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PEER-MEDIATED INTERVENTION AS A STRATEGY FOR SCHOOL INCLUSION: IMPACTS ON THE LEARNING AND DEVELOPMENT OF STUDENTS WITH ASD

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Abstract:
Peer-Mediated Intervention (PMI) and Classwide Peer Tutoring (CWPT) have proven to be effective strategies for the inclusion of students with Autism Spectrum Disorder (ASD) in mainstream primary education. This study examines the application of PMI and CWPT in the school context, highlighting their benefits, such as fostering the development of social skills and reducing isolation among students with ASD. Based on a literature review, various types of PMI approaches are discussed, including Proximity Intervention, Reinforcement Intervention, and Initiative Intervention. The findings suggest that PMI and CWPT are promising methodologies, particularly in naturalistic settings such as schools. However, in many emerging countries, the application of these methodologies remains limited, underscoring the need for further research and practical initiatives to explore their inclusive potential within educational contexts. Consequently, this study aims to contribute to the expansion of knowledge on PMI and CWPT and their applicability in countries where ASD remains a significant challenge for education systems.

Keywords: peer-mediated intervention, classwide peer tutoring, inclusion, evidence-based practices, autism spectrum disorder

1. Introduction

Autism Spectrum Disorder (ASD) is characterised by persistent deficits in communication and social interaction, alongside restricted and repetitive patterns of

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behaviour, interests, or activities, as outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V). These symptoms, evident from early childhood, significantly impact the individual's daily life, particularly in social and educational contexts (American Psychiatric Association, 2013).

In recent years, the prevalence of ASD has risen significantly worldwide. In the United States, current data from the *Centers for Disease Control and Prevention* (CDC) indicate that 1 in 36 children aged up to 8 years has been diagnosed with ASD, with a higher prevalence among boys (Maenner et al., 2023). Although the statistics are less comprehensive, recent estimates suggest that around 1 in 54 children in Brazil is on the autism spectrum, a figure comparable to developed countries (De Souza Freire & Nogueira, 2023).

Given this scenario, the Brazilian educational system faces growing challenges in meeting the needs of students with ASD. Schools, as central spaces in children's lives, must adapt to provide an inclusive environment conducive to these children's development. However, the training of teachers and therapeutic assistants (TAs) remains insufficient, hindering the effectiveness of inclusion practices.

One approach gaining prominence in the international literature is Peer-Mediated Intervention (PMI). PMI is based on the premise that peer social interaction can serve as a powerful methodology for developing social and academic skills in children with ASD (Ramos et al., 2018). Studies have demonstrated that PMI can be applied in naturalistic environments, such as classrooms, playgrounds, and parks, where interactions among students occur spontaneously and contextually.

Peer-mediated interventions are categorised into three main approaches: Proximity Intervention, Reinforcement Intervention, and Initiative Intervention (Odom & Strain, 1986). Proximity Intervention involves strategically placing neurotypical students near those with ASD to encourage spontaneous interactions. Reinforcement Intervention employs positive reinforcement to promote social behaviours, while Initiative Intervention focuses on training neurotypical peers to initiate social interactions with their classmates with ASD.

Despite PMI's proven effectiveness in international contexts, its application remains limited in many countries, including Brazil. Consequently, this study aims to contribute to understanding PMI and demonstrate its potential application in basic education schools to enhance the inclusion and social development of students with ASD.

The Classwide Peer Tutoring (CWPT) methodology is another peer-mediated strategy involving the entire class in reciprocal roles of tutor and tutee, fostering meaningful interaction between neurotypical and atypical students (Kamps et al., 1994). In CWPT, students work in small groups of 4 to 6 members, organised by the teacher, who sets daily goals for each group and provides frequent reinforcements to encourage meeting those goals. This approach has demonstrated effectiveness in improving academic performance and developing social skills across various educational levels, including mainstream and special education, by offering structured and collaborative peer-learning opportunities.

This article is organised into seven main sections. Following this introduction, which contextualises the topic and presents the theoretical foundations of PMI and CWPT, the second section reviews existing literature on ASD, inclusion in mainstream education, evidence-based practices, and the social nature of learning. The third section outlines the methodology used in this research. The fourth section presents results and discusses the effectiveness of PMI and CWPT in developing social skills and including students with ASD in the school context. Finally, the conclusion emphasises the importance of peer-mediated methodologies as inclusive strategies in mainstream schools, followed by information about the authors and the references used.

2. Literature Review

2.1 Autism Spectrum Disorder and Inclusion in Mainstream Education

The diagnosis of ASD in the DSM-V is based on two major criteria: (1) deficits in communication and social interaction, characterised by difficulties in socio-emotional reciprocity, such as abnormalities in social approach or an inability to engage in normal conversation; difficulties in non-verbal communication, such as inadequate eye contact and a lack of facial expressions or gestures; and difficulties in developing, maintaining, and understanding relationships in various social contexts or a lack of interest in peers. (2) Restricted and repetitive patterns of behaviour, interests, or activities, manifested by repetitive motor movements, the repetitive use of objects or stereotyped speech; insistence on sameness, inflexible adherence to routines, or ritualised patterns of behaviour; highly restricted, fixated interests that are abnormal in intensity or focus; and hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment. For diagnosis, these symptoms must significantly impact daily functioning and cannot be better explained by another mental disorder or intellectual disability.

In Brazil, statistics on ASD are less comprehensive than in other countries, but recent studies and estimates (De Souza Freire & Nogueira, 2023) indicate a growing prevalence. Approximately 1 in 54 children is estimated to be on the autism spectrum, a figure comparable to developed countries such as the United States. This rise reflects increased awareness and diagnosis of ASD in Brazil.

As schools are environments where children spend a significant portion of their daily lives, the growing number of students with ASD entering mainstream education increasingly impacts the structure of these institutions. However, insufficient attention has been given to improving the training of teachers and paraeducators to address this challenging context. In Brazil, paraeducators are referred to as Therapeutic Assistants (TAs). Therefore, the inclusion process must not only involve a better understanding of teaching practices but also explore the role of TAs in supporting children with ASD. While inclusion is vital, it is not enough to improve the outcomes of educational practices designed to meet the unique characteristics of children with ASD.

Inclusion extends beyond educating children with ASD in the same environment as their neurotypical peers. In the context of education for social equity, inclusion is a

broader concept grounded in the four principles of the Salamanca Statement (1994), as highlighted by Carneiro and Dall'Acqua (2016, p. 19):

> *"1. The right to education must be independent of individual differences; 2. Special educational needs should not only encompass children with disabilities, but also all those who face challenges in their daily schooling; 3. It is the school that must adapt to the students and their specificities, not the other way around; 4. Education must be diverse, rich, creative, and conducted in a common space for all children*." (Carneiro & Dall'Acqua, 2016, p. 19)

The implementation of inclusion varies greatly across schools. The time students with ASD spend in regular classes often depends on the level of support they require. Children with more severe symptoms tend to spend less time, while those with milder symptoms spend more time in mainstream classrooms (Carneiro & Dall'Acqua, 2016). As expected, the success of inclusion for students with ASD is highly variable, primarily because teachers and TAs often struggle to address the academic, developmental, and social interaction needs of these students. Traditional teaching methodologies frequently have limited relevance to students on the spectrum and fail to achieve the same learning outcomes as they do for neurotypical children.

In Brazil, several laws promote inclusion in basic education, regardless of students' special needs. Article 205 of the 1988 Federal Constitution establishes education as a right for all and a duty of the state and families. Article 208, subsection III, guarantees specialised educational assistance for individuals with disabilities, preferably within mainstream schools. The Law National Guidelines and Bases of Education Act (*Lei de Diretrizes e Bases da Educação Nacional* LDB) - Law No. 9,394/1996, Articles 58 to 60, specifically addresses special education, mandating specialised support for students with disabilities, pervasive developmental disorders, and giftedness, preferably in mainstream schools. The Statute of the Child and Adolescent (*Estatuto da Criança e do Adolescente*) - Law No. 8,069/1990, Article 54, subsection III, ensures specialised educational support for children and adolescents with disabilities.

Decree No. 3,298/1999 regulates the National Policy for the Integration of Persons with Disabilities, guaranteeing access to education and specialised educational services, preferably in mainstream schools. The Brazilian Law of Inclusion for Persons with Disabilities (*Estatuto da Pessoa com Deficiência*) - Law No. 13,146/2015, Article 28, ensures the right to inclusive education at all levels without discrimination, with the provision of specialised educational support, professional assistance, and school environment adaptations to guarantee access for all students.

Law No. 12,764/2012 established the National Policy for the Protection of the Rights of Persons with ASD in Brazil, laying out guidelines to ensure their rights, including access to healthcare, education, inclusion in the labour market, and protection from abuse. This law also considers persons with ASD as individuals with disabilities for all legal purposes and created the Autism Spectrum Disorder Identification Card to

ensure priority access to public and private services. Additionally, it imposes penalties on school administrators who refuse to enrol students with ASD. Decree No. 10,502/2020, part of the National Special Education Plan, establishes an equitable, inclusive, lifelong learning policy.

These laws and policies, among the most comprehensive globally, reflect Brazil's commitment to promoting inclusion in basic education, ensuring that all students have access to education tailored to their needs. However, despite the established legislation, the heterogeneity of symptoms and behaviours among students with ASD presents significant challenges in providing adequate, individualised, and meaningful support for these atypical learners. The reliance on isolated practices fails to address the complex needs of students with ASD, making it particularly difficult for educators to develop the skills necessary to support diverse learners under their care.

In this regard, teacher training must go beyond initial education and basic instruction. Although numerous evidence-based practices (EBPs) established by the National Professional Development Center on Autism Spectrum Disorder show promise, many educators remain unclear about which EBPs are most effective for supporting the inclusion and retention of students with ASD in regular classrooms (Carneiro & Dall'Acqua, 2016).

A recent study conducted in southern Brazil by Finatto and Schmidt (2021) found that the pedagogical practices adopted by teachers working with autistic students were often ineffective, highlighting the limited theoretical and practical training of these professionals. Teachers reported insufficient knowledge about ASD and difficulties in planning, teaching, and evaluating students with ASD as significant obstacles in their practice.

Many teachers feel unprepared and uncomfortable working with atypical students, describing this task as challenging (Finatto & Schmidt, 2021). They emphasised the need for collaboration with the school community and highlighted the lack of initial and continuing training, as well as the absence of specific teaching materials for students with ASD.

Another challenge identified by the authors is the gap between EBPs, typically developed in laboratory settings, and the naturalistic context of classrooms. When EBPs are applied in schools, they frequently fail to replicate the results observed in controlled environments, underscoring the need to adapt these practices to educational settings.

The authors argue that an EBP can only be effective if it aligns with teachers' prior knowledge, the unique characteristics of the students, and the specific demands of the school environment. The review study by Finatto and Schmidt (2021) confirms this difficulty in integrating EBPs into pedagogical practice. Whether due to academic language being removed from the school context, a lack of teacher training grounded in scientific knowledge, or the clinical nature of interventions.

To address these challenges, the authors suggest training programmes that bridge academic knowledge and teachers' realities, using accessible language and promoting the application of EBPs in the classroom context. They further propose valuing existing

pedagogical praxis and fostering closer connections between educators and scientific knowledge. A viable proposal for teacher training involves using case studies, where teachers can apply theoretical knowledge to real-world situations, serving as models to tackle similar challenges in their professional practice.

2.2 Evidence-Based Practices (EBPs)

Although many Evidence-Based Practices (EBPs) are documented in the literature as strategies with significant effects on the development of students with ASD, little is known about how these practices are applied in mainstream schools. EBPs are defined as practices and strategies demonstrated through research to have significant effects on interaction and learning outcomes for students with ASD (Locke et al., 2022).

According to Lacerda (2020), three criteria must be met for a practice to be considered evidence-based:

a) Relevance – the knowledge must be pertinent, either supporting or challenging a specific application;
b) Sufficiency – findings must align with other similar studies, supported by statistical sampling and numerical reliability;
c) Veracity – assurance that data collection was free of bias and conducted without conflicts of interest.

The process of evaluating whether a practice qualifies as evidence-based involves identifying all studies related to a specific intervention, verifying scientific standards in these studies, and demonstrating sufficient replications to suggest that the intervention will be effective in most situations (Sella & Ribeiro, 2018).

Up to 2018, the National Professional Development Center on Autism Spectrum Disorder identified 23 practices as evidence-based, including reinforcement, modelling, visual supports, task analysis, prompting, direct instruction, antecedent-based interventions, extinction, functional communication training, self-management, social narratives, social skills training, response interruption/redirection, time delay, augmentative and alternative communication, discrete trial teaching, naturalistic intervention, technology-aided instruction and intervention, behavioural momentum interventions, peer-mediated instruction and intervention, and video modelling (Sella & Ribeiro, 2018).

For EBPs to be effectively utilised, educators must be familiar with and trained in these practices (Locke et al., 2022). However, familiarity and training in inclusive environments remain underexplored, particularly among TAs. There is a strong relationship between educators' knowledge and their use of EBPs, yet many practices are poorly implemented in schools due to gaps in professional training. Regular teachers often lack adequate initial and ongoing training about ASD, complicating the effective application of EBPs, while TAs frequently have insufficient preparation to address the diverse needs of students on the autism spectrum.

A recent study involving 86 educators, including mainstream teachers, special education teachers, and TAs, sought to identify which EBPs these professionals knew,

were trained in, and used to include and support students with ASD in mainstream educational environments (Locke et al., 2022). Follow-up interviews revealed a mixed understanding of EBP definitions and applications. Among various methodologies, 18.6% of the educators were familiar with some form of peer-mediated instruction or intervention. Of these, 12.9% of special education teachers used peer instruction, while 32.1% of TAs demonstrated familiarity with this type of EBP.

Conversely, reinforcement, modelling, visual supports, and antecedent-based interventions were the most frequently used EBPs to support the inclusion and retention of students with ASD in mainstream classrooms (Locke et al., 2022). Significant differences were noted among educator roles, with mainstream teachers reporting less familiarity, training, and usage of EBPs compared to special education teachers and TAs.

Although evidence supporting social interaction and communication strategies, such as naturalistic intervention and peer-mediated intervention, is strong, these EBPs were rarely utilised, despite their demonstrated effectiveness when applied by educators (Locke et al., 2022). Efforts to improve familiarity and training in specific EBPs could enhance social behaviour outcomes while fostering a more inclusive environment for students with ASD.

The authors suggest that teacher training programmes should include specialised ASD training (Locke et al., 2022). Initiatives such as courses, internships, and rotations during teacher education phases could build familiarity and proficiency in applying EBPs. Additionally, education departments and schools should implement parallel initiatives for professional development to disseminate new EBPs for supporting students with ASD. Partnerships between schools and academic institutions could serve as a pathway to enhance educator training.

Finally, although many schools have established teams comprising educators and specialists (e.g., social workers, psychologists, speech therapists) to support students with ASD, more time for collaborative planning or shared meetings with families and therapists may be necessary to discuss tailored interventions for these atypical learners (Locke et al., 2022). While EBPs have demonstrated significant effects on the learning and social interaction outcomes of students with ASD, they do not guarantee that teachers and TAs with training are fully prepared to implement them effectively in schools. Expanding research on how educators use EBPs and how these practices facilitate the inclusion and retention of students with ASD in mainstream education is essential. Among the various EBPs, peer-mediated instruction and intervention is considered by some researchers to be one of the practices that most closely align with humans' natural social behaviours.

2.3 The Social Nature of Learning

From a Vygotsk perspective, human cognitive development occurs through social interaction mediated by language, as "*human learning presupposes a specific social nature and a process through which children enter into the intellectual life of those around them*"

(Vygotsky, 1998). Social experiences shape the ways of thinking and interpreting the world, because:

> "*We propose that an essential feature of learning is that it creates the zone of proximal development; that is, learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers. Once these processes are internalized, they become part of the child's independent developmental achievement*." (Vygotsky, 1978, p 90).

Social competence develops through the combination of adult-child (vertical) and child-child (horizontal) interactions, as highlighted by Ramos et al. (2018). Vertical interactions, involving a partner with more knowledge and social skill, forge basic abilities, such as safety and protection, during the first year of life. The child evolves and acquires independence in development during the vertical interaction. On the other hand, more sophisticated social skills, which form the foundation of interpersonal relationships, only develop among peers, which highlights the role of social interactions that take place in schools. All children benefit from both types of interactions, vertical and horizontal.

If we limited ourselves to placing a more competent student next to another to help them, we would be facing a poor methodology. In a class organised in this way, with pairs where one offers help and the other receives it, at best, only half of the students would learn. In fact — as peer tutoring proposes — it is about organising the relationships between tutor and tutee in a way that both can learn, thus situating differences as genuine sources of learning for all.

The study by Duran et al. (2015) shows that tutor students learn as much or more than their tutees. This evidence, along with the recognition of the educational relevance of interactions between equals and new explanatory frameworks of teaching and learning. This leads us, in the past decade, to a new definition that goes beyond the previous practice of a more competent student helping a peer with difficulties. Thus, broadly, peer tutoring can be understood as individuals from similar social groups who help others learn and also learn by teaching.

Positive interdependence and individual participation require that we move away from simple peer work, where a more skilled student helps a less skilled one, to a scenario that requires careful planning (or structuring) of the interaction between them, with the aim that the tutor learns by teaching and the tutee also learns by receiving personalised help from their peer. Thus, as a cooperative method, peer tutoring pedagogically harnesses the diversity of students, promoting learning through their differences, including variations in knowledge levels. For this reason, experts consider peer tutoring to be a highly effective practice for inclusive education.

Teachers can easily perceive that, when organising lessons into peer tutoring sessions, students tend to become more engaged in the task and offer much more personalised mutual help than what the teacher could provide alone. It is a way of

multiplying teaching sources in the classroom, transforming the environment into a learning community, where students not only learn from the teacher but also from the pedagogical help they offer each other. These advantages have encouraged the emergence of many peer tutoring educational practices, many of which have led to investigations about their effectiveness.

In another study presented by Duran et al. (2015), a review of experimental studies on peer tutoring with students from ethnic minorities concluded that the key lies in the creation of pairs. The group of tutors should not be reserved for the most competent or highest-achieving students. It is about creating pairs where the tutor knows slightly more than the tutee, allowing all students to become tutors for others who have more difficulties than they do.

According to Bandura (2011), interventions based on behavioural principles and social learning theory make use of peer mediation or small networks of typically developing groups. These are instructed by an adult to mediate social and/or academic skills for children with some form of disability. Peers play the role of intervention agents, acting as behaviour models and mediators of learning for their peers. The children who receive such mediation, in turn, are encouraged to develop and expand their repertoire of both social and academic skills.

The choice of peers for the intervention is usually made by the class teacher, considering criteria such as empathy and mastery of the target skills to be developed. However, not to a level that is too far above the tutee's abilities to avoid demotivating the pair. The age range should be as close as possible to the target child, as both should be in the same class and share some common interests, such as games, characters, etc. Regular school attendance is also essential when selecting the pair, as it is necessary for the peer to be frequently present to participate in group activities, ensuring that the mediation is stable, continuous, and effective.

Examining the social nature of learning, a study by Gnadinger (2008) investigated how children help each other acquire knowledge in an elementary school classroom environment. Second- and third-grade students, aged between seven and nine, who attended Carson School in the southeastern United States, participated in the study. The identification of the ways in which students provided assistance to their peers while learning in this group environment defined their zones of appropriate development during joint collaborative activities.

The following questions guided Gnadinger's study:

1) In what ways do peers provide support to each other during joint productive activities?
2) Do children provide support similar to that of adults, using the six means of assisted performance?

These six means are defined as: instruction, feedback, questioning, modelling, contingency management, and cognitive structuring (Gnadinger, 2008, p.134).

The participating teacher used the five steps of effective teaching described as:

1) Developing language and literacy across the curriculum: encouraging students to develop skills in language and literacy education;
2) Contextualisation: connecting the school with students' lives by linking curriculum experiences with the skills of their home and community;
3) Cognitive complexity: challenging students to develop more complex thinking;
4) Instructional conversation: engaging students through dialogue using conversation as an instructional tool;
5) Producing activities together: facilitating learning between teachers and students to produce and work together in small groups (Gnadinger, 2008, p.134).

Gnadinger's (2008) results suggest that peers provide mutual support in various ways. Upon examining the students' conversations, certain key features of collaboration became evident. Support occurred in three ways:

1) to focus and maintain attention on the task,
2) to help procedurally clarify explanations, and
3) to support academic content.

The focus was to determine how they help each other and provide mutual support in academic activities. Therefore, an analysis of the academic content data provided additional insights into this investigation as the children worked together in the classroom's collaborative environment, in line with the six means of assisted performance mentioned. The most common forms of peer-assisted performance in this classroom were questioning, providing feedback, and instruction.

There has been increasing interest in using peer-mediated strategies in primary education for students with ASD, but with high functionality (Martinez & Duran, 2021). This subgroup of children generally does not have intellectual impairments and is capable of keeping up with academic activities with minimal support. However, the lack of social support for these children creates serious problems in the classroom. These characteristics suggest that high-functioning students with ASD are prime candidates for programs designed to facilitate, primarily, academic development accompanied by social interaction, in order to ensure successful inclusion in regular classrooms.

When seeking the most effective strategies to meet their students' needs, teachers should consider peer collaboration as an effective strategy when planning teaching-learning activities. Research suggests that peer collaboration is an effective strategy for all learners, as both tutors and tutees benefit academically from collaboration. Peer interactions provide more time for the teacher to give greater individual attention, enabling them to do more for students, that is, to provide a more comprehensive education. Although the literature presents a somewhat favourable picture of peer collaboration, the number of studies examining the complexities of these peer groups, particularly in regular early childhood and primary education, remains limited. Studies on teachers' instructional practices regarding peer teaching methods can provide more insights into why some collaborative experiences are more effective than others.

Teachers' lack of knowledge about autism and pedagogical practices to address the specific educational demands of these students in the classroom. This can be partially

explained by the limited support offered in the continuous professional development of pedagogical practices with the potential to organise and consolidate the inclusive process. Since autism is a disability that primarily affects the social domain, one of the most relevant justifications for the inclusion of these students is the possibility of interaction with peers to develop social skills. In this sense, knowledge of peer-mediated intervention methodologies is a first step towards improving inclusive practices in regular schools.

3. Material and Methods

The study you described adopts a solid and well-structured methodological approach to investigate peer-mediated teaching and learning methods, focusing on the inclusion of students with Autism Spectrum Disorder (ASD) in regular school settings. Dividing the research process into three stages allows for a comprehensive and detailed analysis of the topic, as well as providing a critical assessment that significantly contributes to understanding inclusive educational practices for students with ASD.

The first stage, which involves reviewing articles in databases such as Scopus, Web of Science, and Scielo, is crucial for ensuring the collection of relevant and up-to-date information. The use of well-defined descriptors, such as “Peer-Mediated Intervention”, “Autism Spectrum Disorder”, and “inclusion strategies”, ensures the accuracy and relevance of the studies selected for analysis. The second stage, focused on the critical analysis of the studies, is fundamental for evaluating the effectiveness of peer-mediated intervention methods, particularly concerning the social and academic development of students with ASD.

Additionally, identifying the barriers to implementing these methods in the contexts of emerging countries is an important contribution, as it helps to understand the limitations and challenges faced in applying these practices in different settings. Finally, the systematisation of the results, based on relevance criteria such as the impact on school inclusion and applicability in regular schools, provides a clear overview of the most effective methodologies and opportunities for improvement in future interventions. This also highlights gaps in the existing research and suggests directions for new studies, enabling the field of school inclusion to advance based on solid evidence.

This methodological approach demonstrates a commitment to high-quality scientific research and the pursuit of practical and effective solutions to promote the inclusion of students with ASD in regular schools.

4. Results and Discussion

After reviewing the literature on evidence-based practices, with an emphasis on peer-mediated methodologies, this results section aims to further analyse these methodologies within the educational context. The impacts of these strategies on the social and academic development of students with Autism Spectrum Disorder (ASD) and their contributions

to school inclusion will be presented. Additionally, the challenges faced in implementing these practices will be examined, alongside the possibilities for adapting them to the specificities of the school environment in emerging countries such as Brazil.

4.1 Peer-Mediated Intervention

Peer-Mediated Intervention (PMI) has gained international recognition, not only for being an evidence-based intervention that promotes the development of social skills, but also for its applicability in the academic development of children with disabilities. PMI, defined simply as peer-mediated social interaction, is also referred to in the literature as Peer-Based Instruction and Intervention (PBII). It is one of the 28 evidence-based practices (EBPs) according to the National Professional Development Center (NPDC) (Lacerda, 2020).

The pioneering work of Odom and Strain (1982) reviewed PMI approaches published between the 1960s and 1980s, focusing on their application in the social development of children. The study organized a taxonomy of the main types of PMI, highlighting empirical evidence of their effectiveness. The authors identified that structured interventions involving the training of peers to facilitate social interactions resulted in significant improvements in the social skills of children with autism, emphasizing the importance of active peer mediation to maximize benefits.

Odom and Strain (1982) classified PMIs into three main approaches. The Proximity Intervention involves placing neurotypical children and children with autism together, without a formal interaction plan. The Reinforcement Intervention uses behavioural principles, where neurotypical peers are trained to reinforce positive social behaviours through verbal prompts and feedback. The Initiative Intervention encourages neurotypical peers to take the initiative in interactions, creating opportunities for children with autism to actively participate in the teaching-learning process.

Additionally, Odom and Strain (1982) emphasized that for effective results, the intervention must be planned and supervised by adults, ensuring that peers are properly prepared for their roles. The study also addressed the importance of adapting interventions to the individual needs of the children, using positive reinforcement and specific strategies to maintain social engagement. This approach not only improves social interaction for children with autism but also contributes to the social development of neurotypical peers.

The literature review on the application of PMI in the education of students with autism and its implications for research and pedagogical practice showed that the methodology, in addition to being evidence-based, is highly effective. The theoretical assumptions of child development that underpin this intervention were examined by Ramos et al. (2018), who described the evolution of different procedures and methodologies historically used. The authors highlighted the effectiveness of this intervention in the development of social skills for Special Education students and the academic learning of children with ASD.

Within the three PMI approaches, there are two types of intervention, whose difference lies in the role of the peer or teacher. In Peer-Mediated Instructions and Interventions (PMIIs), the peer receives training and guidance from an adult (such as the teacher or clinician) to provide social initiations or instructions in a way that supports the learning objectives of the student with autism. In Adult-Mediated Instructions and Interventions (AMII), the teacher or other adults organize the social environment (e.g., placing the children together) and provide training, guidance, and/or reinforcement to help the student and their peer engage in social interaction. Most of the time, the peer is a neurotypical child of the same age group.

Peer instruction involves teaching specific social or academic strategies, such as inviting to play, providing assistance and demonstrating affection, directing activities, all while using moments of interaction and seeking proximity to the target child during playful activities. Modelling principles can also be used, where the neurotypical peer's behaviour is observed by the target student, who later performs or imitates the task independently, although this can be a more challenging practice for students with autism (Ramos et al., 2018). There is also the technique of role-play or corrective feedback, which helps the understanding of procedures. However, studies show that simply placing a child with atypical development among their peers, without incorporating other intervention procedures, is insufficient to provide significant gains for the child with fewer social skills.

In the review by Ramos et al. (2018), at least 27 experimental studies were identified, providing robust evidence that PMI is an effective evidence-based strategy for students with autism in regular school environments. One of the main advantages of this intervention is its versatility, allowing it to be applied in naturalistic settings such as classrooms, recess, communal meals, and playgrounds.

Considering that social impairment is a core deficit in children with ASD, as outlined in the DSM-V, peer interaction in school settings is one of the main barriers to learning and participation in academic activities. In this context, PMI proves to be an appropriate intervention for the development of social skills in autistic students. Another advantage of PMI, as identified in the literature review by Ramos et al. (2018), is that peers involved in the interventions also increased their knowledge of autism and developed more positive attitudes of acceptance towards classmates with disabilities. Additionally, PMI is particularly useful for students with little or no verbal skills, as in this intervention, the initiative to interact and provide instructions comes from neurotypical peers, who serve as models for both verbal and non-verbal interactions. These interactions result in increased engagement time, thus reducing the isolation periods commonly experienced by students with autism in regular schools, even those that adopt inclusive practices.

Despite the recognition and wide international use of PMI, this practice remains little known in many countries, or is even confused with other similar practices. According to Ramos et al. (2018), PMI may be found in the literature under different names, such as "peer tutoring", which is defined as a teaching system where students

help each other learn through cooperation, repetition, and instruction strategies. Instructions in PMI are not standardized, but personalized according to the initial objective set, resulting in a variety of models for peers to follow, guided by adults.

Due to the very nature of ASD, simply placing same-age peers together without a planned intervention and specific training may not achieve the desired social development outcomes. The lack of proper planning, which includes motivation and support sources, can lead neurotypical peers to become frustrated with the lack of response from their autistic classmates, reducing their interaction initiatives.

New approaches and configurations of PMI have been studied, combining the types described above. These modifications include the use of positive reinforcement strategies not only for the target child but also for neurotypical peers, to maintain their motivation throughout the activities, which can be threatened by the "*difficulties in engaging in reciprocal exchanges with the autistic peer*" (Watkins et al., 2015).

According to Ramos et al. (2018), "Incidental Peer Teaching" is a practice that does not follow a predetermined sequence of strategies from the beginning to the end of the intervention, unlike the traditional model. Instead, it uses environmental arrangements, such as objects and toys, to make the environment appealing to the child, using their own initiatives to initiate, maintain, and enhance exchanges between peers.

Another PMI approach, known as "Playmates", does not involve fixed peer selection for the intervention, functioning as a rotation system among peers, who receive guidance on inclusion, differences, disabilities, and the importance of interactions and playing together (Ramos et al., 2018).

The "Peer Networks" approach, another variation, involves three to five children and shares several characteristics with the Playmates methodology, and can be used in combination. Both approaches involve children with autism receiving mediation from a group of neurotypical children who have been specifically trained for this intervention. This modality shows positive results in the development of social skills, although it requires specific training outside the classroom.

Regardless of the approach used, the evidence regarding the effectiveness of PMI justifies its recognition as an evidence-based practice (Lacerda, 2020). This practice holds great potential for the inclusion of students with autism, particularly in the development of social skills. The effectiveness of PMI was confirmed through visual inspection of data collected via video recordings and the calculation of percentages for variables such as interactive participation and the duration of interactions in Lacerda's (2020) study.

Another study involving PMI evaluated whether peer-mediated socialization would improve the interaction interest of children with autism (Ramos et al., 2018). In this research, an experimental design with a multiple baseline was used, involving three children with autism, aged between four and five years, enrolled in a regular preschool. Following the Playmates approach, the intervention period took place during recess, when the children sat at picnic tables to have snacks with their peers, followed by 30 to 45 minutes of free play. The results showed that none of the children engaged with their peers in the pre-intervention phase, maintaining a null baseline. After the intervention

began, engagement gradually increased, reaching 100% in one case. The spontaneity of verbal initiatives also followed this pattern, starting at 0% in the pre-intervention phase and increasing over the course of the intervention. The data indicated that activities centred on the interests of children with autism, when mediated by peers, resulted in gains both in the frequency of social engagement and in verbal initiatives.

Another study that involved teachers from a school applying the Playmates-type PMI also yielded positive results (Watkins et al., 2015). Typical children were instructed to interact with and elicit communication responses or initiatives from participants with autism, leading to an increase in the frequency of communicative acts of the target children immediately after the intervention was introduced, thus confirming its effectiveness.

A systematic review of studies using PMI with children with autism reported that 91% of the studies analysed showed positive results, although a common limitation was identified in the assessment of the intervention's fidelity (Lacerda, 2020). Overall, it was concluded that the application of PMI is compatible with the typical classroom routine and is appropriate for naturalistic environments, highlighting its potential for use in schools.

Ramos et al. (2018) reported that a systematic review focusing on the use of PMI to develop social skills in children with autism showed that four out of the five studies reviewed were conducted in regular school environments, confirming the feasibility of PMI in this context. These four studies concluded that the participants improved their target social skills after the intervention, including social initiations, social responses, and social communication. Participant characteristics, such as lack of ability, interest, or motivation, as well as the type of social deficit, are important considerations in choosing the appropriate PMI approach to be used.

In addition to the benefits for students with disabilities, PMI also contributes to the social and emotional development of neurotypical peers, affecting the overall classroom climate. Ramos et al. (2018) emphasize the increasing relevance of this intervention in recent years, particularly in the field of inclusive education. The broad variety of contexts in which PMI can be applied, combined with its low cost and the possibility of implementation in naturalistic settings, makes this intervention promising in many emerging countries.

A more recent study by Zhang et al. (2022) demonstrated that the PMI group was significantly more effective in both learning and the quality of social interactions compared to a group without the intervention. There was an improvement in the behaviours and social communication skills of children with autism at support levels 1 and 2. According to the new DSM-V nomenclature, autism levels are 1, 2, or 3, based on the intensity and frequency of support needed, with level 1 requiring the least support and level 3 being highly dependent on caregiver support. According to this research, social difficulties in autism are mainly caused by anomalies in social motivation or social cognition. The researchers suggest that individuals without cognitive impairments should first work on strengthening their social motivation before developing social skills.

The theory of social motivation asserts that weak social motivation can cause individuals to shift their focus of interest and interrupt their pursuit of social experiences, triggering a cascading effect of deficient social learning. In this study, therapists instructed neurotypical children to use methods preferred by children with autism to attract their attention. Moreover, there is evidence that timely rewards in social encounters can increase social motivation. Therefore, it was observed that the increase in social motivation had a significant impact on the social competence developed.

PMI is often used in conjunction with other intervention strategies, such as peer intervention combined with play strategies, video modelling, augmentative and alternative communication, among others. PMI started with basic free play between children with autism and neurotypical children but has evolved into a variety of intervention types, including opportunities for peer contact, peer counselling, positive peer reports, and group play.

In the study reported by Zhang et al. (2022), the experimental group was the PMI group, and the control group was the group receiving Applied Behaviour Analysis (ABA) therapy. After the comparative experimental study between PMI and ABA, with 55 participants and 16 peers, it was found that PMI increased social motivation in children with autism at support levels 1 and 2. PMI was able to minimize undesirable behaviour patterns, effectively improve social skills, and enhance social communication with other peers.

The study by Marins and Lourenço (2020) showed that cooperative learning, based on heterogeneity, is a methodology that:

a) recognizes diversity;
b) benefits from it for teaching;
c) transforms the differences between students into a positive element that facilitates learning;
d) turns the diversity of knowledge levels into a facilitator of the teacher's role, enabling peer learning and encouraging students to take responsibility for their own learning as well as that of their peers.

Marins and Lourenço (2020) highlight five models commonly used in peer tutoring practices:

1) Whole-class Peer Tutoring;
2) Cross-age Peer Tutoring;
3) Peer-Assisted Learning Strategies;
4) Reciprocal Peer Tutoring; and
5) Same-age Peer Tutoring.

Pre-training, especially of the tutors, is a fundamental requirement to transform collaborative interaction into a true tutoring relationship, where each member of the pair plays their role effectively.

Cooperative learning in the classroom encourages students to work together and help each other (Marins & Lourenço, 2020). In this context, discussing content is a way to facilitate problem understanding, indicating that this strategy allows peer interaction and

fosters autonomy and responsibility in decision-making. The authors emphasize several advantages of cooperative learning, including:

a) the stimulation and development of social skills;
b) the creation of a stronger social support system;
c) encouragement of responsibility for others;
d) increased self-esteem; e) creation of a positive relationship between students and teachers;
e) stimulation of critical thinking;
f) helping students clarify ideas through dialogue;
g) development of oral communication skills;
h) improved retention of content; and
i) creation of an active and investigative learning environment.

In cooperative learning, tutors need to be well-trained, and the PPP method (Pause, Prompt, Praise) is suggested, known in the study as WIE (Wait, Intervene, Encourage). This method, introduced by the researcher Baudrit, is emphasized as improving the psychosocial and interaction skills of the tutor, as it requires the use of communicative social skills, such as paying attention, expressing oneself clearly, and giving the tutee time to think or ask questions. According to Baudrit, the mission of tutors is "*to help their peers when they face learning problems but also with integration or insertion issues*."

The explanation of the tutee's learning can be linked to the general principles of instructional psychology. Tutees have a significant opportunity to learn by receiving constant, personalized assistance tailored to their zone of proximal development (Vygotsky, 1998). In this proximity, a climate of trust is created, allowing tutees to raise questions and make mistakes without fear, which is more challenging when the interaction occurs directly with the teacher. This reduces stress and anxiety, resulting in academic improvements, increased motivation, and greater commitment.

On the other hand, the explanation for the tutor's learning is that teaching, by its complexity, offers learning opportunities for the one who teaches, whether it be the student tutor or the teacher. Duran et al. (2015) mention several benefits of peer tutoring. For the tutor: increased commitment, sense of responsibility, self-esteem, and emotional involvement; greater control over the content and the organization of their own knowledge to teach it; awareness of their own gaps and inaccuracies, and the ability to detect and correct the tutee's gaps (the educational needs of the tutee allow the tutor to perceive their own deficiencies and simultaneously learn to detect those of others); and improvement of psychosocial and interactive skills. For the tutee, the advantages can be summarized as: academic improvement and psychological adjustment (reduction of anxiety, depression, and stress, contributing to the creation of a safer and more welcoming environment).

The results of the studies by Marins and Lourenço (2020) highlight crucial issues for the effective planning of Peer-Mediated Intervention (PMI). The first issue concerns the number of tutors, which should be sufficient to meet the demands of the tutoring

sessions without overburdening the tutors. The second issue involves the dependency that may develop between the tutee and the tutor. To prevent this, it is suggested to reduce the frequency of intervention or rotate the tutors periodically. The third issue relates to the tutee's satisfactory interaction with the class teacher, which is essential for the success of the intervention. The fourth issue addresses the duration of the programme, stressing the need to consider the maintenance of strategies throughout the school year. The fifth issue concerns the limitations of the comparative analysis of pre- and post-tests, recommending that qualitative analysis, such as that generated by semi-structured interviews, may have limited the measurement of improvements or lack thereof in the programme's effectiveness.

Furthermore, the study by Duran et al. (2015) points out drawbacks that can arise from the improper application of peer tutoring. The most relevant drawbacks include:

- **For the tutors**: overestimating their own abilities, which can lead to excessive power and assertiveness. A sense of wasted time, particularly when tutees encounter difficulties. A decrease in self-esteem for tutors when tutees fail to progress.
- **During the selection of pairs**: a feeling of imposition and overload for the rejected student. A sense of inferiority for the tutee, who may feel like a "recipient of help".
- **Negative reactions from families**: families who advocate for traditional teaching models may feel that their children are wasting time helping others, or that another student's child is wasting time helping their own.
- **Negative perception of the school as an institution lacking resources**: the school may be seen as an institution that uses students as "teachers" for their peers, which could be interpreted as a lack of resources and support.

In addition to the drawbacks, the incorrect application of peer tutoring or inadequate planning can delay the development of atypical students, such as:

- Failing to detect errors or misconceptions in the tutee's understanding.
- Offering or reinforcing incorrect information, which can consolidate poorly constructed knowledge.
- Displaying impatience, providing ready-made answers, or even doing the task for the tutee, thereby reducing their learning opportunities.

The benefits of implementing Peer-Mediated Intervention (PMI) are significantly greater when compared to the drawbacks of its improper use. Marins and Lourenço (2020) found that the role of tutors contributed to the inclusion process of the tutee in the classroom, suggesting that PMI is a strategy which, if well applied, can help atypical students overcome their challenges and difficulties.

Undoubtedly, there is a challenging shift in perspective when it is proposed that students themselves may assist the teacher in mediating academic and social skills in the regular classroom. Duran et al. (2015) especially highlight that peer tutoring conflicts with two elements of traditional teaching: the conception of the teacher as the sole holder of knowledge and the teaching method based on the linear transmission of knowledge. The Taylorism organisation of schools, student perceptions, and the training and attitudes of

the teaching staff can constitute real barriers. To overcome this paradox, it is recommended that, before applying the intervention, teachers be trained with conceptual foundations about cooperation; a distinction between different methods and techniques; and finally, to organise interactions between team members and develop a new role for teachers that goes beyond the transmissive view of teaching.

Practices based on peer interaction establish a new paradigm for educational systems. These practices are undoubtedly very effective in inclusive classrooms that host both typical and atypical students. However, this interaction practice goes beyond a therapeutic approach; peer tutoring generates other perceptions among students, such as:

- **Recognising the ability to teach**. Current forms of learning and teaching are based on a sociocultural conception, where learning, although individual, is built through social interactions with someone more skilled. This implies recognising that students can play the role of mediators and instructors for their peers. However, for this to occur, the teacher must share the last monopoly they have: the ability to teach. Teachers should encourage situations where students offer mutual pedagogical help, empowering them and providing them with tools to act as tutors to their peers. Thus, teachers are not the only ones teaching in the classroom.
- **Learning by teaching**. Current conceptions of teaching and learning hold that even the more skilled participant learns within the zone of proximal development. As mentioned, the complex activity of teaching others holds a high learning potential for the teachers themselves (Duran et al., 2015). If this principle of learning by teaching is understood by teachers, students, and families, everyone will see the student tutor as someone who learns through the help they offer to peers in need. Students with more difficulties will be welcomed, for, thanks to them, everyone will have more opportunities to learn with greater depth.

Therefore, PMI offers significantly positive contributions both to research and to pedagogical practices in regular schools. The scarcity of research on the application of this methodology in many emerging countries highlights the importance of investing in more studies on PMI. Its application in the school environment fills a gap in the inclusion landscape, making it a relevant, evidence-based, and extremely effective alternative for improving the social interactions of children with Autism Spectrum Disorder (ASD).

4.2 Classwide Peer Tutoring (CWPT)

The Classwide Peer Tutoring (CWPT) methodology is similar to Peer-Mediated Intervention (PMI) and consists of a programme in which all students work together in tutor-learner pairs in reading subjects (Kamps et al., 1994). CWPT has also been successful in increasing and maintaining high levels of academic performance for all students. This strategy requires a high level of interaction between students, thus providing ample opportunities for both neurotypical and atypical students to practice appropriate social skills.

Classwide Peer Tutoring (CWPT) is a specific version of peer tutoring. In CWPT, the entire class is involved in reciprocal tutor and tutee roles. The effectiveness of CWPT has been demonstrated in both regular education and special education, and in primary, secondary, and higher education settings. In CWPT, the class is divided into small groups of 4-6 students. Within each team, students are grouped or can be grouped by the teacher. At the beginning of subsequent lessons, the teacher sets a goal for each group to achieve. Frequent reinforcements are linked to the fulfilment of the daily goals set by the teacher. The CWPT strategy uses an interdependent group contingency, holding students accountable both individually and as a group for their performance.

Kamps et al. (1994) conducted pioneering studies with CWPT and obtained highly relevant information about social interaction. The research showed that integration strategies are limited for students with more severe disabilities, such as autism with a level three support need and intellectual disabilities. The authors note that although most research on peer mediation and social interaction strategies for students with ASD and developmental disorders has shown promising results in the development of skills and the improvement of social interaction, most studies were conducted in preschool and daycare environments (Kamps et al., 1994).

The aim of the study by Kamps et al. (1994) was twofold:

a) first, it sought to measure the effects of a CWPT programme on the reading skills of three high-functioning students with ASD in a regular classroom, and
b) second, it was also conducted to measure the effects of CWPT on the frequency and duration of social interactions that occurred during unstructured free time, both before and after the application of the CWPT methodology.

The three high-functioning students with ASD were from the same classroom and had social skills deficits, such as few interactions with peers, social isolation, limited spontaneity, and low initiative in dialogue.

Social observations occurred during unstructured free activities, immediately after the reading instruction and allowed the frequency and duration of social interactions between peers to be determined. CWPT was carried out in training sessions of 45 minutes. It consisted of 25 to 30 minutes of peer-mediated instruction, occurring 3 to 4 days per week as a supplement to basic reading instruction (Kamps et al., 1994).

The results of this study indicated that CWPT was an effective and efficient strategy for enhancing both academic performance and social interactions of students with ASD and their neurotypical peers. Specifically, CWPT positively affected the academic performance of most students, increasing reading fluency and the percentage of correct answers to reading comprehension questions. However, mixed results were observed for error rates under different conditions. An additional positive finding was that the use of CWPT appeared to influence students socially, increasing the duration of social interaction time during free, unstructured activities immediately following the sessions. Peers also reported that peer tutoring in the classroom promoted reading fluency and comprehension skills. 88% of students indicated that CWPT helped them

relate better to their peers and that they would participate again in classes using this methodology (Kamps et al., 1994).

The researchers in this study considered the indirect effects of CWPT on improving social interactions during unstructured free time after tutoring to be particularly relevant. The study thus suggests that a highly interactive academic intervention can serve two purposes: to improve academic performance while also promoting greater positive social interaction (Kamps et al., 1994). The opportunity to interact and the special conditions for promoting social interaction are particularly important for students with ASD because they often have few natural opportunities for interaction with their peers or are resistant to initiating and maintaining informal dialogue.

According to Kamps et al. (1994), teachers need to more frequently address social goals for students, in the same way they do for academic content such as mathematics, reading, and science. The sequence of structured intervention strategies builds skills for the next stage, cumulatively. Students then benefit from this repeated practice as they add new social skills and competencies to their repertoire. CWPT offers a meaningful strategy to achieve the goals of improving social interactions in children with ASD.

However, according to Kamps et al. (1994), there are still many variables to be studied. The following issues should be examined: (i) the quality of interactions, (ii) extending social repertoires, and (iii) promoting the maintenance and generalisation of social interactions throughout the school day. Further studies are needed to determine the effects of highly interactive academic interventions on both academic and social outcomes for atypical students and their neurotypical peers.

Subsequent studies by Ward and Ayvazo (2010) showed the effects of peer tutoring in the whole class (CWPT) in physical education, a subject often neglected. The authors demonstrated that fully included students with ASD:

a) exhibit higher levels of engagement and social interaction,
b) offer and receive higher levels of social support,
c) have larger friendship networks, and
d) have more advanced Individualized Education Plan (IEP) goals from a developmental perspective than their peers in less inclusive environments.

Peer tutoring has also been successful, according to Ward and Ayvazo (2010), in improving the performance of students with other disabilities. As it helped to increase moderate-to-vigorous physical activity in deaf students, improved correct motor skill performance in students with developmental disabilities, and increased academic learning time for children with moderate-to-severe developmental disabilities.

In conclusion, CWPT is an effective strategy for improving the academic and social skills of students with ASD and their peers in regular primary education. The peer tutoring programme enhances reading skills for most students and can be easily adapted to the classroom routine. This supports the use of peer-mediated strategies to enhance academic performance in heterogeneous classrooms, a reality present in most primary schools today.

5. Conclusion

Peer interaction methodologies, such as Peer-Mediated Intervention (PMI) and Classroom-Wide Peer Tutoring (CWPT), have proven to be effective and promising for the inclusion of students with Autism Spectrum Disorder (ASD) in mainstream educational settings. The benefits of this approach have been extensively documented in the literature, highlighting the development of social skills and the reduction of isolation as key positive outcomes. The versatility of PMI and CWPT, which can be applied in various naturalistic environments, such as classrooms and playgrounds, contributes to their effectiveness.

However, despite global recognition, the implementation of PMI in many emerging countries remains limited. Increased investment in studies and practices exploring PMI in the educational context of these countries could contribute to inclusive education. The application of these methodologies in schools could fill a significant gap in inclusive education, offering a viable and effective alternative for the development of social skills in students with ASD.

Peer tutoring allows students to learn how to teach. This is possibly an essential skill for building a democratic knowledge society. Therefore, it is crucial that future studies focus on adapting and evaluating PMI in different school contexts, considering the cultural and educational specifics of each country. Additionally, there is a need to overcome the paradigm of transmissive teaching and make a collective effort among researchers, educators, and policymakers to promote the widespread dissemination and application of peer tutoring. This will ensure that all students have access to inclusive educational practices. Advancing research on peer tutoring in emerging countries can not only benefit students with ASD, but also contribute to creating a truly inclusive and welcoming school environment for all students.

Conflict of Interest Statement
The authors declare no conflicts of interest.

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