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NDBI-Fi: General Information

NDBI-Fi Development:

The NDBI-Fi is an observational rating scheme that evaluates caregiver implementation of common strategies from treatments classified as Naturalistic Developmental Behavioral Interventions (NDBI; Schreibman et al., 2015). The item definitions below describe the full pool of intervention strategies from which common elements across NDBIs were identified.

Items were developed in stages. First, intervention fidelity forms and manuals, when available, were reviewed to establish an initial set of items. These were sent to experts in NDBIs for open-ended review, and further edited. Stage two experts in several different NDBI models rate the extent to which each item was a component of their NDBI of expertise. The NDBI-Fi Common Item set was refined based on the extent to which items emerge as common elements across raters. Scoring anchors, which further describe the frequency with which these strategies are meant to be used, were developed for the set of common elements. The NDBI-Fi was then piloted on videos from 5 sites and multiple NDBI. These data show preliminary evidence for concurrent, convergent and discriminant validity, and adequate inter-rater reliability and internal consistency (Frost, Brian, Gengoux, Hardan, Rieth, Stahmer & Ingersoll, under review).

NDBI-Fi: Broad Item Definitions

Promoting Engagement

1) Face-to-face and On the Child's Level

The adult is **face-to-face with the child**. The child's and adult's bodies are oriented toward each other, and they are at a similar level (or the adult can be slightly below the child's eye level), such that the adult is **within the child's line of sight**. If playing, toys are between the adult and child when possible (this may be difficult in some activities, such as building a puzzle, or playing with a large dollhouse or on a jungle gym). If the adult is required to move away from the child, or if the child walks away, the adult returns to being face-to-face as soon as possible.

- Both sitting on the floor with a toy in between them, or sitting across from each other at a table*
- Adult gets up to put a toy away, but quickly returns to being face-to-face*
- Adult is sitting on the couch, child is playing on the floor*
- Adult is sitting with the child on her lap, such that the child's back is to her*

2) Setting Up the Activity Space

The adult sets up the space, trying to avoid clutter. **Distractions in the environment, including sounds (e.g. TV), are minimized**. Once a child has chosen an activity, other toys and materials are removed or set aside. This may also include removing an item that has become a perseverative interest.

- Child: Becomes fixated on putting tiny pieces of play dough on the floor*
Adult: Attempts to model functional play with play dough, then later removes the play dough from the play area and brings out two different toys for the child to choose from
- Adult takes a moment to clean up toys with lots of pieces by putting them in a bin if the floor becomes cluttered*
- Adult leaves the TV on, with his smartphone out on the table during snack time*
- Child dumps out 3 bins of toys onto the floor, and the adult begins to play without clearing or pushing some toys to the side*

3) Following the Child's Lead

The adult provides several **developmentally appropriate activity options**, and **allows the child to choose** which toy or activity to play with, **how to play**, and **how long** to stay with an activity. The adult then **joins in the child's chosen activity** by playing with the child, helping the child with an activity, handing the child more pieces, or playing another "role" in the activity. **The adult and child are both active participants in the activity**. If the child does not choose an activity, or expresses disinterest in or dislike of an activity, the adult **notices and responds accordingly**. This may include using the situation to practice expressing refusal, offering a choice between two new materials, or moving new toys into the child's line of sight to encourage changing activities or entice the child's interest. The adult is **permitted to set limits** (e.g. limit their child's access to more snacks) and to **intervene if the child is engaging in harmful, disruptive, repetitive or inappropriate activities**. If using intervention strategies during an adult-directed activity (e.g., dressing, washing hands), the adult incorporates child choices when possible.

- Child: Pushes toy cars away*
Adult: Comments, "You don't want cars," and brings bins with blocks and animals into the play space
- During dressing routine, the adult holds up two different shirts for the child to choose from*
- Child: Opens the bin of blocks and starts to build a tower*
Adult: Sets aside the previous activity, and hands the child more blocks

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- Child: Playing with trains functionally and appears content*
Adult: Abruptly cleans up trains and brings out blocks instead
- Child: Putting shape sorter pieces into a nesting box*
Adult: Takes the nesting box away, and directs the child to put the pieces in the shape sorter instead

4) Imitating the Child

The adult **imitates the child's actions**. Imitation may include mimicking (within a few seconds of the child) a child's play actions, **gestures**, and/or movements.

- Child: Puts pieces in a puzzle*
Adult: Puts pieces in the puzzle too
- Child: Claps and says, "yay!"*
Adult: Claps along with the child
- Child: Holds play tea cup up to her mouth to 'drink'*
Adult: Pretends to sip too
- Child feeds dolls, while adult watches quietly*
- Adult hands the child a plate of food, then goes to wash dishes while the child eats*
- Child drives a car back and forth while the adult builds a road with blocks*

5) Supporting Turn-Taking

The adult supports the child in turn taking, which involves a back and forth interaction in which the adult and child **exchange control of a toy or activity**. The adult helps the child anticipate this exchange if necessary (e.g. says "3, 2, 1, my turn!").

- Adult says, "it's my turn to have some snack," takes the bowl of crackers and eats a couple, then returns the bowl to the child*
- Child: Opens and closes the expanding ball*
Adult: Takes the ball, opens and closes it
Child: Says, "ball" and reaches
Adult: Hands it back to the child
- Child: Opens and closes the expanding ball*
Adult: Takes the ball and begins to play with it, without handing it back to the child
- Child: Opens and closes the expanding ball*
Adult: Takes the ball, then builds a cube with Magnatiles

6) Displaying Positive Affect and Animation

The adult displays **rich positive affect** to promote child **engagement**. This may include adjusting vocal quality or tone, **gestures**, and facial expressions. Affect is **matched to the child's individual sensory needs**, such that the adult promotes engagement without over-arousing the child. On the other hand, some children may need higher levels of affect and animation due to their lack of responsiveness and low arousal level.

- Adult pushes the child on the swing, and says "swiiiiing!" while smiling*
- Adult laughs with the child as he pops bubbles*
- Adult speaks in a whisper while the child quietly puts the baby doll to sleep*
- Child: Becomes dysregulated when his block tower falls down*
Adult: Says, "the blocks CRASHED!" loudly with an excited tone
- Adult has flat affect and appears bored during play*

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7) Engaging the Child in Play Routines

The adult and child participate in **collaborative play routines with toys**, in which the adult and child are both active participants. **Play routines** have **consistent steps, and may be repeated several times**, though they may vary in complexity based on the child's **developmental level**. Code N/A if rating a **home routine**.

- The child and adult take turns putting coins in the piggy bank until it is full*
- Together, the child and adult stack blocks on top of each other, until the tower falls, and they both begin building again*
- Together, the child and adult build a train track, put trains on the track, load blocks onto the train cars, then drive the trains*
- Child and adult move quickly from one activity to another throughout the session, without settling on a joint play activity*
- Child drops marbles down a marble run while the adult feeds a baby doll*
- Adult watches the child play and occasionally narrates what she is doing*

8) Engaging the Child in Social Routines

The adult **introduces social routines** into the interaction. These are joint activities which focus on the dyadic interaction between adult and child, rather than a play interaction involving toys (as in #7). Common social routines include (but are not limited to) singing songs, playing a chasing or hide-and-seek type game, jumping on the bed, rough-and-tumble play, peekaboo, playing a tickle game, etc.

- Child: Becomes dysregulated, and flaps his hands while vocalizing*
Adult: Begins to sing "row, row, row your boat" while swinging the child's arms
- Child: Loses interest in playing*
Adult: Initiates a tickle game by holding hands up and sayings, "I'm going to get you!"
- Child: Loses interest in playing with trains*
Adult: Continues to play with trains

9) Managing Problematic Behavior and Dysregulation

If the child engages in problem behavior (e.g. aggression, self-injury, throwing, whining), the adult uses **behavior-management strategies, and only reinforces appropriate behavior** or attempts at appropriate behavior. Common effective behavior-management strategies include withdrawing attention from the child, displaying neutral affect, redirecting the child and praising positive behavior, or providing visual or behavioral supports as needed. The adult may remove materials to maintain safety. The adult may also **preempt overt problem behavior by reducing demands** on the child or initiating sensory or social play. If problem behavior is frequent, the adult analyzes the antecedents to these behaviors (e.g. transitions, too many stimuli in the room) and makes environmental modifications to reduce the probability of such behaviors. In addition, the adult targets appropriate protesting (e.g. saying "no") in direct teaching opportunities.

- Child: Throws a train across the room*
Adult: Ignores the behavior, moves the trains out of reach, and directs the child to say "all done"
- Adult notices the child becoming frustrated, and preemptively begins to sing "Old MacDonald" while pointing at different animal figures before problem behavior occurs*
- Child: Throws a block*
Adult: Says, "Stop that! Why'd you throw?" and stops the activity to go pick up the block
- Adult: Asks "Want crackers, or want milk?" after child finishes a plate of snack*
Child: Yells and protests
Adult: Gives the child more crackers and milk without waiting for a response

Modeling Skills

10) Modeling Appropriate Language

The adult **adjusts his language to the child's *developmental level***; most utterances match the child's current abilities, while others are slightly above a child's current ability level. The adult avoids asking questions or giving commands (outside of ***direct teaching opportunities***), and **primarily comments** around the child's attentional focus and actions. Utterances are somewhat repetitive, but not overly so, and the adult models language for different objects and actions.

- Adult narrates, "Drive the trains... Train... Push... Go," while she and her child (who primarily uses single words) drive trains together*
- Adult narrates, "Building a tower. More pieces on top. Build with blocks," while she and her child (who speaks in short phrases) build with blocks*
- Adult narrates, "Block... Block... Block... Block... Block" to her child (who speaks in phrases)*
- Adult says, "Wow, are we building a huge block tower?" to her child (who is preverbal)*
- Adult repeatedly asks, "What color?" for each block the child puts on a tower*

11) Modeling Gestures and Joint Attention Skills

The adult **models joint attention skills**, such as pointing, showing, and giving, as well as other ***gestures***, such as **emphatic or emotional gestures** and **descriptive gestures**. Gestures are clear and somewhat exaggerated.

- Child: Says, "car"*
Adult: Says, "blue car!" while pointing to the car
- Adult holds up the juice box and says, "here's the juice"*
- Adult says, "A big tower!" while holding his hands apart to indicate the size*
- Child: Says, "car"*
Adult: Says, "there's the car" without gesturing

12) Modeling New Play Acts

The adult models **new** play acts that **expand on the current play activity**. Play models are ***developmentally appropriate***, and do not add several "steps" to the play at a time. Play models that occur as a ***prompt*** during a ***direct teaching opportunity*** should not be considered here. Code N/A if rating a ***home routine***.

- Child and adult build a Magnatile house together, then the adult puts an animal inside, and continues playing the way the child plays*
- Child and adult put pieces in the shape sorter several times, then the adult drops a shape sorter piece into a butterfly net*
- The adult leads the play with a quick series of models: feeds, gives a drink, burps, wipes face, and puts the baby doll to sleep*
- The adult repeatedly imitates the child by putting pieces in a shape sorter and dumping them out, without adding any new steps or modifying the activity*

Encouraging Communication

13) Responding to Attempts to Communicate

The adult **verbally responds** to the child's attempts to communicate, including vocalizations, eye contact, word approximations, *gestures*, joint attention, etc. This includes repeating, clarifying and/or expanding on the child's communication, and also responding to the child's communication as meaningful. If the child uses a joint attention skill (e.g. pointing, showing, or giving), the adult responds by incorporating a joint attention skill into a natural response.

- ✓ *Child: Says, "block"*
Adult: Says, "build with blocks," and hands the child a block
- ✓ *Child: Points to the train*
Adult: Gives the child the train and says "train!"
- ✗ *Child: Says, "block"*
Adult: Does not respond
- ✗ *Child: Points to the train*
Adult: Says, "I found some animals over here"

14) Using Communicative Temptations

The adult deliberately creates situations meant to **elicit communication from the child**. These "communicative temptations" may involve blocking the child's play, putting toys in sight but out of reach, limiting or withholding access to toys, using toys or containers for which the child needs assistance, or modeling a silly or unusual play act. In most cases, the adult will have shared control over the materials, such that s/he can limit access as needed. These strategies are followed by a brief period of **expectant waiting** to give the child an opportunity to respond. The adult may also use this as an opportunity to introduce a *direct teaching opportunity*.

- ✓ *Adult hands the child's crackers to her in a container with the lid on, and waits to see how she responds*
- ✓ *Adult uses his finger to stop the marble from running down the track, and looks expectantly at the child*
- ✗ *Adult sets up the child's snack so that she has unobstructed access to two snacks and milk*
- ✗ *Adult dumps out a whole bin of blocks for the child to play with*

Direct Teaching

What skills or **targets** are taught using **direct teaching opportunities**? Check all that apply.

- | | |
|--|--|
| <input type="checkbox"/> Eye contact | <input type="checkbox"/> Participating in routines |
| <input type="checkbox"/> Joint attention skills & gestures | <input type="checkbox"/> Increased attention or engagement |
| <input type="checkbox"/> Expressive language | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> Receptive language | _____ |
| <input type="checkbox"/> Play acts | _____ |

15) Pace and Frequency of Direct Teaching Opportunities

The adult **directs the child to demonstrate new or emerging skills** by giving some kind of instruction or cue. There is at least a brief period of time between direct teaching episodes in which the child receives access to a reinforcer, and the adult leaves space for child initiations. The adult can introduce more frequent direct teaching opportunities for children who are highly motivated than for children who are not **engaged**.

- Adult directs the child to ask for a block when he is engaged in the activity, then helps the child build before directing the child to ask for another block*
- Adult instructs the child to ask for blocks five times in a row, without giving the child access to blocks between teaching opportunities*

16) Varying Difficulty of Direct Teaching Target

The adult **intersperses opportunities for target responses that are easier** for the child with those that reflect brand new skills, to reduce frustration and maintain the skills that the child has already demonstrated.

- Adult occasionally directs the child to say "go," which he can do independently, between opportunities targeting the word "marble," which is still difficult for the child*
- Adult follows a teaching opportunity for a new skill (where the child needs physical support) with one that the child can complete independently*
- Adult follows a difficult teaching opportunity where the child needs physical support with another two opportunities of the same difficult skill, leading to child frustration*

17) Using Clear and Appropriate Teaching Opportunities

Direct teaching opportunities **target behaviors that are at or just above the child's current skill level**. When giving an instruction or **prompt**, the adult uses **communication that is clear and developmentally-appropriate**, such that it is clear how the child is expected to respond. Instructions and prompts are simple and direct, and the target skill remains consistent within each direct teaching opportunity.

- (Child who speaks in short phrases) Adult: Says, "Jimmy, give me the ball."*
- (Child who has some single words) Adult: Says, "Ball, or car?"*
- (Child who speaks in short phrases) Adult: Says, "Hey sweetie, do you want some more of those crackers, or would you rather have some juice to wash it down?"*
- (Child who has some single words) Adult: Says, "Hey, Jimmy, could you grab the ball for me?"*

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18) Providing Motivating and Relevant Teaching Opportunities

The adult teaches skills when the child is **motivated, interested, and engaged in the activity**. The child's interest may be indicated by reaching for materials, approaching the adult, making eye contact with the adult, looking at the materials, etc. The **target behavior is logically related to the ongoing activity**, and the adult embeds the teaching opportunity in the context of the ongoing activity.

- ✓ *Child: Building a tower with blocks, and reaching for more pieces*
 Target skill: Two-word requests
 Adult: Withholds the next block, and directs him to say "block please"
- ✓ *Child: Eating crackers*
 Target skill: One-word request
 Adult: Asks, "Crackers, or juice?"
- ✗ *Child: Building a tower with blocks*
 Target skill: Motor imitation
 Adult: Directs him to clap his hands
- ✗ *Child: Playing with cars*
 Target skill: Functional play act
 Adult: Directs him to put a piece in the puzzle

19) Supporting a Correct Response Using Prompts

After initiating a direct teaching opportunity, if the child does not respond independently, the adult **uses prompts of increasing support** to help the child respond correctly. Increasing the level of support may include giving the child additional cues to respond, or scaffolding the child's learning. The adult gives **no more than a few prompts before physically helping** the child follow through. Over time (across several teaching opportunities), the adult then **decreases support as a child learns a new skill**.

- ✓ *Adult: Asks, "What do you want?"*
 Child: Does not respond
 Adult: "Juice, or crackers?"
 Child: Reaches toward juice
 Adult: Says "Juice" and points to the juice
 Child: Continues reaching for juice
 Adult: Shapes the child's hand into a point, and gives her the juice.
- ✗ *Adult: Asks, "What do you want, do you want some more blocks?"*
 Child: Does not respond
 Adult: Asks, "What do you want?"
 Child: Looks at adult
 Adult: Asks, "Do you want some more blocks?"

20) Providing Contingent Natural and Social Reinforcement

Once a child responds correctly to a direct teaching opportunity (including when supported by the adult), the adult provides an **immediate** (i.e. within a few seconds) **natural reward that is directly related to the child's response**, and/or positive **social reinforcement** such as touching, verbal praise, or positive affect. Reasonable attempts to respond correctly, such as word approximations, are rewarded when **developmentally-appropriate**. Children are not allowed access to reinforcement without providing some type of response.

- ✓ *Adult: Asks, "What should we do?"*
 Child: Says, "Crash tower"
 Adult: Playfully knocks down the blocks and smiles

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- ✓ Adult: Asks, "What do you want?"
Child: Says, "Ju"
Adult: Says, "Nice asking me!" and hands her a cup of juice
- ✗ Adult: Asks, "Play ball, or play cars?"
Child: Says, "Play cars"
Adult: Says, "Ok, first let's go to the bathroom" OR "Here's a sticker for telling me!"
- ✗ Adult: Asks, "iPad or marbles?"
Child: Grabs iPad without communicating
Adult: Allows the child to play with the iPad

Glossary of Terms

Developmental level and Developmental appropriateness

Developmental level refers to a child's current repertoire of skills, and often focuses on language level or play skills. These skills tend to develop in a similar trajectory across children. When teaching or modeling skills, developmentally appropriate skills are those that are at or just above a child's current ability level. For example, a teaching target (targeting language) for a child who speaks in some single words may be a two-word request, or a new one-word request that the child has not yet mastered. A teaching target (targeting play) for a child who has mastered functional and combination play might be symbolic play, such as feeding a baby doll or putting farm animals to sleep.

Language level

- Pre-verbal
- Single words
- Short phrases/word combinations
- Complex language/sentences

Play level

- Sensory play
- Functional play
- Combination play
- Symbolic play
- Dramatic play

Direct Teaching Opportunity

Direct teaching opportunities refer to adult-led teaching episodes, in which the adult teaches the child a skill using a clear cue. When performed correctly, the adult uses an "A-B-C" (antecedent-behavior-consequence) approach by first giving the child some kind of cue or instruction (antecedent), supporting the child in performing the target skill (behavior) by providing *prompts*, and then rewarding or *reinforcing* the child's response appropriately (consequence). Various individual NDBIs may refer to these opportunities as teaching episodes, milieu episodes, teaching trials, etc.

Direct Teaching Target

A direct teaching target is a specific skill or response that the adult wants the child to perform in response to a direct teaching opportunity. For instance, if the adult withholds the ball to initiate a direct teaching opportunity, the target might be for the child to make a one-word request by saying "ball."

Prompt

"Prompting, also referred to as scaffolding or cuing, involves inserting a cue (verbal, visual, or physical) between the instruction [...] and the target behavior in order to elicit a desired response and thereby create the context for delivering the reinforcer" (Schreibman et al., 2015). Prompts vary in their level of support. Some prompts may be highly supportive (e.g. physically moving the child's hands or body to help them respond), while others may be minimally supportive (e.g. asking an open-ended question, or making a leading comment).

Engagement

Engagement refers to the extent to which the child is actively involved in an interactive activity with the adult. A child who is engaged with the adult may check in with eye contact, offer a turn, communicate for the purpose of sharing or commenting, request for a collaborative activity to continue, etc. A child who is not engaged may be fixated on a toy without attending to the adult, wander without choosing an activity, ignore the adult's social bids, etc. Although researchers have defined various more specific engagement states (Bakeman & Adamson, 1984), for the purpose of this assessment, these distinctions are not made. Engagement here would include Bakeman and Adamson's categories of 'coordinated joint engagement,' 'person engagement,' and 'passive joint engagement.' The categories of 'unengaged,' 'onlooking,' and 'object-engaged' would not be considered engagement.

Gesture

Gestures are *communicative* body and hand movements. Common gestures include pointing in order to request or direct someone's attention, nodding or shaking one's head to answer a question, clapping to indicate success or excitement, or holding one's hands up to indicate surprise. Descriptive gestures (e.g. holding one's

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hands apart to indicate size), emphatic gestures (e.g. conversational “beats”), and conventional gestures (e.g. waving goodbye, moving hand towards the body to say “come here”), are all considered here.

Routines

Play routine

Play routines are collaborative, toy-play activities where both the adult and child have an active role (which may be the same or different, depending on the activity). Play routines involve distinct play actions that are repeatable. Playing differently but in close proximity (i.e. parallel play) is NOT considered involvement in a play routine. Play routines can vary in complexity based on the child’s developmental level and attention, ranging from very simple (e.g. putting shapes in a shape sorter and dumping them out), to very complex (e.g. giving the baby doll a bottle, burping the baby, giving the baby a bath, and then dressing the baby).

Home routine

Home routines are activities that occur in daily routines in natural contexts. Some examples include dressing, bath time routines, hand washing routines, snack time or meal routines, etc.

Social routine

Social routines are joint activities which focus on the dyadic interaction between adult and child, rather than a play interaction involving toys. Common social routines include (but are not limited to) singing songs, playing a chasing or hide-and-seek game, jumping on the bed, rough-and-tumble play, peekaboo, playing a tickle game, etc.

Reinforcement

Reinforcement occurs at the end of a direct teaching episode, once the child has completed the desired response, and serves to encourage the child to respond similarly in the future. Reinforcement can take several forms, such as giving the child the item or activity they requested, praising them, and showing positive affect.

Natural reinforcement

“Natural reinforcement is reinforcement that is intrinsic to the child’s goal rather than unrelated to the child’s goal (external or extrinsic to the theme or content of the activity or interaction)” (Schreibman et al., 2015). For example, natural reinforcement for the request “car” might be handing the child a car and allowing him to play with it as he wishes. This can be contrasted with ‘artificial reinforcement,’ which is extrinsic or unrelated to the child’s goal. For example, artificial reinforcement for the request “car” might be giving the child a sticker, or giving the child a goldfish cracker.

Social reinforcement

Social reinforcement includes praise, physical touching such as tickles or hugs, and positive affect such as smiling or a happy and excited vocal tone.

Shared Control

An adult has shared control when they have at least partial control of the activity or materials (e.g., toy, game) that the child is motivated by. Shared control can be demonstrated by the adult holding or touching all or part of the materials, or blocking the play. If the child demonstrates consistent responding to language opportunities, it may be appropriate for the adult to elicit communication without obtaining shared control in advance, however the adult should be in close proximity to the child/activity such that they would be able to regain shared control if needed.

References and Acknowledgements

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