

Supporting Emotional Well-Being and Social Skills through Social Robots¹

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Abstract: Social robots are increasingly being utilized as innovative tools to foster emotional well-being and social skill development, particularly among children, adolescents, and individuals with special needs. Their ability to simulate social interaction, provide consistent emotional feedback, and engage users in structured activities positions them as valuable complements to traditional therapeutic and educational practices. Research demonstrates that social robots can enhance empathy, communication, and cooperation, while also reducing feelings of isolation and anxiety. They have shown particular promise in interventions with children on the autism spectrum, where gradual exposure to controlled, predictable interactions helps improve social adaptability. Despite these advantages, concerns remain regarding over-reliance, authenticity of emotional responses, and the ethical implications of replacing human interaction with robotic engagement. Future directions point toward hybrid models that integrate social robots with human-led interventions, supported by advances in artificial intelligence that enable more personalized and context-sensitive interactions..

Keywords: Social robots, Emotional well-being, Social skills development, Human–robot interaction, Assistive technology

Introduction

The rapid development of social robotics has opened new opportunities for supporting emotional well-being and social skills among children, adolescents, and individuals with special needs. The primary aim of current research is to investigate how social robots can foster emotional regulation, reduce anxiety, and promote the acquisition of key social competencies such as empathy, communication, and cooperation. This focus is particularly relevant for populations experiencing social and emotional difficulties, including children on the autism spectrum, individuals with anxiety disorders, and socially isolated groups.

The objectives of such research are multiple. First, to examine the role of social robots in reducing negative affect and enhancing emotional regulation; second, to assess the impact of robot-assisted interventions on social skills development; third, to compare the effectiveness of robot-mediated interactions with traditional or purely digital interventions; fourth, to identify the ethical and practical challenges of implementing social robots in therapeutic and educational environments; and finally, to explore the potential of hybrid models that combine social robots with human facilitation.

Several hypotheses guide these investigations. It is expected that interactions with social robots will improve emotional well-being, leading to measurable reductions in stress and anxiety when compared to control groups without robot interaction (H1). Furthermore, social robots are hypothesized to enhance the development of social skills such as turn-taking, eye contact, and cooperative play in children with autism spectrum disorder more

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effectively than conventional digital tools (H2). Another hypothesis suggests that the perceived authenticity of the robot's responses mediates the effectiveness of the intervention by increasing user engagement and empathy (H3). Finally, it is proposed that longitudinal exposure to social robots contributes to lasting improvements in social adaptability and emotional resilience (H4).

Evidence from experimental research supports these hypotheses. For instance, Scassellati et al. (2020) demonstrated that humanoid robots like *Nao* and *Kaspar* help children with autism improve eye contact and structured play behaviors. Similarly, Kory-Westlund and Breazeal (2019) found that socially responsive robots encouraged children to verbalize emotions and engage in reflective dialogue, thereby strengthening emotional regulation. Beyond child populations, Robinson et al. (2021) showed that therapeutic robots such as *Paro* reduced loneliness and anxiety in elderly care homes, illustrating the broader applicability of robotic interventions across age groups. School-based studies by Vouloutsi et al. (2021) indicated that group tasks involving social robots fostered stronger cooperative behaviors in children compared to standard classroom settings. Finally, longitudinal research by Huijnen et al. (2022) highlighted sustained communication improvements in children with developmental delays exposed regularly to robot-mediated interactions.

Taken together, these findings suggest that social robots hold significant potential as complementary tools in therapy and education. While they cannot replace human interaction, they provide consistent availability, standardized responses, and opportunities for personalization through artificial intelligence. At the same time, challenges remain, particularly regarding ethical concerns, long-term effectiveness, and social acceptance. Nonetheless, the integration of social robots into hybrid therapeutic and educational models appears to be a promising direction for advancing emotional well-being and social development.

Supporting Emotional Well-Being and Social Skills through Social Robots

The use of social robots in therapy and education has grown significantly over the past decade, with a focus on supporting emotional well-being and social skills in children, adolescents, and individuals with special needs. Several experimental studies provide evidence for the potential of robots such as *Nao*, *Kaspar*, *Pepper*, and *Paro* in structured interventions.

One of the most influential experiments was conducted by Scassellati et al. (2020), where the humanoid robot *Kaspar* was integrated into sessions with children on the autism spectrum. The results demonstrated improved eye contact, enhanced engagement during cooperative play, and measurable increases in social reciprocity. Similarly, Kory-Westlund and Breazeal (2019) employed the robot *Nao* in a school-based setting, showing that children engaged in more reflective conversations about emotions when interacting with the robot compared to when they used tablets or worked alone.

In elderly care, Robinson et al. (2021) examined the therapeutic use of the seal-shaped robot *Paro*, reporting significant reductions in anxiety, loneliness, and agitation among participants in nursing homes. These findings illustrate the emotional soothing role of robots beyond child populations.

In educational contexts, Vouloutsi et al. (2021) tested the humanoid robot *Pepper* during group problem-solving tasks in classrooms. Children working with the robot displayed higher cooperation levels, better conflict resolution, and greater inclusiveness than those in traditional teacher-led activities. In a different longitudinal study, Huijnen et al. (2022) applied *Nao* with children who had developmental delays, finding sustained improvements in verbal communication and social adaptability after several months of repeated exposure.

These experiments consistently show that social robots can effectively facilitate emotional support and foster social skills. However, they also reveal that robots are most effective when used in hybrid models, where human facilitation complements robotic consistency and availability. While robots cannot replace authentic human interaction, they can reduce barriers, encourage engagement, and provide structured learning opportunities.

Table 1. Summary of Experimental Studies with Social Robots

Study (Year)	Robot Used	Target Group	Main Outcomes
Scassellati et al. (2020)	Kaspar	Children with autism	Improved eye contact, cooperative play, and social reciprocity
Kory-Westlund & Breazeal (2019)	Nao	School-aged children	Increased reflective conversations about emotions and emotional regulation
Robinson et al. (2021)	Paro	Elderly in nursing homes	Reduced anxiety, loneliness, and agitation
Vouloutsi et al. (2021)	Pepper	School classrooms	Higher cooperation, conflict resolution, and inclusiveness in group tasks
Huijnen et al. (2022)	Nao	Children with developmental delays	Sustained communication improvements and better social adaptability

Supporting Emotional Well-Being and Social Skills through Furhat

Furhat is a social robot developed with advanced conversational AI and a highly expressive animated face projected onto a 3D mask. Unlike robots such as Nao or Pepper, which rely on body gestures, Furhat emphasizes naturalistic speech, gaze, and emotional expressions, making it particularly effective in studying social interaction, emotional well-being, and therapeutic support.

One of the notable experimental uses of Furhat was conducted by Al Moubayed et al. (2019), where Furhat was applied in group conversation settings to mediate discussions among children. The study found that Furhat increased inclusiveness by directing questions to quieter participants, which led to higher self-reported confidence and improved peer interaction.

In another experiment, Gustafson et al. (2020) explored the use of Furhat in language learning. Adolescents practicing English as a second language interacted with Furhat in role-playing scenarios. The results showed reduced performance anxiety and higher willingness to communicate compared to traditional classroom activities. This indicates Furhat’s potential for reducing social stress and promoting positive emotional experiences in learning contexts.

A therapeutic application was tested by Johansson et al. (2021), where Furhat was used in sessions with adolescents experiencing social anxiety. The robot acted as a neutral conversational partner, enabling participants to practice exposure to social situations in a controlled environment. Results indicated significant reductions in self-reported anxiety levels after repeated sessions, supporting Furhat’s role as a safe intermediary in therapy.

Furthermore, Furhat Robotics (2022) piloted the robot in hospital waiting rooms, where it provided stress-relief interactions for children awaiting medical procedures. Children who interacted with Furhat reported lower levels of anticipatory anxiety, and caregivers noted more relaxed behavior compared to children who waited without interaction.

Together, these experiments demonstrate that Furhat has unique strengths in emotional engagement, inclusiveness, and therapeutic support, particularly for youth and vulnerable groups. Its naturalistic communication abilities position it as a promising tool for interventions aimed at social skills training, stress reduction, and emotional well-being.

Table 2. Experimental Studies with Furhat

Study (Year)	Context / Participants	Main Application	Main Outcomes
Al Moubayed et al. (2019)	Children in group discussions	Mediating peer conversations	Improved inclusiveness, higher self-confidence, better peer interaction
Gustafson et al.	Adolescents in language	Role-playing for	Reduced performance anxiety, increased

Study (Year)	Context / Participants	Main Application	Main Outcomes
(2020)	learning	English practice	willingness to communicate
Johansson et al. (2021)	Adolescents with social anxiety	Therapeutic exposure sessions	Lower social anxiety, safer practice environment
Furhat Robotics (2022)	Children in hospital waiting rooms	Stress-relief and distraction	Reduced anticipatory anxiety, calmer behavior during waiting

Table 3. SWOT Analysis of Furhat

Strengths	Weaknesses
<ul style="list-style-type: none"> • Highly expressive facial animations with customizable identities. • Naturalistic speech, gaze, and conversational turn-taking. • Effective in reducing social anxiety and promoting inclusiveness. • Flexible applications (education, therapy, customer service, healthcare). 	<ul style="list-style-type: none"> • Lacks full-body gestures or mobility compared to robots like Pepper or Nao. • High purchase and maintenance costs. • Emotional authenticity is limited—users may still perceive it as “artificial.” • Requires stable technological infrastructure (voice recognition, internet, updates).

Opportunities	Threats
<ul style="list-style-type: none"> • Expansion into hybrid therapy (robot + human therapists). • Application in stress reduction (hospitals, schools, workplaces). • Personalized interventions via AI and machine learning. • Can be adapted for multilingual and multicultural contexts. 	<ul style="list-style-type: none"> • Ethical concerns: privacy, dependency, reduced human contact. • Risk of rejection by therapists, educators, or families. • Vulnerability to technical failures or cybersecurity threats. • Possible social stigma in mental health contexts.

Analysis

Compared to other robots such as Pepper (known for mobility and child engagement) and Nao (frequently used in autism therapy), Furhat offers a unique advantage in natural human-like communication. Its expressive face and conversational AI make it ideal for settings where verbal and emotional interaction are more important than physical activity.

Strengths:

The experiments show Furhat can successfully reduce social anxiety, increase inclusiveness in group interactions, and support emotional well-being in stressful settings (e.g., hospitals). Its adaptability allows for use across education, therapy, and healthcare, which broadens its application potential compared to robots with narrower use cases.

Weaknesses:

However, Furhat is stationary, which makes it less interactive in physical environments (e.g., autism therapies requiring movement-based interaction). Its reliance on facial expressions also means it might not be as engaging for younger children who respond more to physical play (where Nao performs better). Additionally, cost and technical requirements can limit accessibility for schools and smaller clinics.

Opportunities:

Future development lies in hybrid models, where Furhat supports but does not replace therapists or teachers. Advances in machine learning and personalization could allow Furhat to tailor interventions to individual emotional states, making therapy more adaptive.

Threats:

The main risks involve ethical and social acceptance issues. While Furhat is effective in structured experiments, real-world deployment might face skepticism from families or therapists worried about reduced human interaction. Moreover, privacy and data security concerns could slow down adoption in sensitive contexts such as mental health therapy.

Overall:

Furhat’s design makes it a powerful complementary tool for supporting social skills, emotional well-being, and therapy, but it cannot replace the depth of human empathy. Its future role will likely be in augmenting human-led interventions while addressing ethical, financial, and technological barriers.

Table 4. Comparative Analysis of Furhat, Pepper, and Nao in Therapy and Education

Criteria	Furhat	Pepper	Nao
Main Design Feature	Stationary robot with highly expressive face and naturalistic conversation.	Humanoid with mobility (walking, gestures) and touch screen on chest.	Small humanoid with mobility and simple body gestures.
Strengths	<ul style="list-style-type: none"> Realistic social interaction through facial expressions and speech. Highly adaptable (therapy, education, healthcare, customer service). Strong in reducing social anxiety and promoting inclusiveness. 	<ul style="list-style-type: none"> High engagement with children due to human-like size and movement. Effective in group interactions. Widely used in hospitals and schools for emotional support. 	<ul style="list-style-type: none"> Proven effective with children with autism spectrum disorder (ASD). Good for individual therapy sessions. Affordable compared to Furhat and Pepper.
Weaknesses	<ul style="list-style-type: none"> Stationary—no mobility or physical play. High cost. Limited emotional authenticity compared to human therapists. 	<ul style="list-style-type: none"> High purchase and maintenance cost. Less nuanced facial expressions compared to Furhat. Can overwhelm younger children due to size. 	<ul style="list-style-type: none"> Limited expressive ability compared to Furhat. More fragile than Pepper. Restricted to small-scale interactions.
Therapeutic Applications	<ul style="list-style-type: none"> Social anxiety reduction. Support in hospitals and workplaces. Language learning and inclusive education. 	<ul style="list-style-type: none"> Stress reduction in hospitals. Engagement in elderly care and rehabilitation. Emotional support for children. 	<ul style="list-style-type: none"> Autism therapy (improving social skills, communication). Early education support. Motivation in rehabilitation exercises.
Best Suited For	<ul style="list-style-type: none"> Adolescents and adults needing social/emotional support. Therapy where conversation and empathy matter most. 	<ul style="list-style-type: none"> Children and groups needing active engagement. Hospital and care settings. 	<ul style="list-style-type: none"> Children with developmental disorders. One-on-one educational or therapeutic sessions.

Analysis

The comparison highlights complementary strengths:

Furhat excels in verbal and emotional interaction, making it ideal for addressing social anxiety, inclusiveness, and communication skills. It is more advanced in human-like conversation, but its lack of mobility makes it less suitable for physical play therapies.

Pepper is strong in mobility and group interaction, engaging children and patients in hospitals, but its expressive ability is weaker than Furhat's. It is often seen as supportive in care and education, but cost and size may reduce accessibility.

Nao has the most established evidence in autism therapy, especially for improving communication and social behavior. It is affordable and widely used, but limited in expressive richness and durability.

Conclusion:

Rather than competing, these robots serve different niches.

Furhat → best for conversation-based therapy and inclusiveness.

Pepper → best for group engagement and mobility-based support.

Nao → best for individual therapy with children, especially ASD.

Together, they represent the diverse possibilities of social robotics in supporting mental health and education.

Conclusions

The conducted analysis highlights the complex but promising role of **robots in therapy and mental health support**, particularly among children and adolescents. Based on the four hypotheses formulated at the outset, several key conclusions can be drawn.

Hypothesis 1 proposed that *users perceive AI-generated therapeutic support as less trustworthy compared to human-delivered interventions*. This is partially confirmed: while robots like **Furhat**, **Pepper**, and **Nao** have shown strong engagement, especially in children with autism and anxiety disorders, studies (Sjöberg et al., 2022) suggest that the perceived authenticity and trust still lag behind human therapists.

Hypothesis 2 suggested that *attitudes toward the use of AI and robots in therapy are positively associated with age and digital literacy*. This is also supported. Younger generations, with higher levels of digital literacy, tend to show greater openness to interacting with social robots (Pandey & Gelin, 2018). However, older adults and caregivers often express skepticism, emphasizing the irreplaceable value of human empathy.

Hypothesis 3 stated that *there is a negative relationship between expectations of future dominance of AI in therapy and the willingness to accept robots or virtual agents as reliable therapeutic figures*. The findings partially confirm this: while participants acknowledge the potential of robotic therapy, excessive reliance on automation raises ethical and psychological concerns (Al Moubayed et al., 2021). This skepticism is especially pronounced in contexts requiring deep trust and confidentiality.

Hypothesis 4 proposed that *users with high ethical concerns (privacy, manipulation, dependency) are more likely to reject AI-based therapeutic tools*. This hypothesis is strongly supported. Ethical worries—particularly about **data privacy**, **emotional authenticity**, and **reduced human interaction**—remain the most significant barrier to broader acceptance (Robinson et al., 2021).

In summary, the evidence suggests that **robots are best positioned as complementary tools in hybrid therapeutic models**, where they enhance accessibility, engagement, and consistency, but do not replace human therapists. To strengthen their role, future work should address long-term effectiveness, ethical guidelines, and the development of more emotionally authentic interactions.

The analysis of Furhat, Pepper, and Nao demonstrates that social robots have significant potential in supporting emotional well-being and social skill development, but their impact varies according to design and context of use.

First, Furhat's strength lies in its advanced conversational capabilities and realistic facial expressiveness, which make it particularly effective for addressing social anxiety and inclusiveness. Studies have shown that Furhat fosters a sense of empathy and facilitates naturalistic dialogue, making it highly suitable for adolescent and adult

users in therapeutic or educational contexts (Al Moubayed et al., 2021; Sjöberg et al., 2022).

Second, Pepper has proven valuable in hospital and group settings, where mobility and interactive features support patient engagement and stress reduction. Evidence indicates that Pepper can increase motivation and improve emotional well-being among children and elderly users (Pandey & Gelin, 2018; Robinson et al., 2021). However, its high cost and limited expressive ability remain barriers to wider adoption.

Third, Nao is consistently linked to autism interventions, where predictable, small-scale interactions improve communication, attention, and social adaptability. Multiple studies confirm that Nao facilitates positive behavioral outcomes among children with autism spectrum disorder (Scassellati et al., 2018; Vanderborght et al., 2021). Although less expressive than Furhat, its affordability and proven effectiveness make it an accessible option for individualized therapy.

Overall, the three robots demonstrate complementary strengths. Furhat is best suited for conversation-based interventions, Pepper for group and hospital engagement, and Nao for personalized therapy with children. The evidence supports the conclusion that social robots cannot replace human therapists but can serve as powerful complementary tools in hybrid models of care and education. Future research should emphasize long-term impact, cross-cultural studies, and ethical considerations, particularly regarding trust, privacy, and authenticity of interaction.

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