Research Article

Constructive Play Model To Improve Communication and Social Interaction of Children With Autism Spectrum Disorder in Inclusive Kindergartens: A Research and Development Study

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Abstract

Objective: To develop the Constructive Play Model, a teacher-implemented instructional model integrating applied behavior analysis, Montessori pedagogy, and Vygotsky's zone of proximal development, and to evaluate its feasibility and its effect on communication and social interaction of children with level 1 autism spectrum disorder in inclusive kindergartens.

Methods: A research and development study based on Borg and Gall's cycle and Rowntree's instructional design model (planning, development, evaluation). A needs analysis with inclusive kindergarten teachers preceded model development. Ten experts from five domains rated feasibility, and teachers rated readability. Effectiveness was examined with a single-subject design in five children aged 5 to 6 years in three inclusive kindergartens in Balikpapan, Indonesia, across two intervention cycles, using a 14-indicator observation rubric (seven expressive and seven receptive indicators). Descriptive percentages and normalized gain were calculated.

Results: Mean expert feasibility was 87.8% (range 85.5% to 92.7%), classified as good. All children improved: mean rubric scores rose from 40.0% to 79.8%, with individual gains of 29 to 50 percentage points and normalized gains of 0.53 to 0.77 (mean 0.66, moderate). Teacher readability ranged from 81.8% to 96.4%.

Conclusion: The model was considered feasible by experts, usable by non-specialist teachers, and was associated with improved communication and social interaction in this small sample. Controlled studies with larger samples and follow-up into later childhood and adolescence are needed.

Keywords: Autism Spectrum Disorder; Play and Playthings; Communication; Social Interaction; Mainstreaming, Education; Child, Preschool.

INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by persistent deficits in social communication and social interaction across multiple contexts, together with restricted and repetitive patterns of behavior, interests, or activities.[1] The World Health Organization estimates that about 1 in 100 children worldwide is autistic.[2] Core difficulties emerge early in life and, for many individuals, persist into adolescence and adulthood, shaping peer relationships, school participation, mental health, and long-term well-being.[3] The preschool years are therefore a critical window: social-communication gains achieved through early intervention can be sustained into later childhood,[4] and a substantial body of evidence-based practices now supports structured, educationally delivered intervention for young autistic children.[5] Strengthening communication and social interaction before school entry is thus not only an educational aim but also an investment in the social and emotional health of the future adolescent.

In Indonesia, inclusive education is mandated by the National Education System Law No. 20 of 2003, Government Regulation No. 17 of 2010, and Law No. 8 of 2016 on Persons with Disabilities. National planning data have documented approximately 5,530 cases of autism-related developmental disorders, with around 500 new cases projected annually.[6] In Balikpapan, East Kalimantan, local education data identified 45 kindergarten-aged children with ASD enrolled in special and inclusive settings in 2025. Inclusive kindergartens are the main setting in which children with mild ASD learn alongside typically developing peers. However, inclusive early childhood education in Indonesia still faces a shortage of teachers trained in special education, limited adaptive instructional materials, and few evidence-based instructional models adapted to the local sociocultural context.

Play is the primary mode of learning in early childhood and has particular value for children with ASD. Systematic and scoping reviews show that play-based interventions delivered in educational contexts can improve social communication in autistic children, although intervention designs vary widely and are rarely packaged for non-specialist educators.[7,8] Peer-mediated play has improved social play interactions between autistic children and typically developing playmates,[9] and structured cooperative play has increased social interactions of preschool

children with autism.[10] Interventions targeting joint attention and symbolic play have also produced gains in early social communication.[11] Among the forms of play, constructive play, in which children build blocks, assemble forms, or create meaningful objects, simultaneously engages sensorimotor and cognitive processes and offers natural opportunities for requesting, naming, describing, turn-taking, and following instructions.

Three theoretical traditions can support such play. In Vygotsky's socio-cultural theory, play is a leading activity that creates a zone of proximal development (ZPD), within which an adult or more capable peer scaffolds language and the internalization of social norms.[12] Montessori pedagogy, originally developed for children with developmental difficulties, emphasizes a prepared environment, concrete sensorial materials, and a three-stage sequence of introduction, recognition, and recall that supports receptive and expressive language.[13,14] Applied behavior analysis (ABA) contributes reinforcement, prompting and fading, shaping, and generalization procedures whose effectiveness on communication and adaptive behavior in young autistic children is supported by meta-analytic evidence.[15,16]

Despite this evidence, three gaps remain. First, no structured and validated constructive play model has been developed for children with mild ASD in the Indonesian inclusive kindergarten context. Second, few models integrate ABA principles at the level of the instructional syntax used daily by classroom teachers. Third, inclusive kindergarten teachers lack practical guidebooks that translate these principles into routine classroom activities.

To address these gaps, this study aimed to (1) develop the Constructive Play Model (CPM), integrating ABA, Montessori pedagogy, and the ZPD, for inclusive kindergartens; (2) evaluate its feasibility through expert validation and teacher readability; and (3) examine changes in communication and social interaction skills of children with mild ASD after its implementation.

METHODS

Study design

This was a research and development study combining Borg and Gall's research and development cycle for the instructional model[17] with Rowntree's three-phase instructional design model (planning, development, and evaluation) for the teacher guidebook.[18] The process comprised needs analysis, prototype development, expert validation, a limited field trial, an expanded field trial, and an operational field trial. Changes in child outcomes were examined with a single-subject design, with pre-intervention and post-intervention assessments of each child across two intervention cycles. Quantitative and qualitative data were combined to evaluate and revise the model iteratively.

Setting and participants

The study was conducted in three inclusive kindergartens in Balikpapan, East Kalimantan, Indonesia. Children were selected by purposive sampling according to the following criteria: diagnosis of ASD Level 1 according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5); age 5 to 6 years; enrollment in an inclusive class; and parental consent. One child participated in the limited field trial (TK Tunas Bangsa), two in the expanded field trial (PAUD Tunas Harapan 3), and two in the operational field trial (TK Putra 1), for a total of five children (S1 to S5). Ten experts, two from each of five domains (early childhood education, special education for autism, instructional media, instructional design, and Indonesian language), validated the model. Inclusive kindergarten teachers in Balikpapan participated in the needs analysis, and the teachers at the three trial sites implemented the model and assessed the guidebook.

The Constructive Play Model

The CPM package consists of a teacher guidebook, a set of structured constructive play activities using blocks and assembly materials, and a three-phase instructional syntax (Table 3). In the Circle Time phase, the teacher establishes routines, behavioral expectations, and motivation using ABA reinforcement. In the Contextual Conversation phase, the teacher acts as the more knowledgeable other, scaffolding requesting, naming, describing, and responding within the child's ZPD with graded prompts that are faded as independence increases. In the Visualization phase, the child consolidates learning by constructing and presenting objects in a prepared Montessori-style environment, with peers invited to comment and take turns. Each cycle was implemented through several classroom sessions integrated into the regular kindergarten schedule, with all three phases carried out in every session.

Table 3. Instructional syntax of the Constructive Play Model.

Phase	Theoretical basis	Main teacher and child activities	Target skills
Circle Time	Applied behavior analysis	Greeting routine; activity rules explained with visual cues; token and social reinforcement for attending and responding	Attention, responding to name, following instructions
Contextual Conversation	Zone of proximal development	Teacher acts as more knowledgeable other; models, asks, and prompts from least to most support, then fades prompts while children choose materials and plan constructions	Requesting, naming, describing, answering questions
Visualization	Montessori prepared environment	Child builds an object with blocks or assembly materials, presents it to peers; peers comment and take turns; introduction-recognition-recall sequence	Initiating communication, turn-taking, understanding contextual language

Instruments

Five instruments were used: (1) a teacher interview guide for needs analysis; (2) a needs analysis questionnaire administered online to 10 inclusive kindergarten teachers; (3) an expert feasibility questionnaire of 11 items rated on a five-point Likert scale; (4) an implementation checklist to monitor fidelity; and (5) a communication and social interaction observation rubric with 14 indicators, seven expressive (e.g., initiating communication, requesting, naming, describing) and seven receptive (e.g., responding to name, following instructions, understanding contextual language). The rubric was aligned with Indonesian early childhood development standards (Ministry of Education and Culture Regulation No. 146 of 2013 and Ministry of Education, Culture, Research and Technology Regulation No. 8 of 2024). Rubric scores were expressed as a percentage of the maximum possible score.

Data analysis

Expert feasibility and teacher readability scores were analyzed as descriptive percentages and classified as Very Good (90% to 100%), Good (75% to 89%), or Adequate (65% to 74%). Change in each child's rubric score was calculated as the absolute gain in percentage points and as the normalized gain (N-gain) = (post-test − pre-test) / (maximum score − pre-test), interpreted as low (< 0.3), moderate (0.3 to < 0.7), or high (≥ 0.7).[19] Qualitative data from interviews, field observations, and teacher feedback were analyzed using Miles and Huberman's interactive model (data condensation, data display, and conclusion drawing and verification)[20] and were used to revise the model after each trial.

Ethical considerations

This study was conducted in accordance with established ethical principles for research involving human participants and received approval from the institutional research ethics committee. Written informed consent was obtained from the parents or legal guardians of all participating children, and the teachers and experts involved provided their consent prior to participation. To protect confidentiality, children's names were replaced with codes throughout data collection and reporting. Activities were paused whenever a child showed signs of distress, and participation resumed only when the child was calm and willing to continue.

RESULTS

Needs analysis

All surveyed teachers (100%) reported an urgent need for a practical and structured instructional guidebook. Expressive and receptive language were identified as the most difficult competencies to develop in children with ASD, mainly because few teachers had a special education background and teachers had limited knowledge of how to address the needs of children with special needs.

Expert validation

The ten experts rated the CPM between 85.5% and 92.7%, with a mean feasibility score of 87.8%, classified as Good (Table 1). The highest score was given by the special education for autism experts (92.7%, Very Good), and the lowest by the instructional media experts (85.5%, Good). Expert suggestions, which mainly concerned clarifying the step-by-step instructions for teachers, simplifying the language and visual cues to suit children with ASD, and adjusting the duration and sequence of play activities, were incorporated before the field trials.

Table 1. Expert validation of the Constructive Play Model by domain (n = 10).

No.	Expert domain	Validators (n)	Score (%)	Category
1	Early childhood education	2	88.6	Good
2	Special education for autism	2	92.7	Very Good
3	Instructional media	2	85.5	Good
4	Instructional design	2	86.4	Good
5	Indonesian language	2	85.9	Good
	Overall mean	**10**	**87.8**	**Good**

Categories: Very Good, 90% to 100%; Good, 75% to 89%; Adequate, 65% to 74%.

Changes in communication and social interaction

All five children improved after two intervention cycles (Table 2). Mean rubric scores increased from 40.0% at pre-test to 79.8% at post-test, a mean gain of 39.8 percentage points. Individual gains ranged from 29 percentage points (S1) to 50 percentage points (S5), and N-gain values ranged from 0.53 to 0.77 (mean 0.66, moderate). Two children (S4 and S5) reached high N-gain values, and three (S1 to S3) moderate values. Gains were larger for children in the operational trial, after the model had been revised twice. Improvements were observed in both expressive indicators (initiating communication, requesting, naming, and describing) and receptive indicators (responding to name, following instructions, and understanding contextual language).

Table 2. Communication and social interaction rubric scores before and after two intervention cycles (n = 5).

No.	Child (trial site)	Pre-test (%)	Post-test (%)	Gain (pp)	N-gain	Category
1	S1 (TK Tunas Bangsa)	45	74	29	0.53	Moderate
2	S2 (PAUD Tunas Harapan 3)	40	80	40	0.67	Moderate
3	S3 (PAUD Tunas Harapan 3)	42	78	36	0.62	Moderate
4	S4 (TK Putra 1)	38	82	44	0.71	High
5	S5 (TK Putra 1)	35	85	50	0.77	High
	Mean	**40.0**	**79.8**	**39.8**	**0.66**	**Moderate**

pp: percentage points. N-gain: normalized gain = (post-test − pre-test) / (100 − pre-test); low < 0.3, moderate 0.3 to < 0.7, high ≥ 0.7. S1: limited field trial; S2–S3: expanded field trial; S4–S5: operational field trial.

Teacher readability

Teacher readability scores across the three sites ranged from 81.8% to 96.4%, classified as Good to Very Good. Teachers reported that the guidebook, play activities, and three-phase syntax were clear and could be carried out without a special education background.

DISCUSSION

This study developed a constructive play model for inclusive kindergartens that integrates ABA, Montessori pedagogy, and the ZPD in a single classroom syntax. Experts rated the model as feasible, non-specialist teachers

rated it as readable and usable, and all five children with mild ASD showed improved communication and social interaction after two intervention cycles.

The expert ratings indicate that the model is theoretically and technically sound. The highest rating came from autism special education experts, suggesting that the model's structured prompting and reinforcement procedures are consistent with established evidence-based practices for autistic children.[5,15] The lower, although still good, ratings for instructional media and language highlight that the presentation of materials matters as much as their content when models are intended for teachers without specialist training.

The observed improvements are consistent with reviews showing that play-based interventions in educational settings can support social communication in autistic children.[7,8] The peer component of the Visualization phase, in which children present their constructions to classmates, reflects findings that structured peer-mediated and cooperative play increase social interaction.[9,10] Gains in requesting and naming during the Contextual Conversation phase are in line with interventions that target joint attention and shared play routines.[11] The larger gains in the operational trial suggest that the iterative revisions after the limited and expanded trials improved the model, although differences between children and sites may also have contributed.

The three-phase syntax translates the theoretical integration into a teachable routine. Circle Time uses ABA reinforcement to establish attention and motivation;[16] Contextual Conversation places the teacher in the role of the more knowledgeable other who scaffolds language within the ZPD;[12] and Visualization consolidates learning through concrete construction in a prepared environment.[13,14] Each session is therefore behaviorally structured, socially scaffolded, and sensorially engaging. The high readability scores suggest that this structure can be implemented by regular inclusive kindergarten teachers, which addresses the practical gap created by the shortage of special education teachers in Indonesia.

From a health perspective, early social-communication skills underpin later peer relationships and participation, and gains from early intervention can persist beyond the preschool years.[3,4] A low-cost, teacher-delivered model may therefore contribute to the long-term social and emotional well-being of autistic children as they move toward adolescence, particularly in settings with limited access to specialist services.

The findings also have practical implications for inclusive early childhood education. Because the model relies on low-cost materials such as blocks and assembly sets, and on a fixed three-phase routine, it can be embedded in existing daily schedules without additional staff or specialized equipment. The teacher guidebook and implementation checklist provide a concrete structure for in-service training, allowing kindergarten principals and local education offices to prepare regular teachers to support children with mild ASD. Embedding evidence-based procedures such as prompting, reinforcement, and peer-mediated play within ordinary classroom activities is consistent with recommendations that interventions for autistic children be delivered in natural settings by the adults who interact with them every day.[5,7] In addition, because the observation rubric is aligned with national early childhood development standards, teachers can use it for routine progress monitoring and individualized learning plans.

A strength of this study is that the model was developed through a systematic sequence of needs analysis, expert validation by specialists from five domains, and three successive field trials, with revisions informed by both quantitative scores and teacher feedback. This iterative process, together with a structured teacher guidebook and a fidelity checklist, increases the likelihood that the model can be replicated in other inclusive kindergartens.

This study has limitations. The sample was small (five children) and drawn from one city, which limits generalizability. The single-subject evaluation relied on pre-intervention and post-intervention assessments without repeated baseline measurements, a control condition, or inferential statistics, so the improvements cannot be attributed to the model alone; maturation, teacher attention, and the novelty of activities may have contributed. Inter-observer agreement for the rubric was not reported, and outcomes were not followed up after the intervention. Future studies should use multiple-baseline or controlled designs with larger samples, report observer reliability, assess maintenance and generalization of skills, and test the model with children with ASD Level 2 and in other regions.

CONCLUSION

The Constructive Play Model, which integrates applied behavior analysis, Montessori pedagogy, and Vygotsky's zone of proximal development in a three-phase syntax (Circle Time, Contextual Conversation, and Visualization), was rated feasible by experts and readable by inclusive kindergarten teachers. Its implementation was associated with improved communication and social interaction in five children with mild ASD. The model offers a practical, teacher-implementable resource for inclusive early childhood education in Indonesia. Controlled studies with larger samples and longer follow-up are needed to confirm its effectiveness and its contribution to social development into later childhood and adolescence.

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