

The Early Communication Indicator (ECI) for Infants and Toddlers:

What It Is, Where It's Been, and Where It Needs to Go

Charles R. Greenwood

Early Childhood Research Institute on Measuring Growth and Development

Juniper Gardens Children's Project,

University of Kansas

And

Stacey Dunn and Susan M. Ward

Heartland Area Education Agency

And

Gayle J. Luze

Iowa State University

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Abstract

Measuring children's fluency learning a new skill is a component of applied behavior analysis of long standing. In special and general education programs in elementary schools today, fluency measurement can be seen as *Curriculum-Based Measurement* (CBM), and in preschool and kindergarten programs as *Dynamic Indicators of Basic Early Literacy Skill* (DIBELS). Each of these forms of fluency measurement provides a valid and sensitive means of measuring the effectiveness of instructional interventions in reading (CBM: Shinn, 1989) or emerging literacy skills like phonemic segmentation (DIBELS: Kaminski, & Good, 1996) that are precursors to reading. In this paper, we discuss an effort to extend this approach to infants and toddlers, children birth to three years of age. Progress developing an early communication fluency indicator is described, and an example of where research and practice needs to go to advance this work is provided. Implications for further research and practice are discussed.

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A concern exists that early interventionists lack adequate means of monitoring the individual progress of young children particularly infants and toddlers, children birth to three years old (e.g., Greenwood, 2002; McConnell, 2000). Needed for example, are better measures of identifying children with delays developing communication skills and of directly informing early intervention intended to support learning communication skills (McConnell, Priest, Davis, & McEvoy, 2002). Communication is a socially valid general outcome and indicators of increased proficiency in communicative skill are needed (e.g., Priest et al., in press). Early interventionists, childcare practitioners, and home visitors often rely on specialists for assessment of early communication because most lack the training and skills to administer and interpret the standardized tests and ratings typically used for this purpose. While these measures may identify children with delays relative to typically developing children, findings from tests and ratings too often have little direct utility for early intervention (Fuchs, & Deno, 1991; Fuchs, & Fuchs, 1986). One reason is that the conceptual frameworks of most early measures reflect person variables and do not connect with the 'alterable' interaction and ecological variables under the control of early interventionists. Another reason is that these measures may not be administered frequently enough, for example, no sooner than 6-months, to be useful in planning or modifying an intervention. Early interventionists need sensitive, reliable, measures specifically designed for measuring early intervention results.

Luze et al. (2001) recently reported an effort to develop an expressive communication fluency indicator (ECI) for use by early interventionists. Like CBM and DIBELS measures, evidence of the measure's sensitivity to growth over time and age, and its technical adequacy in

terms of criterion validity and reliability are reported. They also described a case example of how the measure might be used to monitor communication proficiency and to monitor the effects of intervention in a childcare center organized around milieu teaching (Greenwood, Luze, & Carta, 2002).

Briefly, Luze et al. (2001) reported that the ECI was sensitive to changes in specific prelinguistic (i.e., gestures, vocalizations) and spoken language skills (i.e., single words, multiple words) measured monthly for a sample of 50 children. The ECI was sensitive to differences in age, with older children in the third year of life demonstrating more fluent and proficient communication skills than children in their second year, compared to the first year of life. The ECI was significantly correlated with a standardized measure of early communication, the Preschool Language Scale - 3 (Zimmerman, Steiner, & Pond, 1992), and a parent rating measure indicating the ECI measures communication skills (see Luze et al., 2001). They also reported that the ECI met reasonable standards for test-retest, alternate forms reliability and interobserver agreement. However, the treatment utility of the ECI with early interventionists using the measure independently of the developers has yet to be demonstrated.

The purpose of this report was to provide an example of the ECI's sensitivity to an intervention developed and implemented by an early interventionist. Like CBM or DIBELS, we sought to use the ECI intermittently (monthly) to screen all children's progress and for children with identified concerns, increase measurement to weekly to measure effects of intervention. Because of the relative absence of knowledge about the ECI's sensitivity to any treatment, a simple intervention provided just prior to the ECI assessment in a weekly home visit was employed as an initial test of treatment sensitivity. Thus, the ECI's sensitivity to a weekly high-active, warm-up activity provided by a home visitor was examined.

Method

Overview

A trainer-of-trainers model was used to teach a number of early interventionists in an intermediate state education agency in the Midwestern United States to use the ECI over two years. The intermediate education agency used a problem-solving model based on continuous progress monitoring as its basis for identification and provision of early childhood special education services (Deno, 2002). In the first year, a group of four education unit staff members meet with the developers of the ECI in a two-day meeting where they learned its rationale and basic procedures. They viewed videotapes of its administration and scoring, and observed administrations taking place in local childcare centers. They learned the definitions of communication skill elements and recorded them from videotapes of children to high standards of interobserver agreement.

After making preliminary preparations among their local staff, some several months later, the developers made several presentations to a larger group of potential users of the ECI at the intermediate education agency, and provided feedback on their preparations to implement the ECI. The original group then trained their agency colleagues to the ECI using the same procedures. Implementation in the second year occurred in a year-long pilot project designed to evaluate feasibility as a progress monitoring and problem solving tool for infants and toddlers. During this period, the ECI was used to assess progress of 30-35 children. The developers provided feedback and individual child progress data was exchanged and evaluated.

Participants/Setting

A young girl and an early interventionist participated in this case study. The girl was 26 months of age at the beginning of the study and was receiving early intervention services under

an Individual Family Service Plan (IFSP). She had been previously described as having a developmental delay in expressive communication based on standardized testing. She was receiving early intervention services in a childcare center and also received intervention visits at home at a frequency of 1 per week for 45 minutes. The early interventionist was an early childhood special education consultant working on her master's degree trained to use the ECI by the original developers as previously described. The study took place within the child's home. ECI assessment and intervention was provided by the early interventionist.

Procedures

The child's communication was monitored using the ECI on a weekly basis over a period of 20 weeks, January-May, 2000. Weekly monitoring also enabled a look at monthly data at every fourth week. A simple AB design was used. The A condition was a baseline condition that occurred in the absence of a specific "warm-up" intervention, condition B. The B condition occurred in the home just prior to administration of the ECI. Condition B was a gross-motor, high-active, warm-up activity designed to accomplish two objectives. One was to promote the child's verbal communication in the context of engaging in the warm-up, the other was to improve the child's muscle tone. Selection and implementation of this intervention illustrates the ongoing problem solving logic used in the provision of services.

Measurement

The ECI was conducted as described by Luze et al. (2001). Each measurement involved (a) setting up a low-structure play task shared by a familiar adult, in this case the early interventionist, and the child using either the Fisher-Price™ Barn or House as alternate-session toy forms, (b) playing with the child for six minutes, and (c) recording the frequency of occurrence of four communication skills on a paper recording form designed for this purpose (see Table 1). The recording form was a simple matrix of cells defined by six 1-minute rows by

four communication behaviors, gestures through multiple words, and a total column. Behavior occurrences were tallied in the appropriate cell by minute of observation and type of behavior. The adult's role in the ECI was to set up and initiate the play session, and thereafter, to support the child's communication by following their lead within ongoing interactive play (Luze et al., 2001).

<Insert Table 1 about here>

Following the 6-minute administration, the frequencies of occurrence were transferred to the child's MS-Excel spreadsheet running on a notebook computer and scores calculated in terms of rate per minute for each key skill element (see Luze et al., 2001). The spreadsheet was preprogrammed to allow entry of the frequency of gestures, vocalizations, single words, and multiple words. Once data was entered, graphs were automatically plotted and updated to reflect current trends. The *monthly data display* provided an analysis of the individual child's level and trend in total early communication compared to the sample mean and ± 1 SD trajectories as reported by Luze et al. (2001). The *weekly data display* illustrated the trends in the rates of each of the four specific skills (see Table 1) and provided a means of tracking intervention changes and dates.

To calculate a total early communication composite score, the separate skill frequencies were combined. In order to weight the frequencies in favor of single words and multiple words in the calculation, each instance of single word counted as 2 and multiple word as 3. Gestures and vocalizations each counted as 1 per occurrence. According to Luze et al. (2001), weighting of the total communication indicator was necessary to reflect growth in communication proficiency by offsetting declines in gestures and vocalization that occur as children increasing learn to use spoken rather than prelinguistic communication skills.

Results

Did this child have a communication problem on the ECI and what was the effect of intervention on communication proficiency based on monthly data?

In terms of mean level and trend, it was clear from the first three months of data that this child was not highly communicative in absolute terms and in comparison to mean levels of children this same age in the original Luze et al. sample. Although, based on 3 monthly data points, the slope indicated that that child was apparently growing in communication proficiency (see Figure 1). The effect of intervention, as evidenced by the last two monthly data points, was to substantially increase total weighted communication compared to baseline and relative to the mean of the comparison sample.

<Insert Figure 1 about here>

What skill elements changed in association with the “Warm-Up” Intervention based on weekly data?

The weekly trends in communication skills are illustrated in Figure 2. Baseline data across 11 weeks indicated that this child communicated primarily using gestures, vocalization, and single words prior to the intervention and trends of each of these skills were level or declining. With the onset of the intervention, three of the four skills (i.e., vocalization, single, and multiple word utterances), appeared most changed in level compared to baseline. And, during intervention, not only were communicative behaviors occurring more frequently, compared to baseline, but an increasing number of multiword utterances were used. In terms of growth over time during intervention, trends indicated increases in single and multiple word communications, with decline in vocalization. Alternately, the intervention appeared to have had relatively little, if not a decreasing effect, on the rate of gestures.

<Insert Figure 2 about here>

Discussion

In an AB case study involving one child, the sensitivity of the ECI was explored. Initial baseline level and trend in monthly total weighted communication indicated performance well below expectation at this age. More frequently assessed weekly data indicated low level use of all communicative behaviors, about one occurrence per minute per behavior, during baseline and little growth in skills over time. In comparison to these relatively low and stable baseline levels, the onset of the “warm-up” intervention was associated with visually apparent differences in both weighted total communication collected monthly (Figure 1) and in terms of three of the four key skill elements (Figure 2). Perhaps most importantly, the intervention increased the child’s single and multiple word use fluency and thus, overall communication proficiency. These changes combined to produce levels of communication as large as those of age-mates in the original sample reported by Luze et al. (2001).

While these data provided an encouraging initial demonstration of the ECI’s sensitivity, they remain limited, however. Because of the AB design, a functional demonstration of the effects of intervention on communication fluency remains to be demonstrated in future research. Also, to establish the generality of the ECI’s sensitive to treatment and treatment validity, both direct and systematic replications of its use to monitor intervention results will be required.

These data also prompt some interesting future intervention research questions that may be addressed using the ECI. One was the relatively large effect of the rather simple intervention. Effects were surprisingly large, closing the gap with peers for a child with an identified communication delay. Effects this large may suggest that the child had previously learned some of these skills but systematically chose not to display them in the absence of the intervention.

This was evident in baseline were this child did display some rate of all four behaviors, and therefore, perhaps able to accelerate responding under the appropriate contingencies of reinforcement. This stands in contrast to a much young child, having not yet learned any of these skills as evidenced by no base rate of some or most of these behaviors (e.g., single words and multiple words).

A second was the nature of the intervention itself and whether or not it would operate similarly if given prior to rather than after the ECI. For example, one may hypothesize effects being a function of “behavioral momentum,” produced when presented prior to the ECI with effects spilling over into the ECI measurement. Would one find similar communication effects if the intervention followed the ECI, representing a cumulative generalization effect from prior week’s exposures? These and other interesting communication intervention related questions remain to be addressed and appear possible using the ECI where prior work has demonstrated its sensitivity, and technical adequacy. Current and future work remains is needed next to provide pervasive evidence of its sensitivity to intervention results and practical utility when used by early interventionists across a range of children, ages, disabilities, and interventions.

Table 1

Definitions of Early Communication Key Skill Elements

Element	Definition
Gesture	Any physical movement made by the child in an attempt to communicate with the partner (e.g., showing, giving an object or toy, pushing away or rejecting a toy, reaching for a toy, pointing to a person or object, nodding or shaking his/her head to indicate ‘yes’ or ‘no’)
Vocalization	Non-word utterance voiced by the child to a partner (laughing, making animal sounds, sounds that appear to be unintelligible words).
Single Word	A one word intelligible utterance used in isolation (not part of a longer intelligible utterance).
Multi-Word Utterance	Intelligible utterance of two or more words understood by the observer.

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Figure Captions

Figure 1. Child's total weighted communication rate over age at testing before and during intervention plotted against a normative linear trajectory defined by the mean and -1 and +1 a standard deviation confidence range (taken from Luze et al., 2001).

Figure 2. Child's communication weekly rates of gestures (upper left panel, vocalizations (lower left panel), single words (upper right panel), and multiple word utterances (lower right panel).



