

IMPLICATIONS OF USING ARTIFICIAL INTELLIGENCE TECHNIQUES TO ENHANCE A CHILD'S SOCIAL SKILLS

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ABSTRACT

Social skills are critical for a child's development as they are fundamental for building relationships and succeeding academically and professionally. In comparison to the academic spheres of reading, language, and mathematics, these skills are just as valuable. However, children, particularly those with autism spectrum disorders (ASD) and social communication disorders, struggle with appropriate social behavior. With advancements in artificial intelligence (AI), such as natural language processing and computer vision, there are new ways to enhance social interactions for children. AI technologies can enable children to receive feedback in real time, engage them with social scenarios, and encourage social play through developmentally appropriate methods. There are, however, ethical, educational, and psychological concerns, such as data privacy, the implications of AI on child development, and the nature of interaction between machines and children. My goal in this study is to analyze how AI can be effectively utilized for the promotion of social skills in childhood, current applications and interventions, and point out gaps for future research. This research aims to draw attention not only to the existing models but also to the innovative approaches in order to highlight the potential of AI in transforming children's development when used responsibly.

Keywords: *Social skill, Childhood, Artificial Intelligence, Social Interactions, School Performance*

1. INTRODUCTION

Living in a society that is progressively incorporating and competently reproducing technology essentially exposes humans to the changing lifestyle. Children, the future recipients of this lifestyle, are now growing up with smartphones and devices from a young age. Televisions and gaming consoles are main members of households and the use of the Internet for everyday entertainments and acquiring knowledge seems to be taken for granted (O. Bailey et al., 2021). This is leading to a decrease in casual social interactions among children, with those who require "advanced" social communication skills being more prone to the consequences of this deprivation (Winston, 2022; otar et al, 2022). The social layers depicted in Fig. 1 have very precise dimensions, with a scaling ratio near 3. That is, each layer is three times the size of the layer immediately inside it. It is worth pointing out that these layers are not confined to friends in the conventional sense. Indeed, the innermost layers contain more family members than friends. But as we move outward, we find ourselves mixing with more and more friends and family of our friends.

Indeed, the outermost layer consists mainly of people we know only in passing (Bzdok & Dunbar, 2022). Artificial Intelligence (AI) could potentially cause disruption in the field of social skills development by replicating the real-life scenarios in a thorough and comprising way. The research is thus conducted to analyze and showcase the assortment of AI methods that have been used to enhance child's social skills.

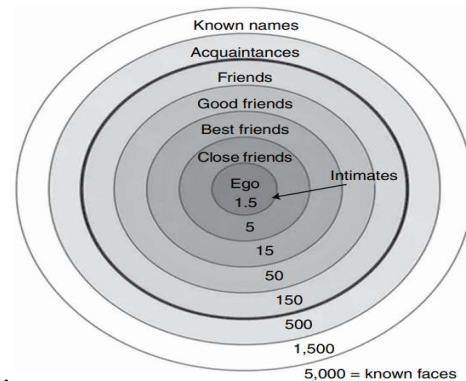


Fig. 1 The structure of the human social world (Bzdok & Dunbar, 2022)

The motivation for embarking on the research lies in the apprehension of a transformative period that is shaping the way children develop and mature, due to the societal domino-effect triggered by the integration of technology in their lives. This is augmented by the conviction that lessons in a child's formative years position the orbit of the rest of their life. Therefore, the pressing necessity to find innovative and possibly more catching ways to develop social skills in children, with some counteracting effort towards socio-economic imbalance, is apparent (Frohn, 2021)(Lopes et al.2021) (Hammadi, Mohadat, & Alawamreh, 2024). This effort can be encouraged by considering the imparting of knowledge and a more comprehensive explanation of the accessibility of previous research conducted already in the field (Hammadi et al., 2021). Hence, this study is embarked and carried with the assumption that the richer and more informative the basis, the more prospectively influential this development can be. The aims are hence to provide a comprehensive insight with regards to employment of AI to enrich child's social skills and reflect upon the accessibility and potential accessibility of elucidation on such exploitation.

Conversing involves a complex interplay between producing and understanding language, planning one's own utterances while closely monitoring the dialogue, and then decoding one's interlocutor's responses. In order to efficiently engage in social communications, children must be proficient in these and many other mental processes. Growing evidence indicates that children with autism or social, emotional, and mental health difficulties show marked deficiencies in their social skills – the abilities to socialize, recognize, interpret, and express feelings, and communicate constructively with one's peers. ECHOES was initially designed for kids aged 4–7 years. ECHOES is a single-user tech-enhanced learning environment that employs an AI virtual character, called Andy, as a social partner for kids with ASC and their TD peers. ECHOES is an ongoing series of studies some of the first of their kind with children that assess a new learning paradigm. Fig. 2 illustrates the ECHOES study procedure, detailing the pre-/post-testing and main intervention along with specific timing for each (Bernardini and Porayska-Pomsta 2013). (Porayska-Pomsta et al., 2018) (muala et al, 2024).

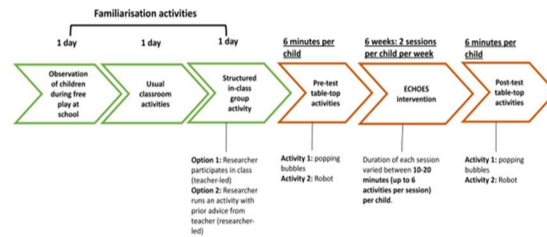


Fig. 2 ECHOES study procedure (Porayska-Pomsta et al., 2018).

Social skills play a crucial role in almost every sphere of growing up: They enable children to form assertive relationships with their peers, while also empowering them to make their wishes, feelings, and opinions understood (Dowd & Green, 2022; Özerk et al.2021; Paz et al.2021;Phillips, 2021;Zamata et al., 2023). Children with these skills are more likely to avoid resorting to disruptive behaviours when aggravated. Additionally, the moral support that comes from possessing social skills better fosters one's psychological integrity (Dowd & Green, 2022; Algan et al.2022; Levantini et al.2023; Champion, 2024). If such vital abilities are deficient in a child, their possibilities of excelling at school, finding gainful employment in later years, or forming gratifying social relationships as an adult become significantly impeded.

Working out how best to promote social skills in students has become an issue of considerable public concern for educators and families alike. For the child who frequently finds interpreting or responding to speech a baffling task, school life is anything but straightforward. He or she might be unable to keep pace with the argument; continuously miss the gist of lectures; find carrying out practical work problematic; understand oral or written instructions awkward; or simply struggle to talk about everyday experiences and express opinions logically (Su & Yang, 2023; DeLaina et al., 2021; Luo et al.2024; Javaid et al.2023; Alawamreh et al, 2023; Qureshi et al.2022). Consequently, the scholastic progress of children who experience these problems might be seriously hampered, with the predictable consequence of persistent academic underachievement that detrimentally influences all aspects of the child's life. Unfortunately, the simplicity with which the preceding goals are accomplished by most children deludes educators into overlooking the elaborate computational processes that arise from the interaction of speaking activities.

This study is underpinned by the assumption that AI technologies, if used responsibly,

may serve as effective instruments for enhancing and aiding the social development of children, particularly of those who find it difficult to cope with conventional pedagogical social learning frameworks. The aims of this research are focused on how AI applications can be used to construct, enact, and automatize social interactions and aid social bonding in a sociologically meaningful manner. The main hypothesis is that tools and interventions powered by AI can positively impact children's social communication skills, particularly for those with developmental difficulties. This study seeks to illuminate ways to advance technology in education by addressing these critical gaps in order to make meaningful and actionable contributions to the design of more inclusive and flexible pedagogy.

2. UNDERSTANDING SOCIAL SKILLS DEVELOPMENT IN CHILDREN

The acquisition of social skills can vary greatly from person to person. Some people are naturally social; they find it easy to make friends and communicate with others effectively (Dowd & Green, 2022). Others struggle fully understanding social cues; they have more difficulties when trying to communicate their very own feelings, fears or desires. However, the process should not be rigid and fixed. The main goal is that children develop key social elements such as smiling, eye contact, imitation, joint attention and good use of language (Çetinçelik et al., 2021; Ghorzang et al., 2021; Suvilehto et al., 2023; Ezeh et al., 2021; Lee & Lew-Williams, 2023). Social skills development in children is a complex process under significant individual variation. The majority admit that genetics determine a big part of social capabilities. However, the environment plays a significant role.

Many important cognitive models and mechanisms have been proposed to explain differences in the development of social skills in children (Genovese & Butler, 2023; Duncan et al.2023; Vila et al.2021). Parenting, teaching and playground behavior might foster the development of social capabilities in children. In this context it is critical to increase the understanding of how social skills develop in order to enhance socially desirable behavior and limit socially undesirable behavior. Relatively young children use a good understanding of social inferences to interpret others' behavior and to quickly judge other's actions (Gönül & Paulus, 2021; Kushnir, 2022). However, those with social skills deficiencies can experience long-lasting impairments and social isolation through their lifetimes. Modern society may have adapted to help

them better integrate in an ever so complex social world. A brief overview of the development of social skills and social skills deficiencies in children is made. A framework is proposed to shed light on how some techniques may benefit the development of social skills and support socially undesirable behavior in children. Finally, some aspirations for future research are granted.

Social skills development in children is a crucial aspect of their overall growth, encompassing abilities such as communication, empathy, and cooperation that are essential for effective interaction with peers and adults. In addition, it encompasses the ability to communicate effectively, establish relationships, and navigate social situations, all of which are critical for their overall emotional and psychological growth (Alawamreh et al., 2023; Genovese & Butler, 2023).

The ability to navigate the complex social world is a critical psycho-social skill that predicts future academic and personal success. This is a growing concern since loneliness is on the rise in younger ages, children are being diagnosed with problematic use of the internet and video games, a risk factor for online harassment, and for the first time in history, the younger generations are being diagnosed with mental health problems (O. Bailey et al., 2021; Alawamreh & Elias, 2016). The development of social skills not only facilitates but also modifies how children interact with their social environment. In addition, there is evidence of a strong bidirectional relationship between child-parent social interactions and child characteristics. For example, quality of parent elicited-imitation is associated with the child's vocabulary growth, even when controlling for the child's initial vocabulary size, and characteristics such as children's attentional control have been found to predict leadership covariation during peer interactions in a classroom setting. This points to the significant role that social skills play in shaping social environments and to their role as a mediator of other child characteristics in determining consequential outcomes.

Social awareness includes the abilities to take the perspective of others, understand social and ethical norms, and recognize the social/cultural characteristics of the setting in which one is functioning (Mitsea et al.2021; Valladares, 2021). Social awareness is critical for successful social interactions that depend on social adaptation and sensitivity to align one's behavior with the environment, as about 18% of U.S. teens experience

social difficulties that require intervention. The connection between social awareness and anxiety mirrors that between social cognition and anxiety (Branje & Morris, 2021; Bauer et al.2021; Qawaqneh et al., 2023). For example, individuals suffering from social anxiety exhibit deficits in recognizing and interpreting facial displays of emotion and experience difficulties while taking the perspective of others.

The association between social anxiety and social-cognitive factors informs both our understanding of the disorder and the development of effective intervention. Quantifying social-cognitive constructs, however, is challenging due to the intricate nature of human social interactions, which can be interpreted through various complex cues and intricacies of communication, most of them non-modal (Moscovitch et al.2023; Halldorsson et al.2023). Non-verbal cues, such as facial expressions, body posture and mimics, account for the majority of intention, affect and meaning contained in the exchange of messages in face-to-face communication, and have been linked to social understanding and the ability to take the perspective of others. The understanding of the direction and timing patterns that underly non-verbal behavior is called behavior synchrony and serves to align and regulate the “dance” of interactive partners, facilitating the sharing of mental states and propitiating the developmental understanding of symmetrical and reciprocal interaction.

3. ARTIFICIAL INTELLIGENCE APPLICATIONS IN ENHANCING SOCIAL SKILLS

The techniques of Artificial Intelligence (AI) can be grouped into three basic categories: rule-based systems, machine learning, and deep learning. A rule-based system works on the basis of fixed rules set by experts. The system makes decisions based on logical statements, which is good for structured situations but may not be flexible enough for the kind of dynamic interactions children have with one another and with adults. In general Table1 summarize the Types of Artificial Intelligence Techniques. Conversely, Orvell stated that on the other side of the spectrum, let us consider rule-based systems, which are AI educational tools that give constant, yet rigid feedback to not-so-smart kids. Some might argue that these systems give consistent feedback, akin to how teachers in some classrooms depend on giving kids rules to follow. Yet, in the same way that social skill development between kids doesn't follow a fixed, rule-oriented path, neither should AI-assisted educational tools. Rigid, rule-oriented systems give feedback that does not consider the personal emotional details known only to a teacher and his or her students, which is necessary for the kind of social interaction that leads to smart kids. Also consider that AIs might have languages as their first languages (such as English) and humans' second. Yet AIs have no emotions. If the child is not family or child welfare service, a teacher has no business with 'social skill' development. The brain is the final frontier.

Table1 Types of Artificial Intelligence Techniques.

Technique	Description	Application in Social Skills	Example Tools
Supervised Learning	A type of machine learning where models are trained on labeled data.	Used to recognize patterns in children's interactions and tailor social skill development programs.	Support Vector Machines, Neural Networks
Unsupervised Learning	A type of machine learning that identifies patterns in unlabeled data.	Analyzes children's behavior to identify social interaction improvement areas without pre-defined outcomes.	K-Means Clustering, Hierarchical Clustering
Reinforcement Learning	Learning method where agents take actions in an environment to maximize cumulative reward.	Helps children learn appropriate social behaviors through interactive simulations that reward positive interactions.	Q-Learning, Deep Q-Networks
Natural Language Processing	Branch of AI focused on the interaction between computers and humans through natural language.	Facilitates communication skills development by providing feedback on children's conversational abilities.	Chatbots, Speech Recognition Systems

Computer Vision	Enables computers to interpret and make decisions based on visual data.	Analyzes facial expressions and body language to improve understanding of non-verbal cues.	Facial Recognition Software, Object Detection Systems
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Researchers and educators have devised and implemented various educational tools that use artificial intelligence to help children gain these necessary social skills. A VR system allows children to practice activities in a virtual classroom in partnership with a “mixed-reality” co-teacher. A conversational agent asks a child a series of questions and observes their responses, against a set of criteria intended to identify post-traumatic stress disorder (Han et al.2024; Laban et al., 2022; aljawarneh et al, 2022). An AI system helps children write a story in a shared activity format through a series of alternating turns (Zhang et al.2022; Liu et al., 2022; Lee et al.2022). Various learning apps send friendly chatbots to the home to remind children to follow their lessons, take regular breaks, or encourage them with positive expressions. A step-worn fitness tracker and an associated app motivate children to be active through a virtual pet. Some implementations employ a group of AI-based educational tools (Guarcello & Longo, 2024; Marr, 2024). Real-time classroom presentations are automatically adjusted to individual students who keep their attention and promote non-verbal social engagement using a non-intrusive system.

Two commercially available educational AI tools, which are each specifically designed for use by one child at a time, can automatically detect a range of visual emotional cues as well as subtle facial expressions. Additionally, there exists a significant number of mobile learning applications that utilize a device’s microphone, camera, or accelerometer in smartphones and tablets, which help facilitate the understanding and practice of nuanced social cues during shared activities that involve interaction between children and their parents or co-learners (Vistorte et al.2024; Pabba & Kumar, 2022; Yu et al., 2024). Furthermore, there are numerous platforms that actively support the creation and sharing of educational AI tools designed for children to be used within the home environment.

These tools can take the form of playful conversational chatbots, innovative vocabulary and sentence construction learning applications, or even reminders for book reading sessions to encourage literacy and engagement (Fitria, 2021; Barua et al.2022; Su & Yang, 2022; Su et al., 2023).

Workshops and tutorials are frequently organized with the objective to empower parents in creating and modifying these advanced educational AI tools tailored for their children. Mastering social skills is essential for establishing effective and meaningful relationships with others, particularly among children and their family members. The intelligent AI assistant offers a variety of online tools that can be collaboratively built with him, which can then be seamlessly integrated into daily life routines to promote the development of a child’s social skills. At the same time, it is crucial to maintain an appreciation for the delicate balance required to avoid overloading or creating an over-reliance on technology, while also being mindful of the privacy concerns that are sensitive to the majority of parents today.

Educational technology innovations leveraging artificial intelligence have expanded rapidly. In the context of enhancing a child’s social skills, there is great promise for the role of AI in educational technology (Vairamani, 2024; Fikri & Rhalma2024; Zhang, 2023; Obeidat, 2022;Devi et al.2022). Building conversational agents, using natural language processing techniques, that provide real-time guidance and active learning in social settings is one potential technological approach to improve the social skills of children. However, just as there are many practical and ethical issues to consider when building AI, conversational systems in general and for community, these considerations are especially important when designing systems for children. This section aims to frame a conversation on how to be intentional in the choices made about the AI algorithms under development for this community, such that it concerns both personal safety as well as more widely shared equitable educational access.

In recent years millions of dollars have been invested in using AI to understand language and human-to-machine contact to build community system products and patents (Gunkel, 2024; Kislev, 2022; Zawish et al.2024; Stone et al.2022). The community application of this conversation was introduced in a context of a growing exposure of students. In the US, the number of devices owned by students in grades 2-12 that give them access to a community system is rising approximately 5-10%

each year (Christensen & Eaton, 2022; Stefanovic & Klochkova, 2021; Soenarto et al.2023; Setiyanti et al., 2022). Considering that this technology is becoming increasingly prevalent, caution is required. There is potential for collaboration with creatives, cutting edge technology professionals, creative individuals, and other industries or geographies that may pose risks to security, privacy, or create a negative impact. There is a persistent need for careful construction, and scrutiny of the conversation database used.

4. METHODOLOGY

This study utilizes a qualitative literature review approach. It focuses on the application of Artificial Intelligence (AI) in improving the social skills of children, reviewing relevant peer-reviewed scholarly work and empirical literature for its systematic study. Scopus, PubMed, IEEE Xplore, and Google Scholar were used to search for appropriate literature from the past 15 years. The documents were selected if they pertained to developments in learning about AI applications in education, therapies for students with Autism Spectrum Disorders (ASD), and social-emotional learning. Emphasis was placed on intervention studies employing computer vision, natural language processing, machine learning, and AI-driven virtual characters or social robots. The organization of the review was around the types of AI tools identified, the population of interest, measures of efficacy, and the effectiveness as reported in the literature. The selected studies were critiqued with the analysis of the limitations and ethical implications of the studies so as to evaluate the practical usefulness and breadth of future research possibilities.

5. ETHICAL CONSIDERATIONS IN AI-ASSISTED SOCIAL SKILLS DEVELOPMENT

Research considers pedagogical, social, ethical, and technical considerations necessary for building ethical datasets for children's conversational agents (Bailey et al., 2021; Chubb et al.2022;Kurian, 2023;Missaouib et al.2021). Moreover, it described the creation and ethical considerations of a dataset of child emotional displays in the context of virtual robot-led emotion recognition training. Artificial intelligence (AI) tools offer interactive and adaptive methods for assisting children's learning processes. This is also the case regarding social skills training. Empirical research has shown that it is possible to enhance social skills in children with autism spectrum disorders (ASD)

through robot-assisted interventions (Rasouli et al.2022;Holeva et al.2024;Bartl-Pokorny et al.2021;Conti et al.2021;Alawamreh & Elias, 2015). One of the key factors of the success of the robot-assisted intervention seems to be the ecological validity of the task; therefore, it is important to train social skills in a naturalistic setting such as classrooms. However, a robot is not always available in naturalistic settings. Indeed, most of the current robot-assisted interventions take place in laboratory settings, which might not always represent the everyday environments of children. For this reason, research has been exploring the use of other AI, non-physical tools, such as intelligent tutoring systems and virtual learning environments to assist the child's learning process in his naturalistic environment. These tools also allow large-scale data collection for further analysis of the learning and socialization processes of children with or without disabilities. However, the use of these tools raises several privacy concerns that require special attention. In this regard, the present paper examines the potential legal and ethical challenges that may arise from the use of AI in the social skills training of children, with a focus on children with ASD. In addition, the analysis seeks to investigate a series of open-ended questions regarding legal, ethical, and data protection implications raised by a hypothetical case scenario of such a social skills training system. The discussion highlights the importance of early dialogue on the introduction of technologies in order to build appropriate and effective implementation strategies.

There is an increased responsibility on the part of developers, educators, and all individuals and organizations involved in the lifecycle of AI tools to ensure the infrastructure is built with sensitivity and care (Charow et al.2021;Schiff2022;Alam2023). There is a litany of different ethical areas that AI practitioners must consider, from the bias embedded within an AI algorithm simply because it learns from people and their data, to the devastating real-world impacts of misrepresentation of social cues to a law enforcement or health system. Product development and deployment result in the collection and use of vast quantities of personal data, an area that, ethically, raises a host of concerns around consent, surveillance, and privacy (Alhatmi, et al2024) Agreement is needed between the child's family and the technology provider to allow certain data uses. The guardian's awareness of what data will be used to power an AI tool, what developed models will receive the data, and the implications of model use are of utmost importance (Law et al.2021). Furthermore, privacy settings and data security

measures to protect the transmitted information need to be rigorously safeguarded. And, importantly, model development, because of the need of large amounts of user data, may hold risks of exploitation of very sensitive information. Finally, the social and emotional impacts of children or a society that depends on technology for communication and socialization must be treated ethically. The deployment of AI models in clinical and public health settings must be done carefully and ethically, with informed consent and the option to revoke that consent at any time. Dependency is that this is reinforcing current socioeconomic disparities and preventing the reduction of stigma associated with social interaction. Embedding and enforcement of these and other challenged ethical considerations that resulted from this work should help define best practices for the deployment and development of a socially driven AI in educational environments, and hasten the progress towards a wide-spread trust in and ethical deployment of these tools.

In the eagerness to use Artificial Intelligence techniques for the improvement of a child's social skills, it is important to apprehend the privacy and data security concerns of those technologies. With the procurement of smart home devices and the utilization of AI applications, diverse data such as textual conversation, audio, images, facial expressions, and physiological data are automatically collected. With the uptake of AI technologies, these applications are incessantly learning and improving adaptively. But it outlines the ways the data can lead to potential data security risks, including unauthorized access of sensitive data, data breaches from built-in vulnerabilities, and the misuse or miss-choice of personal and sensitive data.

By design, children are less experienced than adults and not as alert as they should be; therefore, they are more vulnerable to being exposed to those data security risks. Consequently, managing collected data appropriately is a necessary aspect of deploying AI applications for children's development. Moreover, it analyses the implications of data security incidents and their influence on their emotional and psychological well-being. It is suggested that, in order to help prevent or mitigate the attacks, security solutions can be put into practice and their implications can be transparently communicated with their parents or guardians (O. Bailey et al., 2021). Furthermore, service providers, app developers, caregivers, parents, or data controllers are recommended to carefully consider children's data privacy and integrity. All data processing must be thought out from the beginning

and safeguarded in order to guarantee the lawful rights and safe future of children.

6. EFFECTIVENESS AND LIMITATIONS OF AI IN IMPROVING SOCIAL SKILLS

Children's social skills are put to the test at school. An academic environment is the place where children's social skills are first reviewed rigorously against society's expectations. Children's emotional well-being at school is dependent on their social skills efficiency (Li et al., 2024). In fact, emotional well-being is much more dependent on social skills than academic success. School is where children develop their social skills; therefore, school is accountable for how individuals' social skills grow. That makes it important to identify children's social skills problems as early as possible in their academic life. The earlier the intervention, the easier the development toward better social functioning. While social skills are also shared in interactions with family, the school has a different environment and is primarily responsible to teach children about the rules of this different environment. Also, the authority aspect of the situation, teacher, otherwise kind of equal relationship with family, makes school have a more direct influence on social skills development. Understanding basic social rules at school environment is crucial for fitting in and protecting children from being alienated, getting isolated or bullied.

Artificial intelligence (AI) is changing schools and the way general subjects are being studied. This also allows for new ways of teaching and for better teaching of social skills (Zhai et al.2021). Institutions and individuals who adopt AI systems are able to provide more efficient and successful teaching. AI-powered tutoring systems, chatbots, robots, and applications can provide feedback and assist in areas that teachers do not have the time for. For social skills improvement, several systems have been developed. Chatbots that can be an assistive tool for children with social anxiety have been developed. There are AI systems that improve second language social skills for students. Social Intelligence Dialogue Engine (SIDES), a virtual collaborative problem-solving environment that uses conversational agents to support collaboration and promote students' higher order reasoning, has been developed (Zhai & Wibowo, 2023). There are applications that help in the improvement of empathy, a crucial social skill. This paper aims to discuss how effective those AI-powered systems are in improving children's social skills and the question how applicable those AI systems are in a general group of children.

The effectiveness of artificial intelligence (AI) to enhance children's social skills has been supported by a range of empirical studies. (Lai et al., 2023; Xie et al. 2022; Chen et al. 2024; Zhai et al. 2021; Su et al., 2023; Yuan, 2024) One mixed method study employing AI to develop social interaction skills in autistic children indicated significant acquisition of targeted skills, supported by qualitative feedback from teachers, practitioners, and application designers. The analysis showed a significant increase in the use of diverse reactions by the children to the application as the intervention progressed. Another study assessing the impact of AI technology on the frequency and type of socialness and constructive play demonstrated significant effects for children's social behaviors with peers and social attention received from peers. Although not all social behaviors were affected significantly, a range of social improvement was identified across the sample. A within-subject, longitudinal exploration concerning the same AI environments and aiming to prompt social relatedness in two distinct groups of children, typically developing (TD) and autistic children, revealed group-based differences in the effectiveness of AI-supported interventions (Nandi et al. 2021; Harrigan et al. 2021; Sharif et al., 2022). The TD group exhibited significant improvement in terms of the measures of social relatedness, which was not observed in the group of autistic children. A study treating children after traumatic brain injury with playful AI resulted in encouraging outcomes, demonstrating promise of AI-supported interventions for the enhancement of social skills in this clinically delicate group of children.

All the studies had a small sample size (range from 4 to 25 children). In line with research on the effectiveness of traditional intervention studies, a number of demographic and individual difference variables should be taken into account (Lakens, 2022; Suprun et al. 2022; Hennink & Kaiser, 2022). It emphasizes the need to document the characteristics of the children identified as acquirers, non-acquirers, and regressors following intervention. Dosage effects on children are suggested for future research to help determine the longer-term impact of AI applications on children's socio-cognitive development. Furthermore, the scope of the research should be broadened to include hypothesis-driven studies of potential negative effects of AI-supported interventions.

7. INTEGRATION OF AI TECHNIQUES IN EDUCATIONAL SETTINGS

Educational systems lay the groundwork for the development and growth of children's social skills. Therefore, it is crucial to focus on improving and formalizing intentional interventions to help children develop positive social behaviors. Recent technological advancements offer new opportunities to develop children's social skills effectively (Øzerk et al. 2021; Zhang et al., 2022; Agustina et al. 2023; Alawamreh et al., 2023). The developments and widespread availability of artificial intelligence systems offer a vast improvement in the potential of AI-based social skills interventions as part of the education system. This section discusses the practical aspects of implementing AI-based social skills intervention in educational settings. Analyzing previously established frameworks and strategies can unveil successful approaches to effectively embed AI tools within the educational curricula to help develop children's social skills. The scalability, customization, and integration capabilities of AI tools provide enhanced possibilities to create effective interventions. However, there are critical challenges posed by educators, such as resistance to AI-driven solutions and lack of specific training. Co-designing AI tools in conjunction with all educational stakeholders is pointed out as a strategy for the successful integration of AI tools in educational settings. Several case studies successfully implementing AI tools to generate scalable positive outcomes in children's knowledge and skills are scrutinized as an exemplification of AI-enhanced educational reform. This examination can serve as a guide for future initiatives in the rapidly expanding field of educational AI, ensuring they are systematically geared to developing children's social skills.

The education system is mentioned as an advantageous ground to foster and develop children's social skills. Raising generations of individuals with well-developed social skills is considered the prime concern of educators and policymakers. The importance of social and emotional well-being by providing knowledge and skills to improve interactions, relationships, and overall mental health is emphasized. This guidance suggests that promoting children's social skills is a strategic priority in modern curricula. The development of pro-social behavior and social competencies ensures success and happiness by smoothly navigating an increasingly complex interconnected world. Social skills are not only crucial for interpersonal relationships but are also

associated with long-term well-being and health status.

Artificial intelligence (AI) is having a major impact on many areas of research. One field in which its impact is beginning to be felt is education, notably in helping to develop educational interventions to help children. This subsection considers the implications of using AI to help in the development of a child's social skills.

Enhancing education is one of the major goals AI techniques can serve for. One area in which such techniques could be used is in schools to enhance how children develop. The integration of AI tools in educational settings can both revolutionize and retain the best aspects of traditional educational practices (Barua et al.2022). For example, AI can serve to engage students in new, captivating ways yet can also offer real-time feedback essential for learning . Capitalizing on such benefits, a growing number of educational AI tools have appeared in recent years. However, this change away from face-to-face teaching could be emotive, with backlash against such systems. But these could be a proxy for an irrational fear of change.

Meeting the needs of students with diverse learning styles, age groups, and individual needs is a great challenge for educators due to resource constraints (Cabual, 2021). The considerable promise of using AI to help in this area remains largely untapped. Nevertheless, the development of novel AI methods can empower such educators, benefitting variety of use cases and settings. Moreover, potential obstacles to the widespread adoption of AI in such contexts are considered, including issues of educator readiness and wider disparities in the technology infrastructure. In conclusion, AI technologies for education will become a part of the scenario of state-of-the-art teaching in the future; it is vital to engage with such evolutions thoughtfully. To this end, the need for ongoing, effective evaluation of AI education tools with real-world use-cases is stressed.

8. FUTURE TRENDS AND DIRECTIONS IN AI FOR SOCIAL SKILLS DEVELOPMENT

Artificial intelligence (AI) applications boast an ever-growing potential to enhance social skills and social insight. Building on prevailing trends, these applications may range from targeted training games to broad-spectrum peer analysis. Various AI approaches can enhance peer collaboration and friendship in the classroom and beyond, catering to children with autism, social anxiety, or difficulty making friends. This includes classroom-wide strategies using agent-based modeling, peer-intervention strategies using

complex network analysis and virtual reality, and individualized strategies using machine learning. The efficacy and ethical implications of AI applications for social skills development in children are discussed at the frontier of science and speculation, including participatory AI and moral bioenhancement. Machine learning and artificial intelligence tools might be used to transform the way children's behaviors are analyzed at school, offering novel opportunities to improve student health and well-being. AI tools could synchronize social-behavioral observations of students and global Internet activities, offering insights and facilitating early intervention on issues such as bullying, sexual predation, self-harm, and harassment. Ethical considerations will include data safety, data privacy, unintended consequences of the AI tools, and potential harm to vulnerable youth. Pros and cons of ethically controversial questions, like interfering with Internet freedom to protect children, will be debated. Concerns of AI-induced burnout on teachers and school counselors will be likely to emerge. These concerns could be addressed via ongoing interdisciplinary research aimed at understanding the evolving needs of children raised in a digital age (Schiff, 2021). A checklist is proposed to guide the responsible implementation of AI tools in school settings, ensuring they stay relevant and effective. Such unprecedented interdisciplinary cooperation will lead innovation in analyzing children's complex behaviors at school (O. Bailey et al., 2021).

Advancements in machine learning and natural language processing have made it possible to automate the analysis of social behaviors from different modalities to a much larger scale . This new generation of social signal processing technologies can quantify the behavioral expressions that characterize the social interaction of children in a peer group. These advancements in social signal analysis bear the potential to revolutionize the design of learning experiences geared towards the acquisition of social skills inside connected classrooms.

Virtual reality (VR) and augmented reality (AR) technologies are increasingly used to provide immersive learning experiences that bridge the gap between theoretical knowledge and vocational skills. It is expected that these advanced immersive technologies can be used to realize the child's developmental first-person perspective concept learning experience, where the child is able to actively develop empathy from personally experiencing different social scenarios. This can be achieved by allowing the child to switch the view of

the scenarios between different characters or take a first-person perspective of one character. Given VR and AR require well-defined working environments, the timely development of new machine learning models can alleviate manual creation of VR/AR scenarios. Furthermore, the need for broad deployment of AR and VR technologies can be addressed by allowing VR/AR videos to be played on computer or smartphone screens using standard web browsers.

9. CONCLUSION

Artificial intelligence (AI) has the transformative potential to enhance a child's social-academic skills. AI tools, such as smart conversational agents, can provide meaningful intervention strategies for children demonstrating social-communication difficulties. These AI tools can simulate natural conversations with children in order to develop such skills. Beyond this simple conversation, the most advanced technology systems can provide effective conversational prompts that both encourage a more interactive conversation and target the development of important academic skills. However, there is a need for distinguished techniques for encouraging children to participate in these conversations more humanely, as this will ultimately enable successful development of children's social skills.

Technology has much potential as a tool to empower and support such children with the development of important social skills. Therefore, child developmental psychologists, technology experts, educators, and other stakeholders must collaborate to regulate this potential maximizing the full range of development of children facing social challenges in the school environment. Namely, it is attempted here to investigate the potential of such AI techniques and to provide their implications for the development of socialization skills in typical development as well as those with social communication needs. However, precise attention should be paid to the ethical limitations of using AI technologies for these purposes, and the principle of realism should be implemented to identify the potential challenges in the successful development of social skills found in representative technological applications of these techniques.

10. IMPLICATIONS OF THE STUDY

The results of the present study can be particularly useful in formulating educational and rehabilitative approaches directed towards enhancing social skills in children with

developmental disorders or autism spectrum disorder. With the incorporation of technologies such as natural language processing and computer vision, learning environments can be transformed into interactive exercises, allowing for real-time responsive tailored treatment that adjusts to a child's social interactions (Merrell & Gimpel, 2014). These AI-supported systems can render constant reinforcement, enact sophisticated social scenarios, and give children the chance to learn how to use language in a controlled, nurturing environment devoid of self-consciousness or criticism. It may be possible to lessen the need for social skills training to be targeted through one-on-one adult-led therapy sessions and instead introduced into children's everyday environments in a scalable and easily accessible manner, both at school and at home (Schiff, 2021).

Apart from the scope addressed in the classroom, the examination also analyzes the implications to society at large, especially in relation to the impact of technology in fostering equal access to all children regardless of their background (Qawaqneh, Ahmad, & Alawamreh, 2023). As AI technologies progress, they may aid in diminishing social gaps created by economic status, learning challenges, or inadequate access to tailored assistance. On the other hand, these advantages have to be balanced with ethical considerations of data protection, consent, and the risk of dependency on technology. The research does ask policy decision makers and educational leaders to consider a more nuanced approach that will not put waters AI applications aimed at providing solutions to educational problems. Rather, such measures ought to sustain, not supplant, human touch and nurturing in development.

11. SUMMARY OF FINDINGS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Given its broad spectrum of capabilities, artificial intelligence (AI) has gathered a considerable amount of attention from developers, engineers, and computer scientists in implementing a wide variety of applications. Besides adult individuals, numerous AI applications draw on children as potential users or beneficiaries. From this outlook and in recognizing the lack of other surveys specifically focused on children, research investigated works in which AI techniques and other related methods are utilized for children. Beginning with a literature review on social skills and their development, that portion is followed by an overview of possible applications where AI could

converge to demonstrate, facilitate, or enhance those skills. For each particular application overview, an analysis of today's possibilities, prospective advantages, and limitations is provided. A general view of the field showed current practices and presented trends and the general perspective on AI-utilizing applications aimed at children's social skills. Through a meta-analysis of the literature reviewed, the analysis revealed a significant rise in interest, diverse approaches underpinning a plethora of applications, as well as a considerable heterogeneity of participant, implementation, and evaluation contexts. While the effectiveness of such tools remains debated in parts of the literature, the complexity of social skills itself generates versatile possibilities for operationalization and call for further exploration (Li et al., 2024). One distinct group of research, interventions for individuals with autism spectrum disorders (ASD), stands out for its current depth and fruitful heterogeneity. Both the potential utilization, as well as the design, and further research of AI-powered applications, a set of balanced interdisciplinary considerations, have been proposed. The broader view indicates that broader methodological and interdisciplinary approaches are pivotal for a more holistic understanding of the implications and potentials of AI children's social development-enhancing tools.

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