, and narrow interests in

specific areas. Children with ASD often have problems understanding body language or intonation and senses hidden in sentences.

## 1.2 Social Robots

A social robot, according to Bartneck and Forlizzi (2004a), is an autonomous or semi-autonomous robot that interacts and communicates with humans by complying with the expected behavioral standards of the people with whom the robot is designed to engage and give help to a human user through interpersonal interactions (Bartneck & Forlizzi, 2004a).

A social robot is one type of famous assistive robot. Scassellati (2005) states that robots have been utilized for diagnosis and therapy and can also be used as "socially assistive robotics" (SAR), which aims to create robots that can both socialize and interact with humans and also aid them (Scassellati et al., 2012).

Socially assistive robotics (SAR) intends to address crucial areas and gaps in care by automating the monitoring, training, motivating, and companionship aspects of interactions with people from a variety of large and diverse groups, such as the elderly, people with dementia, and children with ASD (Feil-Seifer & Mataric, 2005).

Furthermore, using these kinds of assistive robots for children with ASD has shown therapeutic advantages in several studies (Billard et al., 2007; Tapus et al., 2012). For example, through emulation activities, the human-like robot Nao has been utilized to promote social interaction among children with autism spectrum conditions (Tapus et al., 2012). Another one, Robota, a child-like robot, was used to evaluate the advantages of using a robot imitator to test the imitation capacity of children with ASD (Billard et al., 2007). These all are different examples of increased attention to social robots and using them for interactions with children with ASD.

The learning environment also influences children with ASD's social interaction. An evaluation of a learning environment in which children diagnosed with Autism Spectrum Conditions (ASC) participate in social interactions with an AI-based virtual agent has been conducted by Porayska-Pomsta. The result showed that the percentage of children's responses to human social partners increased significantly when a virtual agent acted in support of these interactions (Porayska-Pomsta et al., 2018). Nevertheless, when leading the personalization process, it does not consider the learners' emotional conditions.

Engagement rises when programs are matched to individual requirements and emotional states (Athanasiadis et al., 2017). Learner participation in educational processes is related to the efficiency of the learning process (Hamari et al., 2016).

In this regard, the use of social robots in robot-assisted therapy (RAT) showed positive results since it appears to boost children's social interaction. For example, a case study by Pop et al. demonstrated that social robots could help youngsters recognize situation-based emotions in others (Pop et al., 2013). Further studies included the influence of the exterior design of social robots on children's impressions and connections (Costa et al., 2015) and the impact of humanoid robots on increasing body understanding in children with autism (Peca et al., 2014).

Fong et al. (2003) came up with another term, "socially interactive robots," which describes robots that can represent and interpret human emotions, interact using high-level dialogue, learn or recognize designs of other agents, create social relationships, use natural signs (look, gestures, etc.), have a unique personality and character, and learn or develop social competences (Fong et al., 2003).

Sociable robots are socially participatory "creatures" with their own internal objectives and motives. They interact with people for the benefit of both the individual and themselves (Jaffe & Trajtenberg., 2003). These robots recognize not only human social cues but also model individuals' social and cognitive behavior. As a result, the robot's social interaction results from computational social psychology. The capability of robots to engage with people and use the information obtained from these engagements to improve task performance, encourage self-maintenance, and learn in a complicated world like humans, has enormous practical and functional significance for robots (Breazeal, 2003).

Scassellati et al. (2012) suggest that sensing systems that can interpret a child's emotions and desires from behavior are required in robot architecture. Sensors that collect physiological data are invasive for persons with autism because they are typically sensitive, but they present a lot of detailed information regarding emotional and mental states (Scassellati et al., 2012). Physiological sensors monitor blood pressure, pulse, skin conductance, and brain activity (Liu et al., 2008) or cameras that identify behavioral patterns based on physical locations (Feil-Seifer & Matarić, 2011a). In this regard,

research shows that utilizing robots in therapeutic settings has been shown to improve physiological, psychological, and social behaviors (Bharatharaj et al., 2017).

Therefore, as the incidence of children with ASD is growing, based on Surén et al. (2019), in the light of previously mentioned studies, social robots are capable of being effective for teaching and improving children's social and communication abilities.

## 1.3 Norsk Regnesentral (NR) – The "ROSA" project

The NR website states, "The Norwegian Computing Center (NR) is an independent and non-profit private foundation that conducts contract research for business, the public sector, and private organizations both in Norway and internationally." The NR's research areas are statistical modeling, machine learning, and ICT (Robot-Supported Education for Children with Autism Spectrum Disorder – NR, n.d.). Currently, the NR is leading a collaboration project called ROSA, the Robot Supported Education for Children with ASD. This project is working on using social robots to facilitate teaching social skills to children with ASD.

The ROSA project addresses different research areas, including artificial intelligence, Robotics, and Autonomous Systems.

This project mainly aims to explore the best way of using robots to develop language, social and communication skills of children with ASD. The project plans to perform this process by involving teachers, parents, and children with ASD throughout the designing phase and developing the toolbox to help teachers customize education for these children (Schulz & Fuglerud, In-press). Figure 1 - The ROSA Toolbox consists of three parts: a content creator, software that runs on the robot for interpreting the lessons, and a review panel for teachers.

The "ROSA" toolbox consists of three parts (Figure 1): (a) ROSA Content Creator, a tool for quickly creating tailored one-on-one tutorials for children with ASD; (b) ROSA Robot Software, which reads the lessons and runs the content of the lesson customized to the robot's capabilities; and (c) ROSA Review, which tracks lesson progress and provides input for the next lesson. The toolbox's purpose is to help instructors be more effective by offering specially designed education plans for children with ASD that are easier to track. The toolbox lessons for children with ASD will be adjusted to their specific requirements, increasing their motivation to study and developing more excellent linguistic, social, and

communication skills. The robot will display content that is adjusted to the robot's capability. A social robot is an expressive medium and education tool for children with ASD. Exploring and utilizing the specific affordances of a social robot can provide personalized, motivational, educational, and communicative help for using the ROSA toolbox.

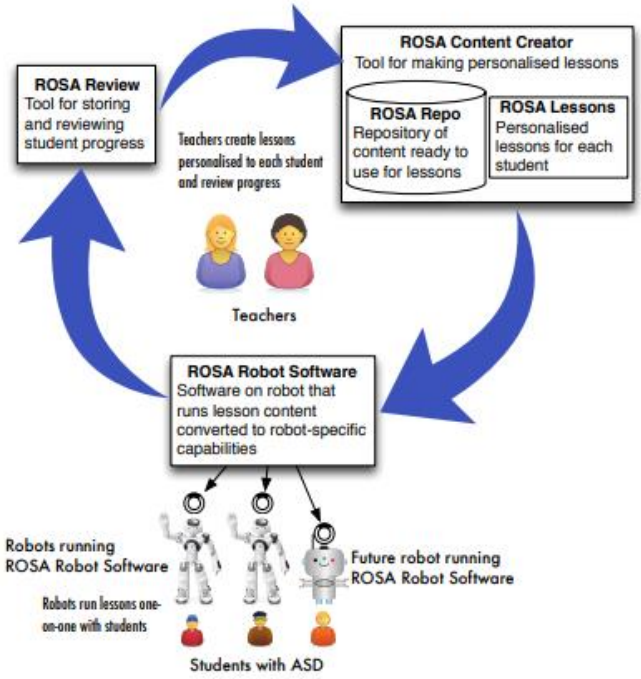


*Figure 1 The ROSA Toolbox (Schulz & Fuglerud, In-press)*

The project team collaborates with a school specializing in working with children with ASD and other cognitive challenges to assure the ROSA toolbox's effectiveness.

Stakeholders in the ROSA project consist of children with ASD; their parents; their teachers; experts in education, pedagogy, and ASD; and others who help support the children and teachers in education, such as technical support personnel.

## 1.4 Problem Description and Research Question

While social robots are getting more and more popular and being widely adopted both in the academic world and in practice, there has been less focus on the legal and ethical aspects of using this technology for teaching children with ASD.

Although being an answer to several ethical issues on their own, these robots are very likely to lead to the creation of some new ethical challenges in society. Having these

ethical aspects in mind and carefully considering them is a MUST in both academic and practical projects; before, throughout, and after these kinds of projects.

In other words, the adoption of any technology, robotics and AI included, occurs in the first place to answer some needs in society. In the case of using social robots for teaching children with ASD, the main requirement to satisfy is for those children to become enabled to get more engaged in society. Having that aim in mind, the most important matter in these kinds of projects is to maintain that ultimate goal. As a result, any possible harm to these children should be carefully considered in advance, and any risks should be well mitigated.

To understand these risks and possible harms better, considering ethical principles is one of the most important tasks.

Having mentioned the importance of ethical considerations, in this project, we decided to have a deep look at these issues and provide better insight into ethical aspects in projects like ROSA, which are adopting social robots to work closely with children with ASD.

Regarding this, we came up with the answer to the following research question throughout this study.

Research Question: What are the ethical implications of having a robot to help teach a child with ASD?

Contributing to collecting knowledge that will allow ethical considerations to be developed and adopted to protect human rights is a significant accomplishment for us. It may inspire researchers to consider setting up new priorities and criteria for the ethical implications of using robots to educate children with ASD. The findings of this study might be used as part of a larger project to support children with ASD who are more sensitive and require more attention.

We also believe that technology is mostly well ahead of time and is developing at a quick pace, while legislation and ethical aspects are mostly fallen behind. Therefore, there is almost always a lack of enough consideration of these issues, although those aspects are crucial and may influence human lives a lot.

# 2 Methodology

In this chapter, the research method for this study will be described. It includes the research design, data collection and analysis methodologies, recruitment process, ethical considerations, and limitations in this study phase.

## 2.1 A qualitative approach: a case study on the ROSA project

As mentioned before, in this study, we have focused mainly on the ROSA project that is under process by the NR research group, and ethical principles have been investigated with the aid of this project. Besides, we have also conducted, at first, a literature review and then a comprehensive study of different ethical documents to base our initial framework on the findings from them.

## 2.2 Data Collection

This project aimed to answer the research question, “What are the ethical implications of having a robot to help teach a child with ASD?”.

For this purpose, there was a need to have strong background knowledge on how this question has been examined before in different projects, and then we needed a more specified answer for ROSA-like projects. Therefore, we first went through the previous literature and conducted a literature review. In the next level, we have invited researchers in the ROSA project to participate in semi-structured interviews and have collected data from those interviews.

The following sections have presented details of these different data collection phases.

### 2.2.1 Data Collected from literature

To gain relevant results from the literature review phase, we decided to conduct the literature review by following the instruction provided by Webster and Watson (2002) for structured literature reviews in terms of filtering articles. As Webster and Watson (2002) suggest, we first searched for related articles with some keywords, then went through their references and went back and forth through them several times to achieve a complete list of articles for consideration in the literature review.

To find related literature, as we wanted to have a look at projects similar to the ROSA project, we decided to focus on more recent papers. The ROSA project was launched in 2021, so we have limited the first paper search from 2015 until 2021.

The keywords that we have used to find related literature include “autism,” “ethic,” “robot,” and “teach.” It used different databases to find relevant papers: Oria and Google Scholar. This search included all academic articles, newspaper articles, conference articles, books, and book chapters and covers only English essays.

As a result of applying the filters mentioned, we achieved 170 articles. Then, we went further by reading the abstract and scanning some parts of each article to have a list of related ones. Finally, we have filtered our inventory to the articles that only focused on children with ASD and the use of robotics for them, specifically, the ones with the ethical aspects under investigation.

The result of all the filtering mentioned above, the final reduced list of the related articles from the first 170 articles, is illustrated in table 1.

| Publication Year | No. of papers or books | H-index range | Quartiles | | | |
|---|---|---|---|---|---|---|
| | | | Q1 | Q2 | Q3 | Q4 |
| 2015 | 1 | 53 | 0 | 1 | 0 | 0 |
| 2016 | 3 | 10 - 14 | 0 | 0 | 1 | 1 |
| 2017 | 3 | 18 - 50 | 1 | 2 | 3 | 0 |
| 2018 | 1 | 53 | 1 | 0 | 0 | 0 |
| 2019 | 6 | 41 - 175 | 3 | 2 | 1 | 0 |
| 2020 | 3 | 53 – 96 | 4 | 0 | 0 | 0 |
| 2021 | 3 | 34 - 53 | 1 | 2 | 0 | 0 |
| Total | 20 | | | | | |

*Table 1 First articles to be considered for the literature review*

As mentioned before, after achieving this list of related articles, we went through them all and checked for both their references and the articles that have referred to them. We have adopted an author-centric approach for organizing the data in the literature review as the main topic was almost the same, and a topic-centric approach would not make that much sense.

During this phase, we have also explored those articles at the same step to prevent non-related articles from being included in our list.

Finally, we got a list of thirty-two articles, presented in table 2. This list consists of twenty-seven journal articles, three books, and two conference articles.

Besides using the data collected from these articles, presented in section 3.1, we also extracted two main ethical documents, mostly used by researchers in these articles to consider ethical issues, out of these papers and have based our semi-structured interview guides. The result of this extracted data has presented in section 3.2.

As the next step and based on the result of the literature review, we agreed on two main documents in the field of ethical principles and analyzed them carefully to define a well-organized and inclusive list of interview questions.

| Paper Type | Publication Name | Tot |
|---|---|---|
| Journal Articles | International Journal of Social Robotics | |
| Journal Articles | IEEE Robotics & Automation Magazine | |
| Journal Articles | Science and Engineering Ethics | |
| Book Section | - | |
| Conference Paper | - | |
| Journal Articles | British Journal of Educational Technology | |
| Journal Articles | Scientific Reports | |
| Journal Articles | Annual Review of Biomedical Engineering | |
| Journal Articles | Autism | |
| Journal Articles | Computers in Human Behavior | |
| Journal Articles | European Journal of Special Needs Education | |
| Journal Articles | Informatics | |
| Journal Articles | Journal of Intelligent & Robotic Systems | |
| Journal Articles | Journal of Special Education Technology | |
| Journal Articles | Paladyn, Journal of Behavioral Robotics | |
| Journal Articles | Procedia Computer Science | |
| Journal Articles | Robotics | |
| Journal Articles | Sensors | |
| Journal Articles | Springer Handbook of Robotics | |
| Journal Articles | Studies in Social Justice | |
| **Total** | | 3 |

*Table 2 Final article list used for literature review*

### 2.2.2 Data collected by In-depth semi-structured interviews

To go further in this study, to achieve more practical data and intend to answer research questions, we conducted semi-structured interviews.

The participants in the interview provided us with a diverse viewpoint from a comparable category since one of them was female and one male and had different backgrounds and nationalities. Also, one of our informants was Iranian and spoke Persian; as we speak Persian, we interviewed in Persian to ease the procedure for both the interviewee and us.

The questions interviewed had no boundaries. Therefore, the respondents were permitted to explain their answers and mention additional related subjects. Most responses were understandable. We transcribed the interviews verbatim for the coding procedure and extracted related information.

### 2.2.3 recruitment process

We decided to limit our participant criteria to researchers working on the ROSA project. The reason for this selection was that after studying previous literature and gaining a wide range of background knowledge to see how these theoretical bases are being adopted in practice, we thought that the ROSA project, as an ongoing project working in the field in Norway, is a great candidate for doing this research.

Unfortunately, we have only gotten two participants for this interview series. The reason for that was that we at first obtained access to some survey data and aimed at using them as we received permission. Unfortunately, the permission to use the data was withdrawn, and we did not have enough time to recruit more participants. Although, we have been fortunate enough to get a great amount of information from only these two respondents. The participant characteristics are presented in table 3.

| Participant-ID | Gender | Background | Relationship to ROSA | Int_language | Int_duration |
|---|---|---|---|---|---|
| Participant1 | Male | Psychology | Research team member | Persian | 00:52:59 |
| Participant2 | Female | Informatics | Research team member | English | 01:03:31 |

*Table 3 Interviewees*

## 2.3 Data Analysis

As data were collected using two different channels, literature review and interviews, we have different types of data, although we tried to analyze them in an almost similar way. The reason for that was to ease the process of comparing those data with one another.

For both data collected through literature review and semi-structured interviews, we first tried to code the data using some keywords, and then we tried to structure that data based on applied keywords.

As depicted in figure 3, we have mostly used the terms that were the most frequent ones as our codes.

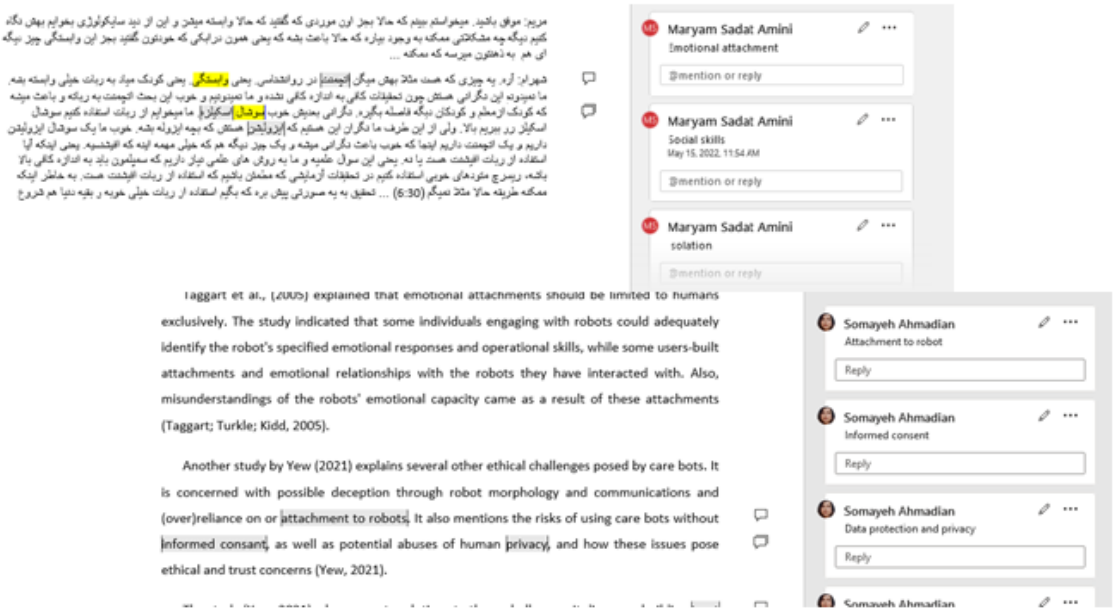


*Figure 2 - coding procedure*

Conducting Semi-structured interviews allowed us to start analyzing data at a very initial phase during the interview sessions. That is, a general theme for the interview session has become provided, and based on the responses from the interviewees and notes which have taken throughout the interview session, we added more questions to achieve a better understanding of what participants had in mind. Then, as mentioned before, applying some coding to the transcripts made it possible to fetch and organize all the data into structured information. The final result of this phase has been presented in section 3.

## 2.4 Ethical Consideration

This study has been based firmly in accordance with data protection legislation and the General Data Protection Regulation (General Data Protection Regulation (GDPR) – Official Legal Text, n.d.). So, in all phases of collecting, storing, and processing data, there has

been a focus on protecting the personal data and the participants' identities. Besides, Norwegian Center for Research Data has been notified for all the phases. The NSD reference number for this project is 386325 and has been attached to this master's thesis as appendix 1.

# 3 Findings and Results

The findings in this study refer to the data collected in two different ways. First, in section 3.1, the result of reviewing the previous research will be presented, and then, section 3.2 will follow the information gained through analyzing two interviews with researchers in the ROSA project.

## 3.1 Literature Review

This section presents the result of reviewing the literature on robotics in ASD. First, the term Welfare technologies (WT), which is the main category that social robots fit in, will be described. We will go through what has been done in the field of using different technologies, robots specifically, in any ASD-related area, particularly for children with ASD.

Companies that provide social and emotional support and stimulation are the welfare technologies (WT), including robot animals, assistants, and conversation partners. A review of the literature performed by Hofmann (2012) on the inherent dilemmas of current and upcoming WT noted several general challenges. First of all, WT is a class of technologies that are likely to be used in people's homes, causing issues with alienation and feelings of safety. Secondly, WT involves several stakeholders concerned about a) who will benefit from WT and b) who will be accountable for adopting, utilizing, and preserving WT. Thirdly, many WTs include third-party participants having access to sensitive information, such as service providers and relatives, which raises concerns about confidentiality and privacy. Fourth, since most technologies are associated with prestige and are not dispersed fairly, which can lead to social prejudice, WT presents justice issues, particularly because it is designed for widespread usage. Finally, WT questions essential human concepts like vulnerability, dignity, and caring (Hofmann, 2012)

The notion is that conventional divides between science and morality, or between machine and human, may change in the world of WT, wherein technology and humans are intrinsically linked (Widdershoven, 1998).

Therefore, the decision-making process for installing such technologies is complicated because individuals have trouble expressing truthful approval due to a lack of knowledge

or decision-making ability. Also, control and safety are passed to technology. Technologies that promote social interaction are assigned both social and moral standing (Melson et al., 2009).

On the other hand, from education and therapy for autism spectrum diagnosis viewpoint, students with intellectual disabilities, such as children with ASD, need more support and meaningful possibilities for learning (Taub et al., 2017).

A study by Bottema-Beutel et al. (2021) discusses that most therapies for young autistic children have unknown potential side effects. Therefore, for conducting therapies, value judgments will be required to determine the utility of an intervention by evaluating potential hazards against potential benefits. They recommended that scholars and researchers can assist by giving explicit instructions on how adverse outcomes, negative effects, and harms should be tracked and reported. Once adverse effects and harm are frequently recorded and understood, researchers, practitioners, policymakers, and caregivers will have to deal with these problems (Bottema-Beutel et al., 2021).

Considering some psychological therapies might have negative consequences for some users, Clinicians must be supplied with data when deciding the outcome of an intervention, including both the advantages and any drawbacks (Scott O. Lilienfeld, 2007). On the other hand, all professionals who work with autistic children are governed by ethical norms that state they must not harm (American Psychological Association, 2016; “ASHA Code of Ethics,” 2015; Bradshaw, 2017; Brady et al., 2016). Therefore, the autistic community should also be included in ethical considerations about how potential harms of intervention programs should be balanced against potential benefits (Bharatharaj et al., 2017).

Considering these considerations for educating children with ASD, we will look at the ethical implications of using technology, AI, and robotics to educate these children in the following sections.

### 3.1.1 Ethical challenges of using technology

Recent years have seen an increase in Human-computer interaction (HCI), which has aided in designing and developing digital mental health treatments. These kinds of interactions are efficient, user-friendly, cost-effective, and adaptive. Nevertheless, it also has its barriers in mental health therapy, including accessibility, efficacy, reliability,

usability, safety, security, ethics, adequate education and training, and socio-cultural adaptation (Balcombe & De Leo, 2022).

Researchers in artificial intelligence (AI) claim that their machines have cognitive and affective characteristics, either explicitly or implicitly. Although, there are ethical issues, namely determining under what conditions anthropomorphizing machines is justified or unjustified is key to the growing debates within AI about the ethical use of artificial systems. In contrast to robots with a machine-like appearance, people anticipate them to follow human norms and have considerably greater expectations of their capabilities (Złotowski et al., 2015).

One of the research areas of using technology and AI is using robots to encourage children's social interactions. Mentioning that, previous research showed that utilizing social robots with children as facilitators in interpersonal interaction enhances the communication between children and caregivers (Shibata et al., 2001). It is also depicted that utilizing technology gives people with ASD active control over the interaction. And that might assist them in gaining self-assurance and achieving better results (Parsons & Cobb, 2011).

Standen et al. (2020) considered the engagement of children and showed that students were interested in evolving activities using artificial intelligence systems (Standen et al. 2020). Also, artificial intelligence virtual agents improve the engagement in social interactions of children with ASD (Porayska-Pomsta et al., 2018).

On the other hand, using data and machine learning can, additionally, provide flexibility in using strategies and personalized tools to move children into a positive status like engagement in learning activities in comparison with traditional ones (Colley, 2013).

Data collection is another subject to consider using technologies as they are capable of collecting data from users. Hudlicka E. (2016) discusses that healthcare providers should consider privacy and data security for technologies that can track human activity and collect personal data. They have investigated ethical concerns in an AI-based game developed to teach social and emotional regulation skills to children with the Autism Spectrum. They found that developing and using technologies that feel, infer, or monitor our feelings poses significant and still unknown ethical concerns. It is especially crucial in behavioral health applications, as participants may be expressing a particularly traumatic experience or disclosing emotions that, if made public, could have undesirable

consequences. Furthermore, they refer to emotional induction and state that since there are no clear solutions to moral dilemmas, end-users and experts administering the technologies must be informed of the potential risks connected with these technologies' usage, and implementation must be adequately supervised (Hudlicka, 2016).

Privacy, security, and proper use of personal data have become the most common ethical concerns with AI to prevent undesirable social outcomes of this technology. Protecting personal data and the rights of vulnerable individuals, such as children and the mentally disabled, will necessitate carefully developed norms and regulations, and as educational tools become more socially capable, more potential social and ethical dilemmas arise (Richards & Dignum, 2019).

A survey by Hofmann (2013) interviewed stakeholders, including parents of children with autism and service providers, administrators, and administrators of ASD organizations. It was the first research that included important stakeholders in order to identify factors that influence the use of technology in the field of ASD. Stakeholders implied that existing concerns and fear of potential side effects might contribute to the reluctance in the uptake of technology in the field of ASD. Some stakeholders identified that technology-based approaches might intensify the social disability of individuals with ASD as they may over-rely on simulated interaction, which may decrease real-life communication and lead to further isolation. While technology has limitations, these issues or resistance may be due to a lack of evidence or belief in the need for technology when the typical behavioral approach is practical (Hofmann, 2013).

According to these studies, stakeholders have a prominent role in using technology for children with ASD. Based on this, Ghanouni et al. (2020) state that if technology is considered a novel tool, it should be consistent with the values and needs of end-users. Before any decision to utilize technology, it should be tested, and the results should be provided for stakeholders. In this way, we can give stakeholders a sensitive role and responsibility in the therapy of people with ASD. Practitioners and authorities working in the field of ASD should be aware of unconscious and conscious biases and internal and external restrictions that might affect the outcomes in health and social care settings (Ghanouni et al., 2020).

In all implementations, AI must be capable of considering societal values and moral and ethical concerns, evaluating the relative priority of values among stakeholders and in

diverse, multicultural settings, explaining its cognition, and ensuring transparency. The need to reconsider responsibility, among all, is probably the most critical topic to address as the capabilities for autonomous decision-making increase. It is recommended that the ART principles (Accountability, Responsibility, and Transparency) could be used to accomplish this (Dignum, 2017).

### 3.1.2 Ethics in robotics

Embodied robotics (robots that learn and experience new things through sensory and physiological interaction with their surroundings) and mind connections (Neural connections and physiological processes) have become more common than before, therefore raising plenty of new ethical issues (Mainzer, 2009).

In 2005, the need for ethical considerations resulted in defining the concept of roboethics by Verrugio. It was a new branch of robotics studying both the good and bad effects of robots on society (Veruggio, 2005).

Roboethic as a moral code is concerned with the ethical design, advancement, and application of robots, particularly autonomous ones (Veruggio & Operto, 2020). The primary considerations of it include the dual-use of robots (use or misuse), the anthropomorphizing of robots, the humanization of human-robot interaction (HRI), the elimination of the socio-technological gap, and the impact of robotics on the efficient allocation of money (Veruggio & Operto, 2020).

Studying the learning of robot abilities is also critical to developing efficient robotic devices, so robot physiotherapists should be able to recognize and respond to their human customers' interests and emotions. Human-like robots offer an opportunity to evaluate psychological and social development hypotheses from a psychological standpoint. It would allow psychological theories to be tested in a controlled, standardized environment without ethical concerns about consent and treatment of young participants (Złotowski et al., 2015).

Matarić & Scassellati (2016) also mentioned ethical issues that arise when it comes to socially assistive robotics (SAR) in their study. It specifies that, in any area of HRI, the user's safety is the first and most evident consideration. In addition, emotional and other sorts of nonphysical safety should be taken into account in SAR. So, as robots become more human-like, ethical concerns become more pressing, and it would be encouraging

if these challenges are actively explored and examined at the early stages of SAR development (Matarić & Scassellati, 2016).

The ethical concerns of SAR are also outlined by Feil-Seifer and Mataric (2011b). It is around the main concepts of ethics applied to human subjects, notably: beneficence, nonmaleficence, autonomy, and justice. Relationships, authority, and attachment are included in the first two principles. They are related to the perception and personification of the robot and the replacement of human care changes in human-human interaction. The third principle, autonomy, encompasses concerns like privacy, choice, and intentional user deception. Finally, justice encompasses the complicated challenges of cost-benefit analysis and responsibility if it leads to harm or failure (Feil-Seifer & Matarić, 2011b).

Considering emotional attachment as one of the significant ethical issues, Sharkey and Sharkey (2010) believe that in children who work with robots, emotional relationships with robots might lead to inaccurate function and emotional issues in children (Sharkey & Sharkey, 2010).

Taggart et al. (2005) explained that emotional attachments should be limited to humans exclusively. The study indicated that some individuals engaging with robots could adequately identify the robot's specified emotional responses and operational skills, while some users-built attachments and emotional relationships with the robots they have interacted with. Also, misunderstandings of the robots' emotional capacity came as a result of these attachments (Taggart; Turkle; Kidd, 2005).

Another study by Yew (2021) explains several other ethical challenges posed by care bots. It is concerned with possible deception through robot morphology and communications and (over)reliance on or attachment to robots. It also mentions the risks of using care bots without informed consent, as well as potential abuses of human privacy, and how these issues pose ethical and trust concerns (Yew, 2021).

The study (Yew, 2021) also suggests solutions to these challenges. It discusses building trust in care bots might help them become more widely used in the healthcare industry. On the other hand, mistrust resulting from a care robot failure can easily restrict the adoption of care bots in the healthcare industry. They also believe that an ethical framework needs to be present to guide the actions and decisions of care bots in the initial stages. Designing the framework can be produced by both “top-down” and

“bottom-up” approaches. Based on this general ethical framework, the robot, which is able to “learn” from interaction with the environment, is allowed to adjust to new moral norms. According to the article, Care ethics empowers the concept of trust when focusing on the capability of care bots in an assistive role to benefit care receivers. They allocate responsibilities to the care bots, human caregivers, designers, and the care recipients in the right way. It is also mentioned that achieving a correct match between Care Ethics and public and user trust in the development of care bots is a continuous effort (Yew, 2021).

Another paper highlights ethical considerations as they apply to the development of AI and robotic systems, from application formulation to execution description. Bartneck et al. (2021) explain that ethics in robotics and AI is a broad subject, involving anything from fundamental design decisions to considerations about the type of society we want to live in. And one that the paper emphasizes is that many of these systems rely on large volumes of data, which might be deemed personal in many situations. Personal data protection issues have undoubtedly become worldwide, more than ever, since the EU defined its GDPR to apply internationally. Therefore, privacy, data exchange, and AI are all related issues that need to be addressed on a global scale (Bartneck et al., 2021).

The autonomy of assistive robots also matters. As Łichocki et al. (2011) discussed, robots are no longer only agent devices that respond simply to human commands; these robots have earned a certain level of autonomy and decision-making. It is believed that debates on what is ethical or not in robotics arise from different ideas about human nature and different expectations about what technology may achieve in the future. So, we are ethically responsible for what we build and send out into the world, and there is a need to continue addressing alternative possibilities (Lichocki et al., 2011).

In addition, increased autonomy and authority of robots require participation in more complex kinds of coordinated actions; consequently, an ethical dilemma may arise from an unbalance of user autonomy and robot authority (Murphy & Woods, 2009).

The appearance of the robot is counted as another ethical concern in socially assistive robots (SAR). In this regard, Ryu et al. (2007) identified anthropomorphic humanoid robots as the most desired design for teaching (Ryu et al., 2007).

Different contexts in the interaction between humans and robots should be taken into account as well. Fridin (2014) conducted research to illustrate how to interact with a

Social Assistive Robot (SAR) in a kindergarten setting. They believe that the design, development, and deployment of SAR systems present significant ethical issues, particularly in childcare. The matter of safety is also widely debated in the literature. Additionally, the most critical non-physical concerns created by SAR systems include an attachment to the robot, deception about the robot's capabilities, and effect on the user's interpersonal interaction. Autonomy and decision-making are also significantly addressed in the literature. For investigation, they employed a little robot with a toy appearance, and children were allowed to stay close to the robot and even touch it during their studies. They made sure that the robot's activities were designed in the children's best interests and prevented any action that would hurt them by following the principles of beneficence and with no malfeasance (Fridin, 2014).

This study also placed a nonfunctional robot near the kindergarten toys to prevent emotional stress. They have created a Disclosure declaration, and the information gathered was only utilized for statistical analysis and was never shared with anyone else. Based on the experiment, they concluded that the children's responses and behaviors demonstrated the positive impact of the experiment's application to ethical issues. The children showed no signs of being afraid of being physically harmed by the robot. The excellent reception of the robot by kindergarten personnel highlighted the advantages of including ethical issues. Even if an emotional attachment cannot be avoided entirely, the pain given to a child by being separated from the robot should be presented as equivalent to missing any favorite thing (Fridin, 2014).

One of the sources for ethical considerations is the Commission for the Ethics of Research in Information Sciences and Technologies (CERNA), and Grinbaum et al. (2017) explored robotics research ethics recommendations based on the CERNA. Grinbaum et al. explain both the scientific and social elements of robot ethics need to be addressed. According to CERNA, researchers should consider the appropriate degree of trust in a robot, its capabilities, limitations, and the attachment it would create with its users. Some robots can also gather personal data, and their deployment would raise privacy and data security concerns. As a result, researchers should keep an eye on the robotic system to guarantee that it facilitates data monitoring and management. In some instances, accurate decision-making will probably become balanced between the robot and the operator or perhaps assigned totally to the robot. Based on this, researchers need to concentrate on the

enhanced capacities for autonomous situation detection and decision-making and the threats connected with these capabilities, such as perception mistakes (Grinbaum et al., 2017).

Furthermore, they suggest researchers should build or use tracking tools throughout the design stage of the robot since robot activity should be tracked to analyze malfunctions in the case of any damage, harm, or loss. Specialists should look at the importance of generating emotions and displaying biomimetic behavior or appearances in a robot. Design and assessment procedures for robotics projects that might incorporate user affectivity, such as generating attachment to a robot, need to be developed. Researchers should assess software for perception, interpretation, and decision-making and identify its restrictions (Grinbaum et al., 2017).

These recommendations emphasize a critical issue, which is also presented by De Graaf (2016) regarding the ethical implications of HRI. De Graaf believes that HRI's ethical implications require multidisciplinary knowledge from the HRI researcher community (de Graaf, 2016). Considering that social connections are important for proper personality development and social behavior, it is necessary to guarantee that HRI does not replace their human counterparts in social relations, which might lead to problems such as emotional attachment. They also discuss that since different cultures and beliefs have specific 'virtues' and 'vices,'' study of robot ethics and rights in various cultural contexts is another essential subject (de Graaf, 2016).

Looking at cultural context, Meghdari et al. (2019) also believe that the use of social robots is a multidisciplinary subject. So, it is critical for researchers to consider societal-specific ethical and cultural considerations and the physical challenges related to the requirements and expectations of the human mind in designing and developing them (Meghdari et al., 2019).

Therefore, robot's actions are likely to differ amongst cultures due to differences in social norms, moral attitudes, and values (Bartneck & Forlizzi, 2004b)

In this regard, Alemi et al. (2020) explored using social robots for education in an Islamic society to examine the possible ethical issues related to the culture. Differences in ethical issues, such as social norms, justice, and human values, were identified in the research. Since social robotics is constantly impacted and impacting the culture and norms of the societies where it is used, this technology evolves as the cultures of its researchers and

developers change. They believe that in the development, design, programming, and deployment of social robots in society, distinct cultural, religious, and ethical factors relevant to users should be considered (Alemi et al., 2020).

### 3.1.3 Ethical challenges in using robotics for ASD

In recent years, assistive robots have been employed in various areas, including elderly care and autism diagnosis (Bharatharaj et al., 2017; Portugal et al., 2018).

Many studies have been conducted in order to investigate ASD therapy through assistive robots.

A study by Billard et al. (2007) has found therapeutic effects in using assistive robots with children with ASD. The results of the study showed that utilizing robots in therapeutic settings can enhance psychological and social elements (Billard et al., 2007). Despite the benefits of these robots, there was a need to investigate the acceptability of using robots for children with ASD in terms of education and therapy. Therefore, it has become the subject of some research.

Van Den Berk-Smeekens et al. (2020) focused on a RAT strategy for children with ASD based on current state-of-the-art research in ASD intervention and robotics. The objective was to assess therapy attendance and acceptability based on the child's and parents' feedback. Results showed that children had favorable impact evaluations following treatment sessions (86.6 percent), and parents rated it highly positive (Mean of 84.8 on a 0–100 scale). Positive robot likability ratings were obtained in most therapy sessions for children with ASD, with explanations connected to robotic motions, voice, and gaming settings. Parents of the children regarded their child's acceptance of robots as largely favorable, mentioning their child's enthusiasm and motivation during the sessions (van den Berk-Smeekens et al., 2020).

In 2016, a survey conducted by Coeckelbergh et al. explored how parents and therapists feel about social robots and whether they believe robots can and should be utilized for ASD therapy for children. They evaluated Ethical Acceptability, Replacement, Autonomy-Safety, Trust-Social Interaction-Emotions and Attachment-Treatment Quality-Privacy, and Data Protection. According to the survey results, the vast majority of respondents support the use of robots in the healthcare system, including in RAT for children with ASD. However, several respondents preferred that the interaction be supervised by the

therapist and that the robot is needed to control rather than entirely automated, in accordance with ethical concerns. Also, a significant number of respondents believe that social robots should be employed to monitor the child's cognitive development and contribute to diagnosis rather than replacing the therapist. The only concern that respondents expressed was that children would regard the robot as a friend and become attached to it, which is mostly posing a challenge to roboticists working on human-like robots for ASD therapy. Finally, data protection was not a major concern for many respondents. People approve of the development and use of these robots if they are beneficial to therapy, and they believe robots could be part of the therapeutic process, but not as therapists. While the findings did not prove that using robots in ASD therapy is unethical, the ethical concerns presented by the ethical analysis and survey must be taken into account (Coeckelbergh et al., 2016).

Different factors can influence HRI. Peca et al. (2016) recognized that social-demographic characteristics, including gender, age, and experience of social interaction of children with ASD, are significant predictors of attitudes toward social robots. In addition, the adoption of social robots for ASD is influenced by the degree and type of experience with robots. In terms of the relationship between participation with children with ASD and ethical acceptability, the statistics reveal that parents typically favor deploying robots in children with ASD while criticizing the use of robots in the absence of therapists. They advise roboticists who develop new robots for HRI, including autism therapy, to use feedback information to eliminate psychological obstacles in HRI and to create and implement ethically. It guarantees that all types of stakeholders are included in the study to produce more inclusive technologies and treatment techniques that are sensitive to social differences and inequality (Peca et al., 2016).

Regarding the importance of using robots for therapy and ethical issues, Sandygulova et al. (2019) presented a set of robot behaviors suitable for RAT for children with various forms of ASD and ADHD. As stated, robot behaviors need to be planned in advance, assessed through frequent iteration, and include therapists, clinicians, and parents in the design process. They have addressed ethical challenges as follows:

There's a possibility that participants will form significant psychological and emotional attachments to the robot and that breaking those links could negatively affect the person. Words like "friend," "love," "miss," and other keywords that could elicit an emotional

response will be omitted from the robot's speech. In addition, parents will be informed through informed consent and reminded at each session that they can refuse to participate in any session or request to withdraw from the entire program. They conclude that RAT or Robot-Assisted Play (RAP) had positive influences on most children based on observations and conversations with parents. They assume that children with severe ASD require customized RAP sessions based on user preferences; thus, they will continue to extend the library of advanced applications, as requested by the parents, to allow for a more participatory and engaging RAP. This work provides the basis for complying with ethical standards and supports the methodology of the possible value of off-the-shelf humanoid robots for special care research and practice (Sandygulova et al., 2019).

In contrast to the negative effects of attachments, as Cano et al. (2021) believe, children with ASD who have problems with emotional deficiencies may benefit from effective social robots as an alternative to assistive therapy. They have discovered when robots demonstrate autonomous cognitive-affective behavior, children will become more curious. When interacting with a child with ASD, it is vital to correctly employ a robot's emotional reactions to communicate, detect, and understand emotion. Models of intelligent, emotional communication are required, in which the robot learns to react to children with varying levels of ASD severity. It is doubtful whether such models and algorithms can be established and developed for children with ASD because they cannot be generalized designs and must also consider ethical factors. Finally, the majority of studies on social robots for children with ASD focused on user perception and emotional expressiveness; thus, it is vital to identify the user's feelings for the robot to modify its behavior autonomously. As a result, creating a social robot involves a multidisciplinary collaboration of professionals who should communicate effectively in order to create intelligent and emotional models (Cano et al., 2021).

Considering the need for responding in robots, Scassellati et al. (2012) present a potential advance in the field of socially assistive robotics (SAR) designs for robot controllers that perceive users' behaviors and respond correctly according to a state study of the art in robotics for autism therapy. Researchers can offer warranties regarding robot behavior by developing a robot control architecture specialized in autism therapy applications, which is a crucial notion for socially assistive applications. A trend in robotics for autism introduced robots, which could detect users' emotions and preferences and change their

behavior in real-time to those aspects. As the possibility of using autonomous robots for autism therapy in the future, they should have such flexibility before functioning, which makes them able to work as autonomous entities in therapeutic interactions (Scassellati et al., 2012).

In research by Bharatharaj et al. (2017), they employed a parrot-inspired robot and an indirect teaching strategy to assist children with ASD. The results depict that utilizing robots in therapeutic settings can enhance psychological and social elements and enhance children's learning and social interaction abilities. Even though psychologists discuss concerns related to differences in children with ASD and those with severe ASD may try to throw the robot at others or use it to hurt themselves (Bharatharaj et al., 2017).

With this kind of concern about hurting children, some studies focused on supervising robots and children's interactions. Wood et al. (2019) stated that during RAT for children with ASD, an adult operator should partially or completely supervise the interaction. Since it is currently impractical to design fully autonomous robots for this purpose, the most reasonable strategy is to develop semi-autonomous systems that decrease the cognitive load on the human operator while keeping them in the control loop. They suggest that while creating robots for this user group, there is a need to keep in mind some important aspects:

- User-focused— The key emphasis should be the therapeutic and educational purposes. So, technology would not be the main focus and is just a mediator.

- Usability—To ensure that technology has a genuinely positive influence on its target users, it must be adequately usable.

– Reliability—Iteratively developing a robotic system can result in instilling user trust in a system, which is critical for motivating users to utilize, trust, and embrace technological tools.

– Safety—Regardless of the user group, safety is a major priority by ensuring that there are no pinch spots, no risk of electrical shock, no sharp edges, and a number of other considerations.

– Affordability—Robotic systems must be developed at a reasonable cost to be accessible to the users.

They also mentioned that to fully use the benefits of such technology, further work and research are required (Wood et al., 2019).

As studies show, HRI needs to be accurate and responsible. Shamsuddin et al. (2014) believe that children with ASD are the most "vulnerable" group and ethical considerations are important and responsible in HRI. Therefore, they present ten "layer" protocols for studies involving robots to aid children with disabilities, especially with ASD. They state that it is critical to consider this guideline to become prepared for the program timetable, the intensity of the therapy, and the appropriate context to conduct the program. The stages are:

1) Establish the aim of the HRI program,

2) Form a multi-disciplinary team,

3) Program the robot for interaction and design of experimental set-up,

4) Ethics approval,

5) Subject selection based on inclusion criteria,

6) Uniformed diagnosis,

7) Parental consent and briefing to teachers,

8) Include the child as a participant,

9) Briefing teachers,

10) Child-robot interaction and analysis.

Shamsuddin et al. also believe that the interaction phase is the most critical; therefore, the atmosphere, setting, and participation of people like parents, teachers, and caregivers must all be considered. They also offer a longitudinal study with repeated exposure to well-planned interactions required to assess the suitability of a robot. The study concludes that due to various factors, the path to acquiring credible results will be extensive. Furthermore, each robot utilized for intervention is not faultless or extremely intelligent to have conversations or be fully personalized to suit each child as desired. Considering these factors, they suggest the best strategy is to use a general standardized therapy that will target a certain subset of autistic disabilities (Shamsuddin et al., 2014).

Tanevska et al. (2016) also provided a guideline for autism study with a humanoid robot and explored the social and ethical concerns that must be considered. They regard safety as part of the social component of HRI that needs to be taken into account and highlighted that there are various ethical concerns with using humanoid robots in autism-

related RAT. The ethical issues included: Emotional attachment level, the Use of robots in treatment as human replacements, and Standard ethical processes in HCI/HRI investigations. To develop the ethical implementation guideline, they employed Shamsuddin et al. (2014) set of ten procedures in RAT research on a reduced scale in six unique sets of therapies with six children, which lasted eight weeks. Those sets include:

"A. Stablish the aim of HRI and form a multidisciplinary team

B. subject selection based on diagnosis and other criteria

C. Ethics approval, briefing, and consent from parents

D. Assessment of needs and robot programming

E. child-robot interaction in an experimental setup

F. Data analysis."

Based on this study, by carefully creating and implementing guidelines, they were able to make sure that the experiment ran efficiently and without any undesirables, ultimately achieving their objectives (Tanevska et al., 2016).

## 3.2 Main Ethic Documents

Having previous related works reviewed and analyzed to see the areas other ethic researchers in the field of technology, robotics specifically, have focused on, we could come up with a list of two main references regarding ethical principles. The ethical principle references include the World Health Organization (WHO) Code of Ethics and Professional Conduct (Drake, WHO, 2017) and the IEEE Global Initiative of "ethics of autonomous and Intelligent systems" (Chatila & Havens, 2019).

The two documents mentioned above have been carefully studied and analyzed, and then a list of ethical concerns related to the ROSA project has been extracted to be used in forming the in-depth interviews guide. This list includes two main subsets, general human-related ethical concerns and ethical issues raised when using technology.

The first subset includes human dignity, social diversity, safety and security, human well-being, and equality.

The other subset includes traceability, accountability, transparency, the existence of frameworks and standards for assurance, the proper translation of existing and forthcoming legal obligations in the form of a legal policy, subordination of human judgment and control over artificial intelligence, consideration of social norms in design

and development of technology, awareness of probable misuses, empowered staff to voice ethical considerations, the existence of interdisciplinary ethical considerations, the existence of a mechanism for reviewing ethical issues with the possibility of participation of all stakeholders, a well-structured mechanism for data protection and privacy of the users, consideration of affective point of view, integrity, and considerations for ethical dilemmas.

The abovementioned factors have all been taken into account when designing the interview guide, which is depicted in appendix 2 of this document.

Table 4 depicts a definition for any of mentioned factors.

| Title | Definition | WHO | IEEE |
|---|---|---|---|
| Dignity | Act in good faith, with intellectual honesty and fairness. | ✓ | |
| Social Diversity | The obligation of every member of the Organization to be answerable for his/her actions and decisions and to accept responsibility for them | ✓ | |
| Safety and Security | Autonomous and Intelligent Systems (A/IS) devices should work in a way that benefits humans. | | ✓ |
| Equality | Behaving ethically at all times and with the utmost respect for each other and external stakeholders, without regard to gender, race, religion, creed, color, citizenship, national origin, age, marital status, family responsibilities and choices, pregnancy, sexual orientation, or disability | ✓ | |
| Traceability | If an A/IS causes harm, it must always be possible to discover the root cause by assuring traceability for said harm | | ✓ |
| Accountability | Why a system operates in certain ways to address legal issues of culpability if necessary, apportion culpability among several responsible designers, manufacturers, owners, and/or operators | | ✓ |
| Transparency | Parties, their lawyers, and courts must have reasonable access to all data and information generated and used by such systems employed by governments and other state authorities | | ✓ |
| Frameworks and standards for assurance | The importance of having ethical frameworks, standards, and guidelines in place to assure that the project is being conducted ethically | | ✓ |

| | | | |
|---|---|---|---|
| Legal policy | Having the legal policies in mind when thinking about ethics in a project | | ✓ |
| Subordination of human judgment | A/IS should not be granted rights and privileges equal to human rights: A/IS should always be subordinate to human judgment and control | | ✓ |
| Social norms | Having the social norms in mind when thinking about ethics in a project | | ✓ |
| Awareness of probable misuses | The public understanding of the potential impact of intelligent and autonomous technical systems on society | | ✓ |
| Empowered staff | Employees should be empowered to raise ethical concerns in day-to-day professional practice, not just in extreme emergency circumstances such as whistleblowing. | | ✓ |
| Interdisciplinary ethical considerations | The need for more constructive and sustained interdisciplinary collaborations to address ethical issues concerning autonomous and intelligent systems (A/IS) | | ✓ |
| Reviewing ethical issues mechanism | Ethical issues and guidelines should be reviewed regularly | | ✓ |
| Data Protection and Privacy | Stakeholders have the right of secured personal data and privacy | | ✓ |
| Affective point of view | How emotional aspects are being considered in forming an ethical guideline | | ✓ |
| Ethical dilemmas | Demonstrates the problematic consequences of technology usage on, or justified by, liberal democratic values and should be consulted as a guide to normative foundations. | | ✓ |

*Table 4 The initial framework for interviews*

## 3.3 In-depth interviews

In this section, the results of the interviews will be depicted. Participants in these interviews, as mentioned before, were researchers of the ROSA project. These participants have reflected on questions regarding robot-related, ASD-related, and research-related ethical issues that have been defined in the previous section. They have also described how these theories are being applied in the ROSA project, and these can also be applicable to other projects like ROSA.

### 3.3.1 Different aspects of ethical issues

In this study, we have looked at ethical issues from two different viewpoints. First, the ethical challenges in the society that ROSA can be an answer to. That can also be pointed at as the project's aims in this case, and second, the ethical challenges that can arise with the implication of the ROSA project.

#### *3.3.1.1 Ethical issues that ROSA can be an answer to*

Interview participants have mentioned several ethical issues that they think ROSA can resolve. These are as follows.

##### Inclusion of everybody in the society

One of the most emphasized aims of the ROSA project has been mentioned as inclusion by both interviewees.

They believe that children with autism and generally people with disability are mostly excluded from the main activities in society. As Participant2 discussed:

> *"So in the society, I think, people with disabilities and people with autism and cognitive disabilities are not as involved in research and development as people in general, so when we develop new technology and new solutions, for example, the use of robots or use of other types of technology, virtual reality, et cetera, these solutions are often directed towards the general population, which means that people with disabilities may be excluded in use of new technology and then as they grow, they may like behind the rest of the population because they are not as exposed to technology and the technology are not adapted to their needs. So, that's at least one aspect that we try to meet in the Rosa project because we are focusing on the group and children with ASD and cognitive disabilities and other disabilities actually at this special school."*

##### User acceptability and user preference

Participant1 has mentioned the acceptability of learning methods for the learners. As mentioned by him, children with autism are very eager to work with technology, and if they are to choose between having interaction with humans or having a device to work

with, they will mostly go with the technological device. So, if we want them to learn social skills, which are not their strongest point, it is better to use devices or methodologies that they like. He mentioned that to be more ethical, they should have them work with something more enjoyable.

Special preferences of children with ASD

Another aspect in this regard has been mentioned participan1 is how these children need repetition and how they enjoy routines. He also believed these robots could provide more routines as they can repeat and repeat, they do not get tired, and they do not change in a different situation. These desired routines can lead to less harm to the children and disturb them less all way through their learning process.

#### *3.3.1.2 Ethical challenges that might rise from the ROSA project*

Emotional attachment:

One main concern in having robots interacting with children with ASD is that they might become too attached to these robots, which might harm them if someday they cannot have the robots anymore. These children like having a rhythm in their lives, and when their routines are gotten away from them that might break them down emotionally. As mentioned by Participant1, these breaking downs are more severe in children with ASD compared to other individuals.

Aggressive behavior:

Participant1 also expressed concerns regarding how children's reactions can be if robots do not work properly or the robots had not been adjusted to the condition of those children. These children can get angry easily, and that anger can lead to some aggressive reactions. Those might hurt the children or teachers and threaten their safety, and safety is always an ethical concern.

Social isolation

Another important aspect of using robots for children with ASD, as mentioned by Participant1, is the danger of children being more isolated. The initial aim of projects like ROSA is for children to learn social skills in an applicable way to their social interactions in the real world. That is, in this project, the process can cause these children to be involved with robots in a way that they prefer their interactions with robots to any other interactions with people. This can be an unwanted result of projects like ROSA, and after

all, this will lead to more self-isolation and, as a result, more exclusion which is not ethical to these children.

Although, Participant2 has argued that among other assistant technologies that are widely used for teaching social skills to these children, robots are the most human-like ones. The other technologies mentioned were mobiles, tablets, and different devices. So, it can be expected that children can apply the skills learned through their interactions with robots to their daily lives more effectively.

### Awareness of chance of efficiency

Another issue that has been pinpointed in the interviews was the extent to which all the stakeholders are familiar with the research works. That is, the chance of failure in the project should be clear, and everyone who is taking part in this project should be truly informed that this project might not come up with the desired results. The participants were also discussing how in this specific project, it is even more sensitive for everyone to have proper information regarding the evaluation of the project in any phase. The reason for this importance has been mentioned to be how these parents can easily raise hope in a way for their children to progress and develop social skills and, on the other hand, how children can easily get heartbroken if that does not come true.

As mentioned by Participant2:

> *"it's difficult to manage their expectations because this is a research project, and we don't know if it will if our solution will be helpful"*

### Too much trust in the robot

Another ethical issue that the ROSA project is dealing with, in one of Participant2's opinions, is the extent of trust from the parent side. These parents have shown a great deal of enthusiasm for this project until now, and project owners are afraid that might not be a good thing as the final results cannot be predicted yet.

### Difficulties in getting consent

Children with autism are considered people with disabilities, and their guardians should give consent for anything related to them. This is because most people with ASD are unable to express their feelings, and some of them cannot even speak, and their will should be understood by some signals. One of the interviewees mentioned that this is so probable that these children cannot give consent by themselves. Therefore, this is the

research team and teachers' responsibility to seek signals and understand if they are unwilling to continue participating in the research and withdraw their participation in that case. Another thing that Participant2 was worried about was that if the parents of these children knew what exact premises they were giving consent to or not. That is, do the research agenda and the project itself transparent enough to them? Are they aware that this project might fail, and what the consequences of these failures are? Do they understand that this is a research project and positive outcomes cannot be guaranteed yet?

#### Wasting precious learning time in case of project failure

Children with ASD need extra time from the teacher's side to achieve their learning goals. Now, projects like ROSA also demand the teachers to put some of this valuable time into working with these robots. And this is happening in a condition that we still do not know how successful or failed the project can be. That cannot be ethical for children to keep away the effective learning path from them and replace it with something that was not successful.

#### Availability

Another aspect that has been pinpointed by Participant1 was the availability of this technology in case this project succeeds and the project owner decides to extend the scope worldwide. As these robots and generally, this technology can be expensive to develop and maintain, the availability of this solution can be different for various regions and countries. One of the very important ethical aspects is that a technology solution, when being broadly used, should be available for people in different conditions, which needs more consideration.

### 3.3.2 Existence of proper ethical frameworks and guidelines

One of the other important aspects that interviewees mentioned was the importance of having ethical guidelines from different disciplines and creating a more inclusive framework that can be adopted for that exact project.

As an example of this framework, Participant1 has mentioned that besides having NSD guidelines in place to support the research part of ethics, it is also important to take REK guidelines into account (Regional Committees for Medical and Health Research Ethics | Forskningsetikk, n.d.)As an example of this framework, Participant1 has mentioned that

besides having NSD guidelines in place to support the research part of ethics, it is also important to consider REK guidelines (Regional Committees for Medical and Health Research Ethics | Forskningsetikk, n.d.). This committee, according to Participant1, mostly concerns ethical aspects related to healthcare and is mostly emphasizing the aspects in which people can get hurt.

Interviewees were also mentioning other different frameworks and were emphasizing that the ROSA project and any other interdisciplinary project should include different guidelines from all those different disciplines. Participant1 has also mentioned that it will be even more useful to have micro-projects through the main one and request ethical confirmation from different ethical institutions for each of these micro-projects.

### 3.3.3 Applying ethics practically to interdisciplinary projects

One of the other main challenges in interdisciplinary projects, like ROSA, is to find a way to apply ethical theories to the project practically and make everyone aware of the concerns of others from different disciplines.

In other words, different disciplines involved in these kinds of projects should have a place to raise their voice if they think something is going wrong or some parts of the project are being unethical. So, as mentioned by participants, it is an important job to create that atmosphere and that situation for everyone to talk and communicate their opinions.

As described by the interviewees, this matter is taken care of in the ROSA project by having monthly meetings. These meetings usually are short and with the participation of everyone involved in the project. The project manager is leading these meetings, and everyone will discuss their concerns through them. One of the participants also mentioned the regular and more frequent meetings that each discipline has for itself and how any problem can be discussed more deeply, and the result of those can be communicated in the monthly meetings afterward.

Participant2 also mentioned that the even more important matter here is to be open to everyone’s concerns, take them seriously, and go through them carefully. It is because projects related to people with disabilities are always very sensitive, and that means they need a greater extent of focus on different worries before the implementation phase.

That is also important to have these considerations continuously and from the beginning to the end of the project.

### 3.3.4 The impacts of social norms on ethical aspects of the project

Social norms always play a role in defining aspects of any project. Based on interviewees, some challenges or ethical issues in some places can be even non-imaginable in other places or vice versa. So, the fact that this project is being deployed and tested in Norway can make the whole ethical consideration different from other locations. So, suppose the project is successful, and the project owner decides to extend it to different places. In that case, it is vital to have all the already-in-place ethical concerns, like other aspects, reviewed and adjusted to the destination society.

One of the mentioned social norms in Norway is the accepted position of all people in society. As noted by Participant1, Norway, having mainstream schools, is a country in which there is a big demand for the inclusion of every child in the society, which might be different in some other societies.

Another aspect that was mentioned was the extent of trust between parents of these children to technology which can be mentioned as a social norm in Norway. It can add an extra burden on the project's shoulders to balance the expectations in this regard. Having mentioned the high level of trust, it is worth noting that according to Participant2, parents in this project accepted the project easily, and this might be different in other societies, and the project might encounter user resistance in other places.

Last but not least, a mentioned consideration is that here in Norway, there is a system of adjusted learning, and it is always essential for the teachers that learning materials are suitable for their target society. That means the content of learning programs that will be injected into these robots should be suitable for the audiences. As autism is a spectrum, there might be a need to customize these materials for any kid separately. If not, it might be considered unethical to expose children to something not suitable for them.

### 3.3.5 Traceability, accountability, and human subordinate

Another important area to cover in robotics is controlling the situation. That is even more important while working with children with ASD who might be more vulnerable than other children. As mentioned by participants in the ROSA project, they have dealt with

this issue by always having a teacher besides the children. That teacher is a special pedagogue who controls the situation and will be careful with both signals from the children's side and failures from the robot side.

Also, as pinpointed in the interviews, there are cameras installed in place for the test phase, and everything is being logged carefully. These logs can be used to trace every potential problem using these robots.

*Figure 3 NAO robots (Nao - ROBOTS: Your Guide to the World of Robotics, 2008)*

Also, as mentioned by Participant2, there might be a time in the future that children want to work with robots without the teacher's supervision, as they might need repetition, and for that time, there would be a need for extra considerations.

Another factor that might seek subordination is safety-related issues. These robots are presented to solve problems, and there should be careful considerations to prevent any harm from happening. An example of harm can be having the kids injured by the robots. As discussed in the interview, in the ROSA project, the robots that will be used are NAO robots shown in Figure 2. These robots are not that big, and the probability of harm will be reduced in this case. However, these issues might be relevant for other projects like ROSA.

Another safety-related issue that Participant2 has discussed was electricity-related issues. This is also another important part that needs to be safeguarded by the technical discipline of the project and needs more consideration in all robotic projects.
In some cases and projects, it is also probable to have AI involved in algorithms for these robots. Participant1 also discussed that there is a need for extra considerations and extra loggings to have a more confident tracing system in that situation.

### 3.3.6 Transparency

Transparency was one of the points that have come out several times during these interviews regarding ethical concerns. Both participants discussed that the most important aspect that should be considered in a project like ROSA is to be as transparent and straightforward as possible. This transparency has been looked at from different viewpoints, one of which is the transparency between the project leader and team members, and the other is between the project team and stakeholders.
One of the aspects that need to be clear is, among other things, giving a clear view of all probable advantages and disadvantages of the project in both cases of success and failure. It means that every possible scenario should be discussed and thought about. All people involved in the project should get aware that this project might not come up with the desired results, and there is a chance that after all made efforts, it turns out not to be efficient at all.
Different ways of achieving the best level of transparency have been pinpointed by interviewees as follows:

- Make catalogs with detailed information about each phase of the project and hand them over to all parents, teachers, and even team members.
- Sending out regular emails with information and articles related to the project and different aspects of it.
- Sending out emails that contain reports regarding the status of the project.
- Having a blog with all related information and the history of all conducted phases of projects besides all the upcoming phases.
- Besides all the detailed information, sending out some smaller parts of information that are easier to follow is also a good idea.

- Setting up meetings that everyone can attend and ask questions about different aspects of projects and having people in that meeting who can answer these questions.

### 3.3.7 Privacy and Data Protection

Throughout the interviews, GDPR was mentioned several times by the participants. Data that is collected in these kinds of projects are mostly related to the health status of people, and their privacy and security are very urgent. There are several possible steps to take to protect data.

First, the project team should review guidelines regularly, follow them carefully, and be aware of any changes that might be applied to them and consider them in the project.

Second, data should be collected just when needed. If storing data is not necessary, we should just simply avoid it. That means that when collecting any data, there should be a plan for using them.

Third, if data is collected, it should be stored securely. The process of accessing data should be secured, and only authorized people should be able to access those data.

Forth, all the ones whose data has been collected should be able to see that data and should have the right to delete the data if they want to.

Fifth, the process of transferring data from the robot into storage should also be reviewed carefully, and preferably, this process should be done encrypted.

Finally, data should be deleted after a certain period. No data should be stored unlimitedly.

### 3.3.8 Ethical Dilemma

Dealing with an ethical dilemma is always one of the main debates in ethical discussions. Interviewees have mentioned different ethical dilemmas related to the ROSA project and similar projects to ROSA.

First, children need to receive the best training. In this way, there might be a huge number of received feedback. Paying attention to all that feedback will need much time and consideration, and the project might be delayed due to this data processing. So, that can be a dilemma to choose what can serve these children to a better extent and how to balance these two different aspects.

On the other hand, there is always a chance that during a project, we get some results that shows that the project is not efficient and it is getting far from its initial goals. There will be different options at that time, including finding and trying new solutions and putting an end to the project. As discussed by Participant1, this will be a huge dilemma to choose between these options, as the first might lead to even more waste if we cannot find the proper solution, and the latter might be not a good option when there might be another solution that we have not tried yet.

In this specific project, there is also a concern for children's health. Participant1 also mentioned that there might be even disadvantages in this project for the children, and because of that, there might be a need for defining some borders and having an eye on those borders not to cross them and not harm children.

In terms of ethical dilemmas, Participant2 was also referred to transparency and how clarification amongst all the stakeholders can help the project make better decisions when encountering dilemmas. That is, when there is the result of estimations and all the statistics related to the performance and efficiency of the project clear and accessible to everyone involved in the project, they can decide better about continuing or not continuing the project.

Another mentioned dilemma was the matter of financing and funds for the project. It has been discussed that there should be careful considerations in terms of proficiency, and the project should stop extending and receiving funds or recruiting researchers if it is not efficient for children anymore.

Overall, ethical dilemmas, according to interviewees, are the matters that should be discussed specifically for any project and should be considered accordingly.

### 3.3.9 Having someone in charge of ethical guidelines

Last but not least mentioned item by Participant2 in terms of ethical considerations was that there is a person in charge of gathering guidelines, including ethical guidelines, and that person always has all these guidelines reviewed and updated, and everyone can go to that person if anything is needed. One of the interviewees highly recommended having that person in place in any project like ROSA.

# 4 Discussion

In this chapter, we will gather all the previous chapters together, and besides addressing the research question, we will discuss how findings from different data sources used in this study can support or decline each other.

## 4.1 Back to the research question

This study aimed to investigate ethical implications when robots are used in facilitating social skill learning for children with ASD.

## 4.2 Why should projects like ROSA exist?

One of the viewpoints of this study regarding ethical issues was that those ethical issues already existed in the society for children with ASD, and projects like ROSA are being created to find a solution to them. Previous studies and results of interviews pinpointed several of these issues that projects like ROSA wish to address.

Some of those issues revealed in this study include the inclusion of everybody in society, user preference when it comes to using technology, the need for repetition and stable conditions in children with ASD, and the need for more training for children with ASD.

Having mentioned these challenges in society for children with ASD, there is an urgent ethical need for studies and solutions that can address those. Already reviewed many studies, we still believe there is not yet enough effort taken in this regard, and that is something that projects like ROSA are seeking to do as a social responsibility. So, not only do we think that these types of projects are necessary, but we also think that it is not enough for those just to exist, and there should be a more focused and more emphasized effort taken into account in these types of projects. We also believe there is a need for more detailed case studies besides those research projects to fulfill the aim for those.

## 4.3 What ethical issues might happen throughout these projects?

Another and the main viewpoint of this project was to investigate the ethical challenges that using robots for the training of children with ASD can lead to.

One of the most mentioned ethical concerns in that regard is the probability of **emotional attachment** between children and robots and the issues that might create if robots are not accessible for these children one day. As mentioned in interviews and some of the studies, the amount of time that children spend with robots should be carefully estimated to prevent this issue from happening or at least lessen the probability of this issue. It can be done in a way to both create enough engagement and prevent extra emotional engagement between them and the robots.

The second mentioned ethical issue is the chance that this solution, although created to raise the inclusion of these children in society, leads to more **social isolation**. The worry here is that as these children typically prefer technology over human interaction, they fail to generalize the interaction they are learning through this way to the interaction with humans, and that makes them even more used to interacting with technologies instead of real society.

The third ethical issue category can be mentioned as **safety** issues. That can be created due to robotic problems, electrical problems, aggressive behavior when confronting robots for the first time, not having an in-place tracing system, not having a monitored and safe environment, etc. To overcome this issue, we need to always have a human supervisor when children interact with robots. Also, other safety guidelines always need to be followed.

Forth, studies and interview sessions also worried about getting **informed consent** for these kinds of projects. As these children are sometimes unable to talk or express their feelings, consent should be taken from their guardians. Although, they can disagree with participating in the project and just fail to express that disagreement. So, there should be more effort in trying to understand if they are satisfied with being a participant in that project or not. Also, parents or guardians of these children, as mentioned in the interviews, can be too optimistic about these types of technological solutions for their children, with high expectations, and that might lead them not to see the drawbacks of these technologies and to give false consent.

The fifth ethical concern in these projects can be the question of "Is it even ethical to expect teachers of these children to spend time on a project that might fail instead of their routine work plan?". In other words, there is always a worry about **wasting time** when we do not know the result of something. That is even more important in this case

as time is precious for these children, and the more time they have, the more improvement they can make.

Last but not least, these robotic solutions and their implementation can be expensive. Suppose the project succeeds and the project owners decide to extend the project scope. In that case, it might not be easy to make it available in every region and country globally. The availability of technology has been mentioned as one of the main ethical principles in different resources (Drake, WHO, 2017).

## 4.4 Ethical dilemmas

Another debate that is always raised when discussing ethical issues is ethical dilemmas in each project and the way they can be dealt with. We believe one of the main ethical dilemmas in any research project can be the answer to the question: "when should we stop continuing this project?". Any research project requires lots of financial and non-financial resources to survive. If the research group feels that the project is not going on its path and the chance of its failure is high, suspension of the project should always be an option. In addition, in the evaluation process for the project, it is very important always to know how far we are from the desired path.

## 4.5 General recommendations for future ROSA-like projects

Finally, we have extracted a list of recommendations from the collected data in both the literature review and the interview sessions presented below.

- It is crucial to define stakeholders properly in these projects and to include everyone who influenced or influenced the project in the list.
- Ethical guidelines and ethical frameworks should not be designed once and followed then, but they should be reviewed continuously, and items should be added to or removed from them according to the project status and other conditions. This review process should be done regularly besides immediately if any concerns arise. In other words, the process of updating ethical frameworks in these projects should be conducted in both top-down and bottom-up approaches (Yew, 2021). That means that we need to both provide an initial framework and regular updates to it. Also, this implication should be done in different phases of the project and alongside the whole progress.

- Transparency matters most. The project status should be available to all of the stakeholders. We always give the participants the right to withdraw from any projects, which is good, but not enough. All the stakeholders should receive proper information related to the specified project and always have enough data to make the best decisions. Specifically, the chance of efficiency should always be available to the stakeholders in these projects.
- Children's behavior and reactions should be monitored and analyzed carefully, and the most effort should be made to understand their feelings and their level of acceptance of the technology. In case of any dissatisfaction or probability of harm, immediate actions should be taken, and if necessary, children should be withdrawn from the project.
- Robot-child interaction should never replace real teacher-child interactions, and these technologies should be used as a supplement to the other learning tools and procedures. This is to be done to lessen the chance of social isolation or extreme emotional attachments of children to the robots.
- Typically, these kinds of projects are interdisciplinary, so the ethical considerations for the project should be defined in an interdisciplinary manner. That means researchers from all different disciplines should be able to voice their opinions and impact the whole theme of the ethical framework at any time. As mentioned in the interview sessions, the best way to achieve that is to set up short and regular meetings with the participation of all disciplines just to have a place to get the concerns of all. Then, a more in-depth investigation should be in place to go through all these concerns, preferably in smaller meetings.
- The impact of social norms on the society where the project is being conducted should always be considered, and all other project circumstances, ethical aspects included, should be defined accordingly. Also, cultural differences should be taken into account when conducting projects in different geographical places. These cultures might include religions, traditions, social norms, and manners.
- When data needs to be collected, it is important to have all the security and privacy considerations in place and follow regulations like GDPR.

- In cases where AI and autonomy are added to the robotic technologies in the project, human subordination, traceability, and accountability should be more emphasized. Also, it is better to have more supervision in place to prevent any harm.

These recommendations might serve as a useful guide for finding solutions to challenges. Based on the circumstances, these suggestions may vary in different situations and in how they refer to crucial issues in that situation.

# 5 Conclusion

In the past decades, robotic technology has been examined to assist children with autism spectrum conditions and facilitate their education and interaction development. Researchers require certain ethical considerations when working with humans, especially when interacting with vulnerable people, children with ASD included.

In this paper, several categories of ethical challenges engaging robots are described by focusing on the challenges that children with ASD confront when using robots in their education process.

These categories include challenges addressed by these types of projects and challenges that arise from these projects.

Concentrating on the most common and frequent ethical concerns has been a significant consideration throughout this study. It also concluded that using robots, although efficient and helpful for these children, can also create new ethical problems. Also, a detailed description of these problems has been presented.

It also revealed that using robots to support children with ASD in developing social skills includes not only ethical implications for using robots in these projects but also respecting children's mental states.

These ethical challenges need to be considered in all stages of any project, including the design, implementation, and use of robots, and also from different points of view. It depicted that ethical principles and frameworks should be defined appropriately and developed to be followed, although they may alter depending on related factors such as the context of use.

Results show that various factors may influence human behavior, and these observational assessments are limited and changeable; therefore, they must be a continuous effort.

# 6 Limitations and future work

There were some limitations during the process of conducting this study, as mentioned below:

- Case study: We have considered the case of the “ROSA” project, which is now under process. Therefore, we faced certain barriers:

Due to Covid-19, the project group was unable to complete the visits to children at the school where they studied. However, they considered continuing to monitor the situation to ensure that the risks of infection remain low to resume their investigation. Also, at the first stages of the study, we obtained access to surveys that were responded to by the researchers working on the ROSA project. Unfortunately, after conducting analysis, when data had become ready to use, it was announced that we were not allowed to use these surveys. It was only confidential to project members.

- Interviews: As the time was limited and most of the ROSA project members were busy with the project, there was a limitation on the number of individuals who had agreed to participate in interviews. That results in reducing the generalizations that can be derived from this data. Despite these challenges, we were fortunate enough to have the opportunity to manage time to meet and have discussions with those volunteer interviewees.

- The geographical limitation: Although the literature review was not bound to any particular country, the case of project "ROSA" is based in Norway. As discussed in the literature and discussion part, the cultural setting has an important role in accepting and implementing robots, especially for children with ASD who are more vulnerable. Although, the result of this study can influence researchers' perspectives in their countries to have a broader view of the advantage and disadvantages of using robots to help children with ASD. So, it can change their expectations, and they can be more aware of the ethical considerations and the probable consequences to make a better decision to manage these kinds of projects in different cultural settings.

- Data analysis: The process of generating meaningful information or codes of ethics regarding the project was based on the information provided by project participants during interviews. As a result, bias was probable. In this regard, we enhanced reliability and accuracy in the coding process by exploring the relationship between interviews and literature review content. Creating a pattern with what we had coded was also

challenging since various coding processes may create different themes. Also, in terms of the validity of this study, we believe the findings of this study are relevant to the same procedures of employing assistive robots in general. The aspects discovered about crucial ethical considerations and decision-making regarding their use are considered to be comparable to the use of such robots in a similar context.

-A large sample size that reflects any group in society would be required to examine all of the robot's functions and children's performance enhancement. The findings are limited to a single case, so generalizing empirical data from a single example is hard to accomplish. Every sample sheds light on phenomena and contributes to the comprehension of considerations. Maybe some quantitative and wider research with a larger sample can be a good supplement to this study.

It is obvious that further study is needed on this topic to address the ethical concerns of using such technology with children with ASD more comprehensively. In addition to knowing ethical and societal challenges, more research into additional possible conceptual and practical difficulties, the development of the ethical frameworks, and alternative structures for future robot ethical implications are required.

Future studies into a wider variety of situations of employing robots for children with intellectual disabilities and children's impressions and preferences may influence the development and use of these robots. Furthermore, because users' attitudes to robots vary, confirmed ethical standards for one user community may not be appropriate for another. For example, alternative ethical concerns may emerge for diverse cultures. This process must be ongoing since the users' responses in interacting with robots will continue to evolve indefinitely and since user and robot interactions will continue to change.

Furthermore, because the number of experiments might influence the results of robot-child interactions, analyzing the effect of utilizing robots in their progress over time, robot-assisted therapies can provide a new angle. It can also enhance the precision of the evaluation.

It would also be interesting to see whether replacing robots with virtual reality devices is possible and how effective it would be by considering potential ethical issues.

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# Appendix 1 – NSD assessment



NSD NORSK SENTER FOR FORSKNINGSDATA

## Assessment

**Reference number**

386325

**Project title**

Master Thesis: the ethical implications of having a robot help teach a child with ASD

**Data controller (institution responsible for the project)**

Universitetet i Sørøst-Norge / Handelshøyskolen / Institutt for økonomi, markedsføring og jus

**Project leader (academic employee/supervisor or PhD candidate)**

Veralia Gabriela Sanchez, veralia.g.sanchez@usn.no, tlf: +4735575361

**Type of project**

Student project, Master's thesis

**Contact information, student**

Maryam Sadat Amini, 238831@usn.no, tlf: 93972716

**Project period**

14.02.2022 - 01.08.2022

**Assessment (1)**

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**03.03.2022 - Assessed**

ABOUT OUR ASSESSMENT
Data Protection Services has an agreement with the institution where you are carrying out research or studying. As part of this agreement, we provide guidance so that the processing of personal data in your project is lawful and complies with data protection legislation.

We have now assessed the planned processing of personal data. Our assessment is that the processing is lawful, so long as it is carried out as described in the Notification Form with dialogue and attachments.

TYPE OF DATA AND DURATION
The project will be processing general categories of personal data until the date documented in the Notification form.

LEGAL BASIS
The project will gain consent from data subjects to process their personal data. We find that consent will meet

the necessary requirements under art. 4 (11) and 7, in that it will be a freely given, specific, informed and unambiguous statement or action, which will be documented and can be withdrawn.

The legal basis for processing general categories of personal data is therefore consent given by the data subject, cf. the General Data Protection Regulation art. 6.1 a).

PRINCIPLES RELATING TO PROCESSING PERSONAL DATA

We find that the planned processing of personal data will be in accordance with the principles under the General Data Protection Regulation regarding:

• lawfulness, fairness and transparency (art. 5.1 a), in that data subjects will receive sufficient information about the processing and will give their consent
• purpose limitation (art. 5.1 b), in that personal data will be collected for specified, explicit and legitimate purposes, and will not be processed for new, incompatible purposes
• data minimisation (art. 5.1 c), in that only personal data which are adequate, relevant and necessary for the purpose of the project will be processed
• storage limitation (art. 5.1 e), in that personal data will not be stored for longer than is necessary to fulfil the project's purpose

THE RIGHTS OF DATA SUBJECTS

As long as the data subjects can be identified in the data material, they will have the following rights: access (art. 15), rectification (art. 16), erasure (art. 17), restriction of processing (art. 18), data portability (art. 20).

We find that the information that will be given to data subjects about the processing of their personal data will meet the legal requirements for form and content, cf. art. 12.1 and art. 13.

We remind you that if a data subject contacts you about their rights, the data controller has a duty to reply within a month.

FOLLOW YOUR INSTITUTION'S GUIDELINES

We presuppose that the project will meet the requirements of accuracy (art. 5.1 d), integrity and confidentiality (art. 5.1 f) and security (art. 32) when processing personal data.

To ensure that these requirements are met you must follow your institution's internal guidelines and/or consult with your institution (i.e. the institution responsible for the project).

NOTIFY CHANGES

If you intend to make changes to the processing of personal data in this project it may be necessary to notify us. This is done by updating the Notification Form. On our website we explain which changes must be notified: https://www.nsd.no/en/data-protection-services/notification-form-for-personal-data/notify-changes-in-the-notification-form

Wait until you receive an answer from us before you carry out the changes.

FOLLOW-UP OF THE PROJECT

We will follow up the progress of the project at the planned end date in order to determine whether the processing of personal data has been concluded.

Good luck with the project!

# Appendix 2 – Interview Guide

We started to present a brief of ethical considerations related to social robotics for educating children with autism spectrum to present the study case of this research.

then we argue that this study ...

Interview questions:

- What ethical challenges do you think projects like ROSA are an answer to? In what way?

Human dignity

Diversity

Safety and Security

Human wellbeing

Equality

- What ethical issues do you think these kinds of projects may lead to and need to be considered beforehand?

Safety

Effective

Sensitive data

Psychological issues

- What codes of ethics, standards, and framework do you follow in this project? Do you think there is a clear and practical ethical policy in place in this project? Do you have any plan for reviewing the codes of ethics regularly and updating them throughout the project?

- As this project is an interdisciplinary project, how do you make sure that every discipline voices its idea about ethical concerns at the beginning and throughout the project?

- What social norms do you think play a role in terms of ethical concerns of projects like this? How different do you think these concerns were if the project has based somewhere else but in Norway?

- How Traceability can be considered in projects like the ROSA project? What considerations are in place for the probable harms? Who should be accountable? Is there a clear set of guidelines for determining who is responsible for the consequences of employing these robots? Is there adequate supervision and control over the entire process?

- How transparent do you think the robot work can be to stakeholders of this project?

- Is the human teacher subordinate to robots? Social robots will respond autonomously to a child's actions, but how likely are these robots to make mistakes throughout the interaction? How much control do you possess over the procedure?

- How GDPR is being followed in projects like this and how data is protected? When collecting and using personal data during design, production, and implementing A/IS, are ethical considerations considered?

- How do you think is the best way to handle ethical dilemmas?

- How do you think stakeholders of projects like this can be included in reviewing ethical challenges?

- Is it ethical for children with autism to regard social robots as friends due to their therapy, with the potential for emotional problems?

- Do you have anyone in charge of providing ethical guidelines for this project?

# Appendix 3 – Information Letter and Consent Form

Are you interested in taking part in the research project

" Ethical implications of having a robot help teach a child with ASD"?

This is an inquiry about participation in a research project where the main purpose is to investigate ethical considerations in using robots to help teach children with the Autism Spectrum Disorder (ASD). In this letter, we will give you information about the purpose of the project and what your participation will involve.

Purpose of the project

This project is a master's thesis in which we will concentrate on ethical issues related to the use of intelligent robots. Despite their importance, ethical issues have received less attention in the technological age. Robot ethics is a growing multidisciplinary topic that examines the ethical implications of robotic technology or applied ethics in the use of robotics. As a result of creating robots, there is a need for greater studies on ethics in this subject. The outcomes of this study may lead to the progress of using intelligent robots to aid ASD children in learning.

Due to the importance and motivation of ethics in robot assist projects, we will try to answer the following question:

RQ: What are the ethical implications of having a robot help teach a child with ASD?

Who is responsible for the research project?

The University of South-Eastern is the institution responsible for the project.

This project will be conducted with collaboration the Norwegian Computing Center (Norsk Regnesentral (NR www.nr.no), an independent and non-profit private foundation that carries out contract research for businesses, the public sector, and private organizations both in Norway and internationally.

Why are you being asked to participate?

Considering that NR is currently working on a project about robot-supported education for children with ASD, this research sample will include researchers on this project. The sample population will include people who are involved in the process.

What does participation involve for you?

If you chose to take part in the project, we will use focus group discussion, a qualitative approach to gain an in-depth understanding of the subject. The method aims to obtain data from a purposely selected group of individuals who works on the ROSA project. The survey includes questions about possible ethical problems and related considerations in this project. It will take between 60 to 90 minutes and audio recording will be used to record data.

There is no need for personal information in this research and we will use your response for analysing the results.

Your personal privacy – how we will store and use your personal data

We will only use your data for the purpose(s) specified in this information letter. We will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act).

The personal data, such as your name and contact details, will not be asked or used in this project, and data from the focus group will be used in the data analysis by Somayeh Ahmadian (student), Maryam Sadat Amini (student), and Veralia Gabriela Sanchez (supervisor).

In addition, the NR company can access collected data from this research which will also be anonymous.

What will happen to your personal data at the end of the research project?

The project is scheduled to end by June 2022.

All collected and used data for this research, both on paper and digitally, will be referred to NR company and USN at the end of the project.

Your rights

So long as you can be identified in the collected data, you have the right to:

- access the personal data that is being processed about you
- request that your personal data is deleted
- request that incorrect personal data about you is corrected/rectified
- receive a copy of your personal data (data portability), and
- send a complaint to the Data Protection Officer or The Norwegian Data Protection Authority

What gives us the right to process your personal data?

We will process your personal data based on your consent and in accordance with data protection legislation.

Where can I find out more?

If you have questions about the project or want to exercise your rights, contact:

Maryam Sadat Amini: by email: (238831@usn.no) or by telephone: +47 93 97 27 16.

Somayeh Ahmadian: by email: (238827@usn.no) or by telephone: +47 97 30 82 17.

Veralia Gabriela Sanchez (Supervisor): by email: (veralia.g.sanchez@usn.no) or by telephone: +47 35 57 53 61.

- Data Protection Services, by email: (personverntjenester@sikt.no) or by telephone: +47 53 21 15 00.

Yours sincerely,

| Project Leader | Students |
| --- | --- |
| Veralia Gabriela Sanchez | Maryam Sadat Amini |
| | Somayeh Ahmadian |

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Consent form

I have received and understood information about the project and have been allowed to ask questions.

- I give consent to participate in the interview.

I give consent for my personal data to be processed until the end date of the project, approx. June 2022

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(Signed by participant, date)