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JASPER Intervention in Children with Autism Spectrum Disorder: An Integrative Review of Evidence for Social Communication.

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Abstract:

Background: This integrative review aims to provide a holistic understanding of the mechanisms and active components of the JASPER intervention in the development of social communication skills in children with autism spectrum disorder, moving beyond a mere assessment of effectiveness to explore how developmental change occurs. **Method:** The methodological framework developed by Dhollande et al. (2021) was used to conduct the integrative review, and the PRISMA 2020 guidelines were followed to organize the search process. After screening and selection, the results led to the included of 12 studies in this review, with a thematic analysis of the study results. **Results:** The thematic analysis revealed that working on the variable of joint engagement represents a central mechanism of the intervention, contributing 69% of its impact on subsequent language development. Furthermore, working on joint attention is considered an active component for improving social communication skills, while the caregiver's responsiveness and the precision of implementation are important factors in the stability and sustainability of gains. **Conclusion:** The study concluded that the JASPER intervention is highly effective and flexible in implementation, as it transforms the interactive context into a sustainable learning environment. The researchers recommend the adoption of the JASPER protocol in Arab and Algerian intervention centers.

Keywords: JASPER Intervention; Social Communication Skills; Joint Attention; Autism Spectrum Disorder; Integrative Review.

الملخص:

الخلفية: تهدف هذه المراجعة التكاملية إلى توفير فهم شامل لآليات ومكونات تدخل JASPER الفعالة في تنمية مهارات التواصل الاجتماعي لدى الأطفال المصابين باضطراب طيف التوحد، متجاوزة مجرد تقييم الفعالية لاستكشاف كيفية حدوث التغير النمائي. الطريقة: تم استخدام الإطار المنهجي الذي طوره Dhollande et al. (2021) لإجراء المراجعة التكاملية، كما تم اتباع إرشادات PRISMA 2020 لتنظيم عملية البحث. و بعد الفرز والاختيار، خلصت النتائج إلى تضمين 12 دراسة في هذه المراجعة، مع تحليل موضوعي لنتائج الدراسة. النتائج: كشف التحليل الموضوعي أن العمل على متغير المشاركة المشتركة يمثل آلية مركزية للتدخل، حيث يساهم بنسبة 69% من أثره على تطور اللغة لاحقاً. علاوة على ذلك، يعتبر العمل على الانتباه المشترك مكوناً نشطاً لتحسين مهارات التواصل الاجتماعي، في حين أن استجابة مقدم الرعاية ودقة التنفيذ يعدان عاملان مهمان في استقرار واستدامة المكاسب. الاستنتاج: خلصت الدراسة إلى أن تدخل JASPER ذو فعالية عالية ويتسم بمرونته في التنفيذ، حيث يحول السياق التفاعلي إلى بيئة تعليمية مستدامة، وتوصي الباحثتان باعتماد بروتوكول JASPER في مراكز التدخل العربية والجزائرية. الكلمات المفتاحية: تدخل JASPER؛ مهارات التواصل الاجتماعي؛ الانتباه المشترك؛ اضطراب طيف التوحد؛ المراجعة التكاملية.

1.Introduction

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder characterized by persistent deficits in social communication (SC) and social interaction, accompanied by restricted and repetitive behaviors and interests, as noted by Maurya et Khan (2022, p.122), the primary challenge in this disorder lies in the inability to share emotions and interests with others. The recent update to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR) highlights that this deficit is evident across all social contexts the child encounters (APA, 2022). Studies confirm that children with ASD face significant difficulties in joint attention (JA) skills, particularly in the ability to initiate joint attention (IJA), in addition to their failure to interpret nonverbal social cues such as facial expressions, gestures, and tone of voice (Lord et al., 2020, p.1). This leads us to characterize this condition as limited social cognition, where the child is unable to understand social expectations or interactions, ultimately leading to maladjustment and difficulty communicating with peers (O'g'li et al., 2026, p.220).

Social communication skills are defined as the appropriate use and correct interpretation of verbal and nonverbal cues in social contexts to communicate with others (Dall et al., 2022). SC skills consist of essential active components, the most prominent of which are JA, imitation, and reciprocal social interaction. According to the latest findings (Mundy, 2016), the researchers argue that deficits in JA are not merely overt behaviors; but rather the defining characteristic unique to ASD. They emphasize that JA is not a single skill but rather a product of the Parallel and Distributed Processing Model (PDPM), in which the child integrates their attention to themselves with their attention to others and objects simultaneously; Therefore, deficits in these skills result from processing impairments, and thus Mundy (2019) the need for careful differentiation in interventions when targeting JA skills as a key component for improving SC skills—specifically between Response to Joint Attention (RJA) and IJA—as the latter is considered the most complex skill among children with ASD from preschool through adolescence.

The researchers argue that the fundamental importance of targeting these skills in intervention programs stems from the fact that deficits in them represent the missing link that hinders subsequent language development in children with ASD. Very recent studies also indicate that interventions targeting SC skills at an early age (3–4 years) are essential for enabling children to participate in everyday environments such as kindergartens (preschool) and interact with caregivers (Thanh et Phong, 2026, p.93). Recent research trends also focus on targeting SC skills through individual and comprehensive interventions, as the most effective approach to achieving social adaptation and preparing the child for school and social integration (O'g'li et al., 2026, p.219).

Furthermore, recent studies confirm that SC skills do not develop automatically with age in children with ASD, but rather require comprehensive developmental approaches such as Neurodevelopmental Behavioral Interventions (NDBIs), which integrate the principles of Applied Behavior Analysis (ABA) and principles of developmental theories in natural interactive contexts, where learning is integrated into stimulating play contexts. This approach was developed by Schreibman et al. (2015), and among the most prominent of these interventions are (JASPER, ImPACT, EMT, ESDM, PRT).

The JASPER model has emerged as an evidence-based practice within naturalistic behavioral developmental interventions, specifically designed to improve SC skills and JA through strategies based on interactive play in natural settings. It was developed by Connie Kasari and others through a foundational study published in 2006 at the University of California, following a series of studies and research conducted by Kasari and Peter Mundy on JA. This intervention draws its strength from its focus on four key components: JA to enhance nonverbal communication; symbolic play to build imagination and interaction; emotional regulation to support sustained interaction; and joint engagement as a mechanism to increase interaction (Kasari et al., 2022). Accordingly, the researchers argue that the importance of using JASPER lies in its ability to transform a child from a passive responder into an “active initiator,” as randomized controlled trials (RCTs) have demonstrated a significant positive effect and marked improvement in the development of these skills, as shown in studies by Kasari et al. (2008, 2012); Shire et al. (2019), along with subsequent notable improvements in language skills.

Although researchers’ interest in the JASPER intervention for improving SC skills in children with ASD has grown, the available literature remains fragmented in terms of study design, diversity of application contexts, and variability in reported results. Furthermore, most studies have focused on effectiveness in specific contexts, without providing an integrative understanding that synthesizes the various findings or explains the mechanisms underlying the intervention’s impact.

In this context, there is a need to adopt an integrative review approach that allows for the synthesis of evidence from diverse studies (experimental, descriptive, qualitative) to construct a comprehensive framework explaining the intervention’s mechanisms of action and patterns of impact across different contexts. Accordingly, this study seeks to bridge this knowledge and methodological gap by synthesizing and analyzing the available evidence in an integrative manner to explore common patterns across studies and enhance the theoretical and practical understanding of the JASPER intervention. This review also derives its significance from the fact that—to the best of the researchers’ knowledge—it is one of the first reviews to address the topic in the Arab world, specifically in the Algerian context, thereby enhancing its scientific value and

contributing to the enrichment of the Arabic literature in the field of ASD interventions. Based on the above, the following main question can be posed:

What is the nature of the available evidence regarding the JASPER intervention in improving social communication skills in children with autism spectrum disorder, and what patterns and mechanisms can be derived from a synthesis of the evidence?

2.Method

The study adopted a integrative review methodology based on the practical framework of Dhollande et al. (2021), which aims to integrate multiple lines of research evidence (quantitative and qualitative) to arrive at a comprehensive understanding of the phenomenon under study. This framework includes seven methodological steps to ensure the principle of reproducibility by other researchers, including the formulation of the research question; the search strategy; critical appraisal of the evidence; extraction and synthesis of results; thematic analysis of patterns; and derivation of practical and research recommendations; This review was characterized by a rigor comparable to that of integrative reviews, while providing a comprehensive picture of the topic and its mechanisms of action in various contexts.

It is also worth noting that the search procedures and data extraction were conducted in accordance with the PRISMA 2020 guidelines for reporting Systematic Reviews and Meta-Analysis, which Dohalland et al. (2021) cite as a key element in organizing integrative reviews.

2.1. Determine the Search Strategy

A systematic search was conducted in four electronic databases covering the period from 2007 to 2025, including Scopus, PubMed, ERIC, ProQuest and other sources. These databases were selected because each covers a significant portion of the studies relevant to such topics. The search was conducted using specific keywords with Boolean operators (AND/OR) and MeSH terms to ensure the comprehensiveness and relevance of the results to the review. The search strategy was also adapted to the requirements of each database.

2.2. Eligibility Criteria

To identify studies suitable for inclusion in integrative review to answer the research question, clear inclusion and exclusion criteria were established based on the PICOTS framework, which we will outline as follows:

- **Inclusion Criteria**

(1) Children diagnosed with ASD. **(2)** Focus on early childhood. **(3)** Implementation of the JASPER intervention. **(4)** Focus on SC skills; JA. **(5)**

RCTs; quasi-experimental studies; single-case studies; descriptive studies. (6) Studies published in English and Arabic. (7) Studies published between 2007 and 2025.

- **Exclusion Criteria**

(1) Participants not diagnosed with ASD. (2) Studies focusing on other developmental stages. (3) Studies that did not implement the JASPER intervention. (4) Studies not focused on SC skills or JA. (5) Theses; opinion pieces; conference papers. (6) Studies published before 2007. (7) Studies published in languages other than English or Arabic.

2.3. Data Extraction and Reduction

In accordance with the fifth step outlined in the methodological framework (Dhollande et al., 2021), data were extracted and reduced, as shown in (Table 1). This step aimed to transform the quantitative and qualitative data presented in the studies into condensed and organized data. The data were entered into an extraction table containing the following information: **Authors and year of publication; country; study design; participants' "size; age; severity of disorder"; intervention; duration of intervention and follow-up; measured variables; measurement tools; main outcomes.** This organization enabled effective comparisons of variables both visually and analytically, and contributed to data reduction while providing a comprehensive overview of each individual study or its comparison with other studies.

2.4. Evaluate the Quality of the Evidence

To ensure the quality of the studies included in the integrative review, all studies that passed the initial screening according to eligibility criteria were subjected to an evaluation of the quality of evidence based on the Council for Exceptional Children (CEC, 2014) criteria using eight indicators: **Context and Setting; Participant; Intervention Provider; Description of Intervention; Fidelity of Implementation; Internal Validity; Outcome Measures; and Data Analysis.** These were adopted as the primary assessment tool, as they are specialized and reliable criteria for evaluating the quality of evidence in the field of special education and behavioral interventions, allowing for the identification of studies with high-quality evidence "methodologically sound" or low-quality "methodologically flawed" evidence, so that they can subsequently be relied upon in interpreting the findings.

2.5. Thematic Analysis and Synthesis

In line with the objectives of the review, and drawing on the methodological framework of (Dhollande et al., 2021) Thematic analysis was used as a methodology for synthesizing the evidence. The process involved coding the data

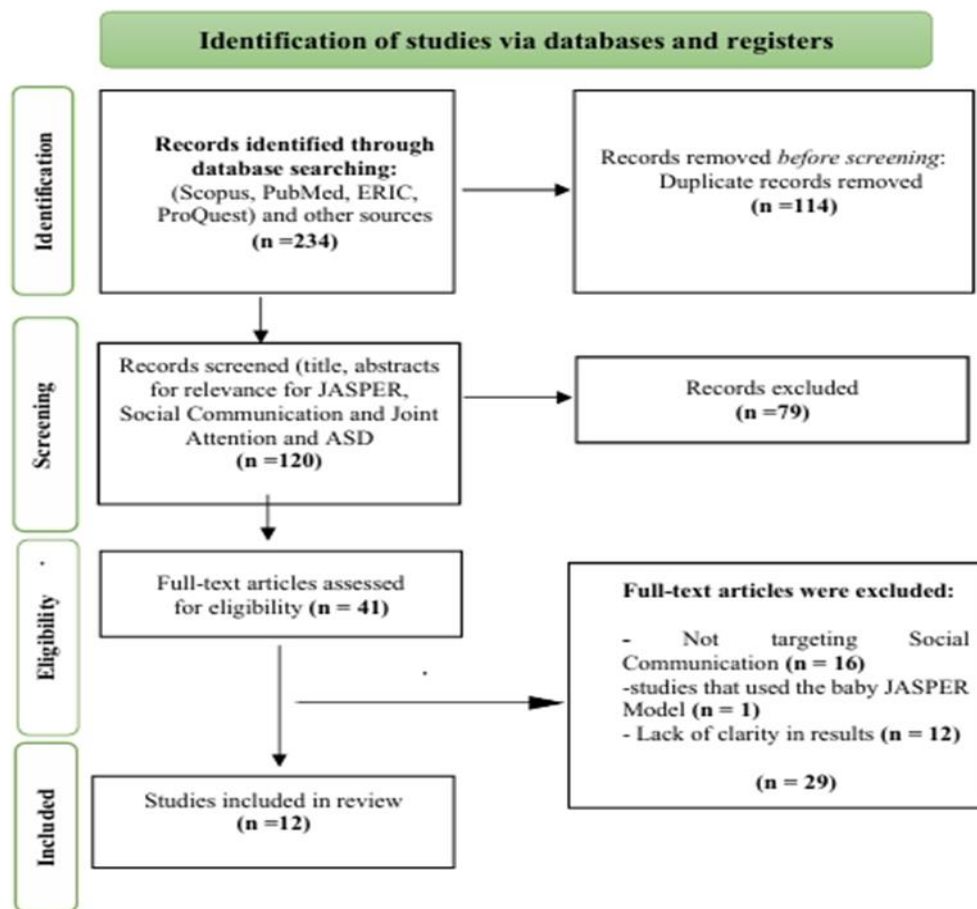
extracted from the studies and then classifying these codes into thematic patterns representing the mechanisms of change and the impact of the JASPER intervention, in order to ensure the construction of a coherent and reliable body of evidence.

3.Results

In this section, the final results of the research process and the evaluation of the quality of the evidence will be reviewed, in accordance with the procedural framework outlined by Dhollande et al. (2021). This stage begins with a summary of the research findings, which aims to provide a comprehensive quantitative and qualitative overview illustrating the breadth of the included literature. To ensure maximum transparency, a PRISMA flow diagram was included to visually represent the study selection process. This was followed by data extraction and reduction, where the included studies were entered into extraction tables, enabling the creation of a coordinated visual presentation to facilitate linking and comparing study results. This, in turn, paved the way for the thematic analysis phase to identify patterns across studies regarding the use of JASPER and SC skills.

3.1. Summarize the Search Results

After collecting studies from the databases, 234 records were identified and transferred to Rayyan.ai to support the screening process, where duplicates were automatically removed. Subsequently, 120 records were screened based on titles and abstracts, and 41 records were selected for full-text retrieval, while 79 records were excluded based on predefined criteria. In the second stage, the full text of the articles was evaluated, and in the final stage, 29 studies were excluded, and 12 final studies were included for review. The PRISMA 2020 flowchart was included to document the study selection process (Figure 1).

Figure 1. PRISMA flow diagram.

3.2. Results of Data Extraction and Study Characteristics

The data extracted from the included studies were organized into summary comparison tables, which helped reduce the volume of data and organize it, thereby facilitating direct comparison of the key variables across each study. Table 1 below presents comprehensive data summarizing the characteristics of the studies, to ensure the construction of a clear audit trail that allows for tracking the scientific evidence regarding the JASPER intervention and facilitates the subsequent objective analysis of study patterns.

Table 1. *Study Characteristics and Summary of Extracted Data*

Authors and Year	Country	Study Design	Participants	Intervention	Duration & Follow-up	Outcomes measured	Measures Tools	Main findings
Gulsrud et al. (2007)	USA	RCT	n=35 Age: 3 and 4 years. Degree: varying levels.	JASPER	Duration of intervention: 5 to 8 weeks, with one session per day for 30 minutes Follow-up period: NC	SC; JA; SP	Novel Probes	The results demonstrated the participants' ability to generalize SC skills and JA to new contexts, and the accuracy of implementation was 95%.
Kasari et al. (2008)	USA	RCT	n=58 Age: 3–4 years. Degree: varying levels.	JASPER	Duration of intervention: 5–6 weeks, at a rate of one 30-minute session per day Follow-up period: After 6 months and 12 months.	SC ;JA SP ; JE Language	ESCS; MSEL; ; TCX. RDLS	The results showed a clear and sustained improvement in SC skills, expressive language, JA, and SP, with the greatest effect observed in children with limited language skills.
Lawton et al. (2012)	USA	RCT	n=52 Age: 3 and 5 years. Degree: Not specified.	JASPER	Duration of intervention: 5–6 weeks at a rate of one session per day Follow-up period: Conducted at 6 and 12 months.	SC; JA; SP; language	ESCS; MSEL; RDLS.	The results showed positive effects of the intervention on the quality of JA, symbolic play, and language, compared to the control group.
Kaale et al. (2014)	Norway	RCT	n=61 Age: 2.5–5 years Degree: varying levels.	JASPER	Duration of intervention: 8 weeks At a rate of two sessions per day for 20 minutes. Follow-up period: After 6 months and 12 months	SC; IJA; JE Language	RDLS; SCQ; ESCS.	The intervention led to long-term improvements in IJA, social engagement, and SC skills in children with ASD, with no significant effect on language skills.
Shire et al. (2016)	USA	RCT	n=85 Age: less than 36 months. Degree: varying levels.	JASPER	Duration of intervention: 10 weeks One session per week for 1 hour Follow-up period: After 6 months.	SC; JA; JE	MBRS; TCX ; MSEL; TFC.	The pace of IJA and the RJA and joint interaction among parents and children in the JASPER group improved, and these improvements persisted up to 6 months after the intervention ended.
Shire et al. (2019)	USA	RCT	n=118 Age: 24 and 36 months. Degree: varying levels.	JASPER	Duration of intervention: 10 weeks At a rate of 3 sessions per week for 30 days Follow-up period: Continuous follow-up over two years.	SC ; IJA ; SP ; JE	TCX ; TFC ; SPACE.	The study confirms that JASPER is a successful and effective program for improving SC skills and JA, play, and behavioral regulation in children with ASD in early intervention settings, with evidence that the benefits persist beyond the intensive intervention period.

Table 1. Continued.

Authors and Year	Country	Study Design	Participants	Intervention	Duration and Follow-up	Outcomes measured	Measure s Tools	Main findings
Shire et al. (2020)	USA	RCT	n=113 Age: 24 and 36 months. Degree: Not specified.	JasPEER	Duration of intervention: 11 weeks One session per day for 30 minutes Follow-up duration: Follow-up after one month.	IJA ; SP ; JE ; SC	TCX ; MSEL ; SPACE.	Children in both groups made significant gains in social communication, particularly IJA and play, with no substantial differences between the individual and dyadic interventions across the two groups.
Shih et al. (2021)	USA	RCT	n=179 Age: 2–5 years. Degree: varying levels.	JASPER	Duration of intervention: 10–11 weeks at a rate of 30 minutes per session. Follow-up duration: One month later.	IJA; JE; SC; Language	MSEL; TCX	The JASPER intervention achieved a significant increase in the time children spent in joint engagement, leading to improvements in the IJA and SC skills; this improvement was also associated with positive effects on language.
Aldarmaki (2023)	UAE	Quasi-experimental	n=7 Age: 6–8 years. Degree: Mild.	JASPER	Duration of intervention: Approximately 4 months at a rate of 3 sessions per week for 1 year Follow-up: One month later.	SC	JTM.	The JASPER intervention had positive effects on SC skills and JA, while reducing the severity of ASD symptoms.
Khadr (2023)	Egypt	Quasi-experimental	n=5 Age: 6–9 years. Degree: varying levels.	JASPER	Duration of intervention: 12 weeks at a rate of 3 sessions per week for 20 minutes Follow-up duration: One month later.	SC	SC Scale	The intervention contributed to improving various SC skills among participants, as well as JA skills, with the effect persisting after the follow-up assessment.
Shih et al. (2024)	USA	RCT	n=86 Age: Less than 3 years. Degree: varying levels.	JASPER	Duration of intervention: 10 weeks at a rate of two sessions per week for 30 minutes Follow-up period: After 3 months.	JA ; JE ; SC	MSE ; CD ; SPC	The caregiver-targeted intervention JASPER led to a significant improvement in caregiver adherence and the sustainability of intervention strategies, which contributed to improved JA and SC skills in children with ASD compared to the control group.

Notes: **JA:** Joint Attention, **RJA:** Response to Joint Attention, **IJA:** Initiating Joint Attention, **SP:** Symbolic Play, **JE:** Joint Engagement, **SC:** Social Communication, **SPACE:** Short Play and Communication Evaluation, **ESCS:** Early Social Communication Scales, **RDLS:** Reynell Developmental Language Scales, **MSEL:** Mullen Scales of Early Learning, **MBRS:** Maternal Behavior Rating Scale, **TFC:** Treatment Fidelity Checklist, **TCX:** Teaching Assistant–Child Play Interaction, **PCX:** Parent–Child Interaction, **JTM:** JASPER Tasks Measure, **SCQ:** Social Communication Questionnaire, **CD:** Caregiver Diary, **SPC:** Symbolic Play Coding.

Based on the descriptive data presented in Table 1, this review will examine the most important methodological and demographic features of the studies included, focusing on: **(1) Sample inclusivity and developmental characteristics:** The review included a large database of participants, numbering approximately 500 children across all studies. It was noted that the majority of studies focused on early intervention in the preschool stage, while Arab studies contributed evidence regarding the implementation of interventions with school-aged children. **(2) Methodological diversity and quality of evidence:** In line with the core objective of the review—which allows for the integration of diverse methodologies to comprehensively understand the subject of study—the review included various research designs (RCTs) such as the studies by Kasari et al.(2008, 2012); Shire et al. (2019, 2020); Shih et al.(2024) as high-quality evidence, and quasi-experimental studies such as those by Aldarmaki (2023) and Khader (2023) as supporting evidence for the findings of the integrative review. **(3) Diversity of intervention settings:** The data extraction results revealed a variety of settings in which the JASPER intervention was implemented, extending beyond research centers and university clinics to include classrooms led by teachers, and home settings through training parents in intervention strategies, which demonstrates the intervention’s flexibility and adaptability across various contexts. **(4) Geographic scope and cultural appropriateness:** The table above clearly shows the extent of the intervention’s international implementation over time, ranging from the original foundational studies launched at the University of California, Los Angeles (UCLA) to recent applications in the Arab context(Egypt; UAE), which confirms that the inclusion of these local studies reveals the high adaptability of the JASPER intervention for implementation in Arab contexts beyond the Western environment from which it originated, without any cultural or educational barriers preventing its application in Arab society or within other cultural contexts. **(5)The results of the included studies:** all indicate that the JASPER intervention has a positive effect on improving SC skills, as well as response and initiative skills related to JA, along with increased joint engagement, which was statistically proven to be the mediating variable explaining 69% of the intervention’s effect on the development of skills such as language, The data also recorded a pattern of long-term sustainability of acquired skills, as in the study by Kasari et al. (2012), with a close correlation observed between the continuity of the child’s skill development and the caregiver’s responsiveness levels and accuracy in implementing intervention strategies, as in the studies by Shire et al. (2019) and Shih et al. (2024). In the Arab context, study results showed

statistically significant differences in the improvement of SC skills and a marked reduction in the severity of ASD symptoms among Arab participants.

3.3. Critical Appraisal of Search Results

The quality of the evidence in the integrative review was assessed according to the Council for Exceptional Children (CEC, 2014) criteria, by evaluating it against eight core indicators. The results of the evidence quality assessment concluded that 10 out of 12 studies classified as high-quality evidence or “methodologically sound,” as they met all eight quality indicators, which in turn included randomized controlled trials ranging from the study by (Gulsrud et al., 2007) up to the most recent one (Shih et al., 2024), which reinforces the reliability and accuracy of the findings in this review.

Meanwhile, two studies were classified as **low-quality evidence** or “methodologically flawed”: the study by Aldarmaki (2023) and the study by Khader (2023). The methodological shortcomings in these studies primarily focused on three key indicators: **(QI 5)** accuracy of implementation; **(QI 6)** internal validity, in addition to the failure to meet **(QI 8)** the data analysis indicator in the study by Khader (2023). In line with the principles of Dhollande et al. (2021), they were included in the thematic analysis despite their low quality and were considered as supporting evidence for the results of the integrative review.

3.4. Results of Thematic Analysis

After completing the data extraction phase, we moved to the thematic analysis phase according to the framework of Dhollande et al. (2021), using thematic analysis to identify patterns and organized relationships among the results of the integrative review studies. This process was carried out by grouping the studies and coding them according to the common patterns among them (Themes), reflecting the logical structure of the evidence regarding the intervention’s effectiveness, its mechanisms of action, and contexts of application, as well as the sustainability of its impact in the short and long term. Thematic analysis aims to provide a comprehensive understanding that goes beyond the narrative description of the studies. The results of the thematic analysis are presented in (Table 2).

Table 2.*Thematic formation and patterns derived from the included studies*

Studies	Direction of Effect	Extracted Codes	Themes	Results
Shih et al.(2021)	↑ Positive	Developmental Mediation	Mechanism of Change and Mediation	The results demonstrated that improvements in joint engagement directly and indirectly led to increased SC skills and a subsequent 69% increase in JA and language initiatives among children with ASD.
Shire et al.(2019)	↑ Positive	Peer Generalization	Generalization of Skills to Peers and Voltage Drop	The intervention succeeded in generalizing SC skills and JA toward peers; however, in the absence of research supervision in the follow-up assessment, the use of complex strategies by teachers declined.
Shire et al.(2020)				
Shih et al.(2024)	↑ Positive	Caregiver Strategies	Moderating Variables	Gains in SC and JA continued to grow strongly in follow-up assessments among children with ASD whose parents possessed high levels of natural interaction strategies and accuracy in implementing JASPER intervention strategies.
Shire et al.(2016)				
Kaale et al.(2014)	↑ Positive	Stability of gains	Short-term Sustainability	Teachers succeeded in increasing and generalizing SC skills and IJA, and sustaining this increase in the natural school environment for a full year.
Gulsrud et al.(2007)	↑ Positive	Long-term functional sustainability	Qualitative transformation and long-term sustainability	Participants demonstrated qualitative improvements in SC and JA skills, particularly when associated with positive emotions and SP, and sustained positive growth one year after the intervention, thereby laying the foundation for the development of functional developmental skills such as expressive language after 5 years.
Lawton et al.(2012)				
Kasari et al.(2008)				
Kasari et al.(2012)				
Khader (2023)	↑ Positive	Cultural Suitability	Applicability in the Arab Context	The two studies demonstrated that the intervention is feasible in various cultural contexts, particularly Arab ones, as it improved SC skills and maintained its effects one month after the intervention ended.
Aldarmaki(2023)				

The results of the thematic analysis of the studies included in the review (Table 2) revealed several key patterns derived from the scientific evidence regarding the JASPER intervention. We briefly mention some of them here, to be further explained in the discussion section, namely **(The pattern of change mechanisms and mediation; The sustainability of the effect; Pattern of moderating variables; Effectiveness and applicability in the Arab context).**

4.Discussion

A careful review of the tables and study results clearly reveals a consistent positive direction of effect in favor of the JASPER intervention in improving SC skills in all their dimensions across all included studies, This hierarchical arrangement of studies by patterns provided a comprehensive visual representation of the effect pathway, allowing for the observation of consistency

in the direction of effect despite variations in settings (clinic; home; school), contexts (foreign; Arabic), and intervention implementers (researchers; teachers; parents). Based on the structural presentation of the data, a set of patterns emerged from this data, which explain the mechanisms of the intervention; the pathways of its sustained impact; and the exploration of moderating factors that contributed to its success or limited its effectiveness; as well as exploring its applicability in other cultural contexts, particularly the Arab context, given the limited studies on the subject.

4.1. Pathways of Sustainability and Qualitative Transformation of SC Skills (Long-Term)

The most significant pattern emerging from this synthesis highlights how the impact of the JASPER intervention is not limited to a quantitative improvement in SC skills, but extends to bring about a qualitative transformation in their quality and nature, with exceptional sustainability over the years; This pattern is based on a body of high-quality evidence, specifically the longitudinal data from the original study by Kasari et al.(2006) and the four studies derived from it (Gulsrud et al., 2007; Kasari et al., 2008, 2012; Lawton et al., 2012), as well as the study by Kaale et al.(2014). This pattern can be broken down into two pathways:

Effectiveness of the intervention in improving SC skills and JA: The included studies indicate that the intervention based on the JASPER model produces significant improvements in SC skills and JA skills, areas in which children with ASD exhibit significant deficits, and consequently face clear difficulties in language and SC as a whole. Evidence from longitudinal studies (Gulsrud et al., 2007; Lawton et al., 2012) indicates that children first acquire the skill of RJA, supported by interventionists; but the deeper impact of the intervention lies in the development of spontaneous initiative—such as spontaneous pointing to initiate interaction—which is the most challenging skill in which children with ASD exhibit significant deficits and impairments, and which is directly linked to subsequent language development. Furthermore, a study by Lawton et al. (2012) revealed that children with ASD not only learned to perform JA skills automatically, but a clear improvement was also observed in the quality of JA, as the children's trajectories showed an increasing association between IJA and the exchange of positive emotions with caregivers, meaning that children do not merely perform the skill mechanically but recognize its true communicative and emotional purpose.

A trajectory of sustained impact and long-term developmental progress: with a focus on high- quality evidence; follow-up studies such as those by Kasari

et al. (2008); Gulsrud et al. (2007), and Shire et al. (2019) sustainable and positive growth in SC skills and JA skills, particularly initiative, one full year after the intervention ended. This also had a positive impact on the cognitive and linguistic development of the participating development of the participating children. This trajectory also supports the findings in the study by Kaale et al. (2014), which demonstrates that teachers successfully increased the generalization of SC skills and sustained them within the school environment for a full year after the intervention ended. Furthermore, the 5-year follow-up study Kasari et al. (2012), that training in SC skills— specifically the JA component—at an early stage serves as a cornerstone for the development of other, more complex developmental skills such as expressive language and social interaction. It is worth noting that the participating children began the intervention with low language levels; however, they achieved greater language growth after receiving the JASPER intervention compared to their peers.

4.2. Exploring Mechanisms of Action and Generalizing the Effect

This integrative model reveals the mechanisms through which the JASPER intervention succeeds in bringing about sustainable change, and how this impact extends beyond interaction with adults to include peers, through:

Direct effect mechanism and mediating variables: The study based on mediation analysis (Shih et al., 2021) provided conclusive evidence that improvement in joint engagement is the mechanism and mediating variable that led to increased SC skills. as well as a 69% improvement in language skills among children with ASD. Additionally, some follow-up studies and secondary analyses provided an explanation for the mechanism of sustained effects; evidence indicated that the inclusion and training of “caregivers and parents” plays a crucial role in maintaining these gains.

Generalization of skills to peers and adults: When tracking the path of SC skill generalization from the adult-child context to the child-peer context, we find that the modifications made to the JasPEER intervention to suit peers—as in the study by Shire et al. (2020), have led to significant gains in SC skills—JA, regulation, and symbolic play—on par with the adult-directed intervention. The study also noted that classrooms supervised by adults using the JASPER intervention showed significantly greater development in levels of constructive play, suggesting that complex skills may still require more direct adult guidance and supervision, as illustrated by the study by Kasari et al.(2012) that one of the key strengths of the JASPER intervention is the ability of children with ASD to

generalize acquired skills to include people who did not participate in the training (such as parents and teachers) and new contexts over the long term.

4.3. Moderating Variables

This pattern highlights the factors and surrounding conditions that can increase or diminish the effectiveness of the intervention over time, through:

Baseline characteristics and parental involvement serving as moderating variables: the data showed that the magnitude and persistence of the effect were not consistent across all participants, but rather depended on pre-intervention characteristics (Baseline Characteristics). At the child level, it was found that initial play skills, such as “constructive play ability,” serve as a strong predictor of a child’s ability to acquire expressive language and develop SC skills after 5 years (Kasari et al., 2012). At the caregiver level, a study by Shire et al. (2016) indicated that children whose caregivers exhibited high levels of responsiveness combined with frequent use of strategies spent significantly more time in child-initiated joint engagement compared to others. Furthermore, an analysis by Shih et al. (2024) demonstrated that parents’ interaction style prior to the intervention served as a moderator of the intervention’s effectiveness; as parents with high levels of natural interaction strategies were better able to implement the intervention (fidelity) and sustain the use of these strategies after the intervention ended, leading to the continuity of SC skills gains during the follow-up period.

The influence of the environmental context and the phenomenon of reduced effort in community: implementation was revealed through a review of studies and tracking the pathways of intervention transfer from controlled clinical settings to natural and community settings (classrooms and teacher-led training), highlighting factors that may affect the intervention. A study by Shire et al. (2019) noted that when external support from the research team was withdrawn, community caregivers succeeded in maintaining foundational strategies (environmental arrangement; child modeling) but experienced a decline—or what is known as the “voltage drop” phenomenon—in the application of complex strategies (building advanced play routines). In the first cohort, which received intensive supervision and support, children with ASD achieved significant improvement in JA, whereas in the second cohort, where teachers implemented the intervention without supervision, their adherence to complex strategies declined, which was reflected in the children’s outcomes, showing only a slight improvement that was not statistically significant. Therefore, the success of

teaching assistants in sustaining the implementation of the intervention is attributed to integrating the intervention into the routine classroom program rather than treating it merely as an external addition, with local supervision. This transforms the intervention into a part of the institution's daily life—a process known as institutionalization—which is a fundamental solution to the phenomenon of effort decline.

4.4. Feasibility and Effectiveness of the Intervention in the Arab Context

This model provides evidence of the intervention's flexibility, applicability, and adaptability to cultural contexts different from the controlled clinical settings from which it originated, and Arab studies have been used to demonstrate this model.

Effectiveness and sustainability of the impact in the Arab context: despite the limited number of Arab studies that have implemented the intervention in the Arab environment, the trends in the impact were positive. A study by Khader (2023), conducted in the Egyptian setting, indicated that the intervention led to a statistically significant improvement SC skills, which positively and directly reduced the severity of ASD symptoms among the participating children. Conversely, Aldarmaki (2023) study in the UAE context confirmed the sustainability of the positive gains from the intervention tasks and their impact on SC skills in general, even one month after the intervention ceased, reflecting its adaptability and applicability in local environments. Both studies also showed that no modifications were made regarding cultural or linguistic aspects, meaning that the intervention is highly flexible for application in various contexts and environments, and there are no cultural factors preventing its application in the Arab context.

5. Conclusion and Implications

The scientific evidence from the integrative review confirmed that the JASPER intervention is an effective NDBIs with a clear impact on improving SC skills in children with ASD. It is also highly flexible in implementation, as it does not merely train the child in skills but successfully creates the context in which these skills develop, addressing the core deficits of ASD by focusing on JA and joint engagement as key mechanisms for developing SC skills and subsequent developmental characteristics such as language. The intervention has also demonstrated sustained effects in the short term (1 to 6 months) and the long term (1 to 5 years), making the skill an integral part of the child's personality rather than merely a temporary, experimental response. Furthermore, the intervention is

characterized by its ability to be implemented in various settings (home; clinic; school) and by different practitioners (therapist; parents; teachers), and is adaptable to different cultural settings. Based on the results of the final synthesis of the evidence, as well as the results of the thematic analysis, the integrative review concluded with a set of implications, namely:

(1) At the practical level: The JASPER protocol must be adopted as the first-line option in early intervention centers and specialized institutions in Algeria and the Arab world in general, with a focus on the natural environment and mediating mechanisms such as JA and joint engagement as key drivers for improving SC skills.

(2) In terms of education and training: there must be a shift from training only the child to a model that trains caregivers, as the results demonstrated that the accuracy of parents' implementation of intervention strategies, as well as the extent of their responses and interactions, are the moderating variables in the sustainability and generalization of the effect. Additionally, teachers should be trained to incorporate the intervention as a core routine within the classroom.

(3) At the level of scientific research: the researchers recommend the need to conduct RCTs in the Arab world, and in Algeria in particular, as the current review is the first Algerian study to address the JASPER intervention.

Study Limitations

The integrative review revealed the existence of certain methodological and practical limitations, the most significant of which are: **(1)** The scarcity of rigorous Arabic studies based on RCTs designs compared to international studies, which necessitates caution when generalizing statistical results to a specific population. **(2)** The absence of Algerian RCTs addressing the JASPER intervention, which constitutes a knowledge and geographical gap preventing the generalization of results. **(3)** Analysis of the included studies revealed a clear gap regarding the sustainability of the intervention when transferred from the clinical (laboratory) setting—which demonstrated high positive results for the —to the natural community setting (classrooms), where teachers showed a decline in the use of advanced and complex intervention strategies, leading to reduced effectiveness due to what is known as the “diminishing effort” phenomenon.

Compliance with Ethical Standards

For review studies, formal consent was not required.

Disclosure Statement

The authors declare no conflict of interest related to this review.

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