



## Applying Syntax Bootstrapping to Facilitate Early Language Skills in Children with Autism

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### ABSTRACT

This study investigates the role of syntactic bootstrapping as a linguistic strategy to support language development in children with autism within inclusive elementary education settings. Syntactic bootstrapping refers to the process by which learners use syntactic cues to infer the structure and meaning of utterances. Employing a qualitative case study design, the research involved classroom observations, in-depth interviews with teachers, and document analysis of autistic students in an inclusive school context. The findings reveal that syntactic bootstrapping strategies, when systematically adapted to the cognitive and linguistic profiles of children with autism, enhance their ability to comprehend sentence structures and improve both receptive and expressive language skills. Specifically, structured exposure to patterned sentences and guided interaction with syntactic cues were found to facilitate more accurate interpretation and production of utterances. The study offers several practical implications. First, it highlights the need for teachers to integrate syntax-focused scaffolding techniques into daily instruction, such as explicit modeling of sentence structures and repetition of patterned input. Second, it suggests the development of instructional materials that emphasize consistent and meaningful syntactic patterns. Third, at the policy level, the findings support the inclusion of linguistically-informed intervention strategies in teacher training programs and inclusive education guidelines to ensure more equitable learning opportunities for children with autism.

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## 1. Introduction

Inclusive education, as emphasized in the Sustainable Development Goals (SDGs), prioritizes equitable access, participation, and learning outcomes for all learners, including children with autism (UNESCO, 2024). Within this framework, language development particularly syntactic competence plays a central role in enabling effective communication, academic engagement, and social interaction (Tager-Flusberg & Kasari, 2023). However, children with autism frequently experience challenges in acquiring and processing syntactic structures, which in turn limits their participation in inclusive classroom settings and constrains broader educational outcomes (YISADDI, 2024).

From a psycholinguistic perspective, syntactic bootstrapping offers a theoretically grounded mechanism through which learners use grammatical structures to infer meaning (Göksun et al., 2020; L. Naigles, 2017). While this mechanism has been widely examined in typical language acquisition, its potential as a structured linguistic strategy for supporting language development in children with autism remains underexplored, particularly in pedagogical contexts (Goodwin et al., 2022; Swensen et al., 2017). This gap is significant, given that children with autism often demonstrate sensitivity to patterns and predictable structures, suggesting that syntactic cues may serve as an effective entry point for language learning when appropriately scaffolded (Lailiyah & Gigik, 2024).

Existing studies on autism and language development have largely emphasized pragmatic and social communication deficits, with comparatively less attention to the role of syntax as a foundational component of language competence (Pettersson-Bloom & Holmqvist, 2022; Smith & Al, 2020). Although recent research has begun to address structural aspects such as morphology and syntax, these studies tend to remain within cognitive-linguistic analysis and offer limited insight into how such mechanisms can be translated into classroom-based practices. In parallel, instructional approaches in inclusive education particularly in the Indonesian context continue to rely predominantly on behavioral or visual-based methods, with minimal integration of linguistically-informed strategies.

This disconnect between linguistic theory and pedagogical practice highlights a critical research gap (Kover et al., 2022). Specifically, there is a lack of empirically grounded studies that examine how syntactic bootstrapping can be operationalized as a language support strategy within inclusive classrooms for children with autism (Desiningrum et al., 2020; Eigsti & Fein, 2021). Furthermore, limited context-sensitive research in Indonesia restricts the development of adaptive, evidence-based instructional models that address the linguistic needs of these learners.

Addressing this gap, the present study investigates the application of syntactic bootstrapping as a linguistically-informed strategy to support language development in children with autism in inclusive elementary education settings. Rather than positioning syntactic bootstrapping as a diagnostic tool, this study conceptualizes it as an instructional approach that can be systematically adapted to learners' cognitive and linguistic profiles. By doing so, the study aims to contribute both to the theoretical refinement of syntactic bootstrapping in atypical language development and to the practical advancement of inclusive pedagogical strategies that promote more equitable learning opportunities.

Research on language development in children with autism has seen significant advancements in the past decade. Several previous studies, such as Paul et al. (2019), Paul & Norbury (2022) dan Tager-Flusberg (2016) Tager-Flusberg (2016) and Paul et al. (2019), have focused on pragmatic and social communication aspects, while more recent studies have begun to explore the structural aspects of language, such as morphology and syntax (Aronoff et al., 2016; Göksun et al., 2020). However, there remains a limitation in research specifically addressing how natural language acquisition mechanisms, particularly syntactic bootstrapping, can be systematically applied within inclusive education settings.

Research by Naigles (2020) has reinforced the evidence regarding the role of syntactic bootstrapping in early childhood language learning, including for children with developmental disorders. However, its primary focus remains within the cognitive-linguistic domain, without extending to pedagogical contexts or classroom practices in inclusive education. Similarly, the study by Kover et al. (2022) indicates that children with autism have the potential to utilize syntactic cues, yet it has not detailed practical strategies for implementing these cues in formal educational settings.

On the other hand, studies on learning strategies for autistic children within the context of inclusive education in Indonesia tend to focus primarily on visual methods, ABA (Applied Behavior Analysis), or sensory-motor approaches. There has yet to be research that explicitly integrates the syntactic bootstrapping approach as an adaptive and contextual linguistic learning strategy in inclusive classrooms. Additionally, the scarcity of local research that combines theoretical linguistic approaches with inclusive pedagogical principles hinders the development of evidence-based educational policies.

This study offers a novel contribution by reconceptualizing syntactic bootstrapping from a cognitive-linguistic mechanism into a pedagogically actionable strategy for supporting language development in children with autism within inclusive classroom settings. While previous research has primarily examined syntactic bootstrapping in controlled experimental or theoretical contexts, this study bridges the gap between theory and practice by demonstrating how syntactic cues can be systematically adapted into classroom-based instructional scaffolding. Additionally, it provides context-specific evidence from Indonesia, where linguistically-informed intervention models in inclusive education remain limited.

## **2. Method**

### **2.1 Research Design**

This study employs a qualitative approach with an exploratory case study design, aiming to gain an in-depth understanding of the implementation of syntactic bootstrapping strategies in the learning process of children with autism in an inclusive educational setting. This approach was chosen because it is capable of capturing the complexity of linguistic and pedagogical interactions in natural settings, as well as allowing for the holistic exploration of the learning experiences of children (Creswell & Poth, 2018).

### **2.2 Data Collection Technique**

Primary data is collected directly from the field through several methods. First, direct observation of teaching and learning activities in the inclusive classroom setting provides firsthand insight into how the syntactic bootstrapping strategy is implemented during lessons. Second, in-depth interviews are conducted with key stakeholders, including special education teachers (GPK), regular classroom teachers, and parents of children with autism. These interviews aim to gather detailed perspectives on the educational practices, challenges, and experiences related to the learning process. Lastly, documentation of student learning outcomes and recordings of verbal

interactions during learning activities are used to analyze the linguistic progress of the children. This documentation offers a rich, qualitative record of the students' development in real-time classroom settings. Secondary data, on the other hand, is sourced from various academic and educational documents. This includes reviewing curriculum documents and teaching modules to understand the structured learning framework within the inclusive classroom. Additionally, student learning progress notes are analyzed to assess how individual students are advancing linguistically and academically throughout the study. Finally, the scholarly literature is reviewed, with a focus on syntactic bootstrapping, teaching strategies for children with autism, and policies related to inclusive education. These secondary sources provide a broader theoretical and policy context that supports the primary data, contributing to a comprehensive analysis of the research topic.

### 2.3 Participant

The study focuses on 10 children diagnosed with mild to moderate autism, aged between 4 and 8 years, who are part of inclusive elementary classrooms. It also involves the teachers responsible for implementing linguistic approaches in their teaching practices. The research is conducted across three inclusive elementary schools in Kediri City, selected based on their inclusivity and accessibility criteria.

The sampling strategy employed in this study is **purposive sampling** (Petersson-Bloom & Holmqvist, 2022), which is considered appropriate for qualitative case study research aiming to obtain in-depth and context-specific insights rather than generalizable findings. Participants were deliberately selected based on specific criteria: (1) children formally identified with autism spectrum conditions within the mild to moderate range, (2) active participation in inclusive classroom settings, and (3) exposure to structured language learning activities. These criteria ensure that the selected participants are information-rich cases that can meaningfully illustrate the implementation of syntactic bootstrapping strategies.

Furthermore, the inclusion of multiple schools is intended to enhance the **variation of contexts**, allowing the study to capture diverse instructional practices and classroom dynamics. While the sample size is relatively small, it aligns with the exploratory nature of qualitative case studies, where depth of analysis is prioritized over breadth. This approach enables a nuanced understanding of how linguistic strategies are adapted to individual learner profiles within inclusive educational environments.

### 2.4 Data Analysis

The data were analyzed using thematic analysis, following several distinct stages. First, all observational and interview data were transcribed, followed by a process of data reduction to select only the relevant information aligned with the research focus. This reduction ensures the analysis remains focused on the key aspects of the study, eliminating any irrelevant data. Next, each segment of data was assigned a code to identify patterns related to syntax, linguistic strategies, and the children's responses to the learning activities. This coding process helped categorize key elements that directly related to the research questions and objectives. Following this, the main themes were identified, such as sentence structure comprehension, repetition strategies, linguistic modelling, and children's syntactic responses. These themes emerged from the repeated occurrence of specific data patterns, providing deeper insight into the focus areas of the study. Finally, the classified data was interpreted to understand how the syntactic bootstrapping strategy was implemented and its impact on the achievement of inclusive learning outcomes. The interpretation aimed to assess the strategy's effectiveness in promoting language development among children with autism and its contribution to the broader goals of inclusive education. The analysis was conducted iteratively, allowing for the refinement of insights as new data emerged. To ensure the validity and reliability of the findings, triangulation of techniques and sources was employed. This method helped to corroborate the results and enhance the overall credibility of the study (Lincoln & Guba, 1985; Santosa, 2021).

Despite its contributions, this study has several limitations that should be acknowledged. First, the relatively small sample size and the use of purposive sampling limit the generalizability of the findings beyond the specific contexts studied. However, this is consistent with the qualitative case study design, which prioritizes depth and contextual understanding over statistical generalization. Second, the study is confined to inclusive elementary schools within a single geographical area, which may not fully represent the diversity of inclusive education practices across different regions. Variations in institutional support, teacher expertise, and classroom resources may influence the implementation of linguistic strategies such as syntactic bootstrapping. Third, the reliance on qualitative data, including observations and interviews, may introduce interpretive subjectivity. Although triangulation was employed to enhance credibility, the findings remain influenced by the perspectives of participants and the researcher's analytical lens. Finally, this study focuses primarily on short-term observations of language development within classroom interactions. It does not examine the long-term impact of syntactic bootstrapping strategies on sustained language acquisition outcomes. Future research is therefore recommended to incorporate longitudinal designs and mixed-method approaches to provide a more comprehensive evaluation of the effectiveness of syntactic-based interventions.

### 3. Result

To facilitate understanding and reading, the results of the research are described first and then followed by a discussion. Result subtitles and discussion subtitles are presented separately. This section should be the main part, at least 60% of the entire body of the article.

#### 3.1. *Strengthens Children`s Lexical Understanding*

One of the key findings of this study is that children with autism demonstrate a more accurate understanding of word meanings when the words are presented within a complete and consistent sentence structure. The syntactic bootstrapping strategy used by the teacher, through simple subject-verb-object sentence models, helps children systematically link syntactic structure with lexical meaning.

##### Data 1

**Teacher's Utterance:**

"Father reads the newspaper. What are you reading?"

**Child's Response:**

"A book."

The child utilized the sentence structure that had already been introduced to construct a response by substituting the object. This reinforces the connection between the sentence structure and the meaning of the verb "reads."

##### Data 2

**Teacher's Utterance:**

"Brother drinks milk. What are you drinking?"

**Child's Response:**

"Drinking juice."

The child identifies the syntactic pattern and substitutes the object based on personal experience, demonstrating the ability to process the predicate-object structure.

##### Data 3

**Teacher's Utterance:**

"Mother carries a bag. What is Father carrying?"

**Child's Response:**

"A bicycle."

The child generalizes the sentence structure learned and applies it in a new context, demonstrating the transfer of syntactic structure.

##### Data 4

**Teacher's Utterance:**

"Mother writes on the board. You write in the book. Try repeating: Where do you write?"

**Child's Response:**

"Writing in the book."

The above exchange illustrates the success of the strategy of repeating sentence structures to reinforce the child's understanding. The child not only memorizes the word "writes," but also applies it within the correct syntactic structure, demonstrating comprehension of the subject + verb + locational phrase pattern. This reflects the principle of syntactic bootstrapping, where the sentence structure serves as a cue for the meaning of the word.

#### 3.2. *Functional Sentences Modeling Enhances Verbal Production*

The teacher employs a functional sentence modelling strategy by altering the subject or object to expand the child's response variations. This strategy has proven effective in encouraging the child to construct independent sentences based on previously recognized patterns.

##### Data 5

**Teacher's Utterance:**

"Sinta sweeps the floor. Dika sweeps the yard. What are you sweeping?"

**Child's Response:**

"Sweeping the table."

The child modifies the object to align with a context more familiar to personal experience, using a known pattern. Although the response semantically lacks precise meaning, the syntactic pattern is correctly established, with "sweeping" (verb) and "table" (object) following the structure.

##### Data 6

**Teacher's Utterance:**

"We have breakfast. They have lunch. Now, when do you eat?"

**Child's Response:**

"I eat at night."

In this case, the child applies the sentence pattern by altering the time of day, demonstrating the ability to generalize and use the structure of the functional sentence model effectively.

### 3.3. *Functional Sentences Encourage Children to Use Temporal Variations as Predicate Complements, Strengthening Syntactic Awareness*

The teacher employs a functional sentence modelling strategy by altering the subject or object to expand the child's response variations. This strategy has proven effective in encouraging the child to construct independent sentences based on previously recognized patterns.

**Data 7****Teacher's Utterance:**

"Father sleeps in the room. The cat sleeps on the sofa. Where does the dog sleep?"

**Child's Response:**

"Sleeping on the terrace."

The child demonstrates an understanding of prepositions and locational phrases within sentence structure, gained from previous modelling of sentence patterns. Although the child's response does not fully adhere to the syntactic structure, the pragmatic meaning has been understood correctly.

**Data 8****Teacher's Utterance:**

Ali eats rice. Mother eats bread. Now, what are you eating?"

**Child's Response:**

"I eat chicken."

The child successfully substitutes both the subject and object of the sentence according to context, showcasing syntactic inferencing ability. This indicates that the child utilizes the previous sentence structure to understand the grammatical function of words. This demonstrates that the child's ability to construct sentences is not simply a result of memorization, but a deeper processing of structures, at the core of syntactic bootstrapping (Naigles, 2020).

### 3.4. *The use of Visuals and Gestures strengthens the syntactic Structure*

The visualization of actions and the use of gestures clarify the relationships between elements in a sentence, thereby reinforcing syntactic associations for children. This multimodal combination accelerates linguistic input processing in children with autism, particularly those with a visual-kinaesthetic learning style.

**Data 9****Teacher's Utterance and Action:**

(Teacher points to a picture of a person running on a field.)

"He is running on the field. Now, look at this picture, who is this?"

**Child's Response:**

"He is walking."

The child modifies the verb based on the new visual context, demonstrating an understanding of sentence structure from the visual information. The child can construct a sentence following the subject + verb pattern.

**Data 10****Teacher's Utterance and Action:**

(Teacher holds up a picture of a child drawing a flower.)

"This child is drawing a flower. What are you drawing?"

**Child's Response:**

"Lily is drawing a car."

The visual aids help the child recognize sentence structure and substitute the object based on the context shown in the image.

**Data 11****Teacher's Utterance and Action:**

(Teacher demonstrates the sitting motion and then points to a picture of a child sitting in a chair.)

"He is sitting in the chair. Where are you sitting?"

**Child's Response:**

"I'm on the floor."

The child integrates body movement, visual cues, and sentence structure cohesively, enhancing syntactic awareness and semantic understanding.

**Data 12****Teacher's Utterance and Action:**

(Teacher points to a picture of a person reading a book.)

"He is reading a book. Now, you (while pointing to the child), what are you reading?"

**Child's Response (while looking at the picture):**

"Reading a red book."

The child not only imitates but modifies the object to "red book," demonstrating an understanding and expansion of sentence structure. With visual cues and situational context, the child is better able to process the subject-verb-object relationship within the sentence structure.

### 3.5. *Consistency in Sentence Structure Aids Language Paradigm*

The repetition of consistent sentence structures over several days enhances the child's predictive ability regarding word order in sentences. The child begins to demonstrate the ability to anticipate the word that will appear in a sentence based on its position and structure.

**Data 13****Teacher's Utterance:**

"He is eating... (pause)"

**Child's Response:**

"Bread"

The child demonstrates the ability to complete the sentence based on a recurring pattern previously learned.

**Data 14****Teacher's Utterance:**

"I am drawing... (pause with gesture)"

**Child's Response:**

"A big house"

Filling in the gap in the sentence shows the child's linguistic predictive ability based on consistent exposure to sentence structure.

**Data 15****Teacher's Utterance:**

"Budi is writing... (teacher looks at the child)"

**Child's Response:**

"In the book"

The child completes the sentence with the locational phrase they have learned, demonstrating mastery of syntactic elements.

**Data 16****Teacher's Utterance:**

"I am..." (teacher pauses and gestures for the child to continue)

**Child's Response:**

"I am eating"

The child shows syntactic prediction ability by filling in the gap in the sentence. This ability develops through exposure to repeated sentence structures. This phenomenon supports the theory of structural priming and bootstrapping, where the child builds syntactic expectations based on prior linguistic exposure (Kover et al., 2022).

### 3.6. *Impact on Children's Linguistic Empowerment in Inclusive Classrooms*

In general, this strategy enhances the verbal participation of children with autism in the classroom, including answering questions, giving instructions, and expressing simple opinions. Teachers also reported an increase in communication initiative, especially in activities that use repetitive sentence structures.

**Data 17****Class Discussion Activity:**

**Teacher's Utterance:** "Who wants to tell a story?"

**Child's Response:** "I want to tell you about my cat."

The child spontaneously speaks with a complete sentence structure, indicating an improvement in communication empowerment.

**Data 18****Writing Activity:**

**Teacher's Utterance:** "Write it down! I like..."

**Child's Response:** "I like ice cream."

The child demonstrates the use of a learned structure in written form, showing the transfer of syntax to different modes of language.

## Data 19

### Task Presentation:

**Child's Utterance:** "This is my house. I use crayons."

The child uses sentence structures to explain their work, indicating active participation and confidence in using language.

The teacher's utterances highlight that syntactic strategies are not only linguistic tools but also provide children with access to social and cognitive interactions in an inclusive learning environment. This aligns with the principle of educational equity, which emphasizes providing learning tools tailored to students' needs to achieve equal outcomes (UNESCO, 2023a).

### 3.7. *Teacher Responses to Syntactic Bootstrapping Strategies in the Classroom*

The inclusive classroom teachers, Mrs. S (pseudonym) and Mr. R (pseudonym), reported that the implementation of syntactic bootstrapping strategies significantly assisted children with autism in understanding the language patterns used in daily learning. They observed an improvement in the children's ability to independently form simple sentences.

"Previously, they could only say one or two words. Now, they can respond with short sentences.

I think it's because we keep using the same sentences repeatedly, so they memorize the pattern and know when to speak." (Mrs. S)

"Children with autism are usually passive or just repeat words. But since I started using consistent sentence patterns—like 'I eat...!', 'he plays...!'—the children began completing the sentences on their own without me asking. That's amazing to me." (Mr. R)

The teachers also emphasized the importance of visual involvement in supporting comprehension. According to them, the use of pictures and gestures when presenting sentences helped accelerate the children's response to syntactic structures.

"When I showed a picture of a child running and said 'He is running on the field,' the child could mimic and change the location, for example, 'in the park.' This indicates that they understand the structure, not just mimic it." (Mrs. S)

However, the teachers also acknowledged that consistency and patience are essential in this process. They suggested that other teachers working with inclusive classrooms should receive technical training in this strategy, ensuring that their approach is not only intuitive but also based on appropriate linguistic theory.

### 3.8. *Speech Therapist's Perspective on the Effectiveness of Bootstrapping Strategies*

Speech therapist Mr. Y (pseudonym) conveyed that the syntactic bootstrapping strategy is highly relevant for use in language therapy for children with autism, particularly because it provides a stable and predictable structure. This is crucial as many children with autism tend to exhibit rigidity toward patterns and struggle with handling language that is random or unstructured.

"This strategy is very suitable for children with ASD characteristics. They need consistent and repetitive patterns. Bootstrapping provides that, as the children get used to hearing and completing the same sentence structure, but with changing contexts." (Mr. Y)

The interview data describe that he believes the children who receive gradual syntactic stimulation tend to understand the relationship between verbs and objects in sentences more quickly compared to children who are only provided with vocabulary exercises without structure.

"I have a patient who could only say one word, like 'eat.' But after being accustomed to sentences like 'I eat rice,' they started to complete it on their own. Now, they can even change the object." (Mr. Y)

Mr. Y also emphasized the need for collaboration between therapists, teachers, and parents to maintain consistency in syntactic structure both at school and at home. He believes that generalization will occur if children are exposed to the same language patterns from different environments.

From in-depth interviews with both inclusive classroom teachers and speech therapists, three key themes emerged that underscore the effectiveness of the syntactic bootstrapping strategy in teaching children with autism. First, consistency in syntactic structure is seen as essential for helping children understand language patterns. Both teachers and therapists agree that the repetition of uniform sentence forms, such as subject-verb-object, provides a sense of security and helps children build meaning and expand verbal expression. Second, a multimodal approach involving visualization and movement further strengthens syntactic understanding. The combination of images, physical gestures, and verbal cues has been shown to help children link words with context, making the learning process more concrete and meaningful. Third, both teachers and therapists stress the importance of cross-role collaboration between educators, therapy professionals, and families to ensure consistency in approach across learning environments. They also highlight the need for more structured professional training to ensure that the implementation of syntactic strategies is not sporadic but systematic and based on the correct linguistic approach.

These three thematic findings reinforce that the syntactic bootstrapping strategy is not only effective in theory but also practical in inclusive education and language therapy practices.



Figure 1 Application of the syntactic bootstrapping model

The model is (figure 1) structured as a flow, starting from external support systems and moving toward internal cognitive processing, ultimately resulting in improved communication skills. At the top of the model, the foundation is built on two primary external inputs: Teacher Scaffolding & Guidance and Classroom Interaction & Peer Learning. These elements represent the social and educational environment where the child receives structured help and observes natural social exchanges. In the center sits the Integrated Syntactic Bootstrapping Model, which acts as the "Syntactic Cues Core Hub." This hub is the engine of the model, where the child begins to decode language through three specialized domains.

- Sentence Structure Recognition: Focuses on identifying word order cues and recognizing patterned sentences to understand how thoughts are organized.
- Contextual Understanding: Involves interpreting verb and argument cues within a specific situational context, helping the child connect words to real-world actions.
- Language Production Skills: Moves the child from passive listening to active participation through guided practice and formal sentence construction.

The processing of these syntactic cues flows downward into two complementary streams of linguistic competence. On the left, the model highlights Receptive Language Skills, which focuses on the child's internal comprehension and ability to process incoming information. On the right, it emphasizes Expressive Language Skills, which focuses on the child's ability to engage in active communication and outward expression. The model culminates at the base in a unified goal: Enhanced Language Development. By integrating structural cues (syntax) with environmental support (teachers and peers) and situational context, the model provides a roadmap for children with autism to bridge the gap between simple word recognition and complex, functional communication.

#### 4. Discussion

The findings of this study suggest that syntactic bootstrapping can function as an effective linguistic strategy to support language development in children with autism, particularly in facilitating the acquisition of basic sentence structures and functional language use. However, rather than viewing these findings as definitive confirmation of the strategy's effectiveness, it is important to critically examine the conditions under which these outcomes emerge.

While the results are consistent with syntactic bootstrapping theory (Gleitman, 2017; Landau & Gleitman, 2022), which posits that children utilize syntactic cues to infer meaning, the present findings also indicate that the effectiveness of this mechanism may be contingent upon **instructional mediation**. In this study, the role of the teacher in providing structured input, repetition, and explicit modeling appears to be a key enabling factor. This suggests that the observed improvements may not solely reflect children's spontaneous use of syntactic bootstrapping, but rather an interaction between cognitive-linguistic potential and pedagogical scaffolding (Göksun et al., 2020; Hoff & Naigles, 2017). In other words, syntactic bootstrapping in this context operates as a *supported process*, not a purely naturalistic one.

An alternative interpretation of the findings relates to the role of **repetition and predictability**, which are well-documented as effective learning supports for children with autism (LeBlanc & Fagiolini, 2019; Roberts & Al, 2019). The improvements in sentence completion and pattern use may therefore be partially attributed to general learning mechanisms such as memory reinforcement and pattern recognition rather than exclusively to syntactic bootstrapping processes. This raises an important question as to whether the observed outcomes are specific to syntactic cue processing or reflect a broader responsiveness to structured input. Future studies could disentangle these effects by comparing syntactic bootstrapping-based interventions with other structured language approaches.

Furthermore, the integration of multimodal elements (visuals, gestures, and contextual cues) complicates the attribution of outcomes to a single linguistic strategy. While multimodal support is pedagogically advantageous, it may also function as a confounding factor, making it difficult to isolate the unique contribution of syntactic bootstrapping. This suggests that the effectiveness observed in this study should be interpreted as the result of a **combined instructional ecology**, rather than a single-method intervention (Kover et al., 2022; Yuan & Fisher, 2020).

In relation to existing literature, this study extends previous findings (Arunachalam & Luyster, 2018; Naigles, 2020) by demonstrating that sensitivity to syntactic cues in children with autism can be activated within classroom-based interactions. However, unlike prior studies conducted in controlled experimental settings, the present findings highlight the variability and context-dependence of such processes in authentic educational environments. This reinforces the need to reconsider syntactic bootstrapping not only as a cognitive mechanism but as a pedagogically mediated practice (Alassaf, 2025; Mottron et al., 2016).

Despite these contributions, several limitations must be acknowledged in interpreting the findings. The small and context-specific sample limits the transferability of results to broader populations. Additionally, the qualitative design relies on interpretive analysis, which may be influenced by researcher subjectivity, despite the use of triangulation. The relatively short observation period also restricts the ability to assess long-term language development, raising the possibility that the observed improvements may reflect short-term adaptation rather than sustained acquisition.

Taken together, these considerations suggest that syntactic bootstrapping should not be viewed as a standalone solution, but rather as part of a broader set of linguistically-informed and context-sensitive instructional strategies. Its potential lies in its adaptability and alignment with the learning characteristics of children with autism, particularly when integrated with structured, multimodal, and scaffolded teaching practices.

From a broader perspective, the study contributes to ongoing discussions on educational equity by highlighting the importance of aligning linguistic theory with inclusive pedagogy. However, achieving equitable learning outcomes requires not only effective strategies but also systemic support, including teacher training, curriculum design, and institutional readiness. Therefore, the implications of this study should be understood as both pedagogical and structural, pointing toward the need for more comprehensive and contextually grounded approaches to inclusive language education.

## 5. Conclusion

This study demonstrates that syntactic bootstrapping holds potential as a linguistically-informed strategy that can be contextually adapted to support language development in children with autism within inclusive educational settings. Rather than functioning solely as a theoretical mechanism of language acquisition, the findings highlight that its effectiveness is closely linked to structured instructional design, active teacher scaffolding, and the integration of multimodal supports aligned with learners' cognitive profiles. Thus, the primary contribution of this study lies in repositioning syntactic bootstrapping from a cognitive construct into a pedagogically actionable approach in inclusive classrooms.

However, these findings should be interpreted in light of several limitations. First, the small sample size and the context-specific nature of the study limit the transferability of the results to broader populations. Second, the qualitative design does not allow for statistical generalization or precise measurement of effect size. Third, the relatively short observation period constrains the ability to assess the long-term sustainability of language development outcomes. Therefore, the findings should be viewed as exploratory and indicative rather than conclusive.

Based on these considerations, several targeted recommendations are proposed. At the instructional level, teachers should incorporate explicit and repeated sentence structure modeling into daily classroom interactions, for example through the consistent use of sentence frames to support pattern recognition. At the materials development level, learning resources should be designed around simple, progressive, and contextually meaningful syntactic patterns, supported by relevant visual cues. At the professional development level, teacher training programs should expand beyond behavior-based approaches to include applied linguistic strategies, particularly those related to syntax-focused instruction. Finally, future research should employ longitudinal and mixed-method designs to examine the sustained impact of syntactic bootstrapping and to compare its effectiveness with other language intervention approaches.

More broadly, this study underscores that achieving equitable and high-quality education for children with autism requires not only inclusive policies but also linguistically responsive pedagogical practices. Integrating insights from linguistic theory into classroom instruction is therefore essential for developing adaptive, effective, and sustainable inclusive education.

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