

## **Early Childhood Assessment: A Comparison of the Bayley Scales of Infant Development and Play-Based Assessment in Two-Year Old At-Risk Children**

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*Practitioners are using a variety of assessment tools to measure cognitive functioning in young children. These measures are used for similar purposes yet the relationship among them is largely unknown. The purpose of this study was to analyze the relationship between two assessment approaches used to determine the cognitive functioning level in young children, the Bayley Scales of Infant Development-II and Play-Based Assessment. A sample of two-year olds participating in a Neonatal Intensive Care Unit Follow-Up Clinic were evaluated on both measures. Results indicated a high correlation between the two techniques. A comparison of the two techniques is provided as well as recommendations as to when each might be used most effectively in early childhood assessment.*

Early childhood assessment has received increased attention over the last decade, primarily because of the expansion of programs that serve young children with special needs. The primary purposes of these assessments is threefold and includes: 1) determining eligibility for early childhood special education; 2) identifying specific strengths and weaknesses so that appropriate interventions can be developed; and 3) developing a method of monitoring a child's progress. In the United States, public policy has had a major impact on the services provided to children with disabilities. Public Law 99-457, originally passed into law in 1986, guaranteed that exceptional children aged three to five will receive special service through public education programs. In subsequent years, revisions of the Individuals with Disabilities Education Act, 1997 (IDEA 97) ensured that services were also available for infants and toddlers (from ages birth through two). These services are now encompassed under Part C of IDEA 97. The purpose of the law is to ensure that free and appropriate educational programs are made available to meet the unique needs of eligible preschoolers and their

families. The intent is to raise a child's level of functioning and prevent new problems from developing or existing problems from worsening (Hardman, Drew, & Egan, 1999).

One developmental domain that must be measured, as required by Public Law 99-457 and its subsequent revisions, is cognitive functioning. Because of the increase in need for measures of cognitive functioning, new tests and innovative assessment techniques have been developed in recent years. The law does not require any specific test but, instead, that some reliable and valid method of assessing cognitive level is utilized when evaluating the cognitive functioning level of children (McLean, 1996).

Because of the need for sound psychometric properties, standardized tests are frequently chosen to measure cognitive functioning in referred children. The Bayley Scales of Infant Development-Second Edition (BSID-II; Bayley, 1993) is a standardized assessment technique commonly used to determine the cognitive level of young children.

The primary purpose of standardized tests, such as BSID-II, is to meet the first goal of assessment, which is to determine eligibility for special education programs. They also provide several benefits such as providing normative data and possessing high reliability and adequate validity. Standardized tests, however, have received considerable criticism (e.g., Greenspan & Meisels, 1996; Linder, 1993; McCormick, 1996; Neisworth & Bagnato, 1992). Specifically, these tests require the use of standardized procedures that are foreign to most children, including: use of an unfamiliar and unappealing environment, an unfamiliar examiner, instructions regarding how to play with specific toys, and a question and answer format with which the child may have minimal experience or ability. For purposes of maintaining standardization, examiners cannot deviate from the administration procedures dictated in the test manual. Thus, they cannot accommodate the potentially different needs of children with disabilities. Furthermore, the tests may be biased against children with disabilities, as they require use of language and motor skills that these children may not possess at the time of the evaluation. Children with communication or physical impairments may not be adequately assessed for other strengths they possess; thus, potentially unrepresentative or even inappropriate samples of behaviour may be obtained from the child

being tested (Linder, 1993; McCormick, 1996). An additional concern is that, although standardized tests are generally used in determining eligibility, they were not developed to define intervention needs or monitor progress and, therefore, should not be used for these purposes.

Because of the proposed limitations of standardized tests, the context of play has been suggested as a viable setting for collecting assessment data. Many researchers have conducted studies that support ecological validity of play assessment and they state that assessment in the context of play can lead to specific interventions and a mechanism to monitor progress (e.g., Bailey & Bricker, 1986; Barnett, Macmann, & Carey, 1992; Bricker, Bailey, & Slentz, 1990; Fewell & Kaminski, 1988; Fewell & Rich, 1987; Lidz, 1986; Lidz, 1992; Linder, 1993; Lowenthal, 1997; and Wolery & Dyk, 1984). Specifically, the use of free play in a natural environment as an appropriate means of assessing cognitive functioning has been purported by numerous researchers (e.g., Fewell & Kaminski, 1988; Linder, 1993; Lowenthal, 1997; and Wolery & Dyk, 1984). For instance, Barnett, Macmann, and Carey (1992) emphasized the importance of preschool assessments conducted in natural settings. They define this type of assessment as ecobehavioural analysis and specifically suggest that examiners observe play behaviours. Similarly, Lidz (1986) proposed that early childhood assessments should lead directly to interventions and be based in natural environments such as play settings.

One innovative method of play assessment that has received considerable attention and use by practitioners is Transdisciplinary Play-Based Assessment (Linder, 1993). The focus of this technique is on the child's strengths and areas of need for intervention. Unlike standardized tests, flexibility is allowed in the assessment process and, therefore, children with disabilities may be more fairly evaluated to determine strengths and areas of need. Linder did not develop Transdisciplinary Play-Based Assessment (TPBA) with the purpose of determining eligibility. Her primary focus was to find an ecologically valid method for determining a child's specific needs as they related to interventions. The methodology can be used to assess skills in several areas of development including: cognitive, fine motor, gross motor, communication, and social skills (Linder, 1993).

Little published research exists that analyzes the use of TPBA in determining cognitive development (Malone, Stoneman, & Langone,

1994). This is a major concern given that many practitioners are routinely using TPBA in their evaluation of the functioning level of young children. One exception is a study that examined the social validity of TPBA (Myers, McBride, & Peterson, 1996). Social validity was defined as "the validation of our work by consumers" (p. 103). The researchers found that professionals and parents had positive perceptions of the assessment of their child, team meetings, feedback from professionals, and written reports that resulted from the TPBA evaluation. They also reported that, overall, play-based evaluations were completed in a significantly shorter time than traditional assessments. Furthermore, the reports generated from data obtained during the play sessions were said to include more useful information that could be directly translated into interventions than did traditional reports.

Although published research is yet to be available, professional interest in TPBA is increasing (Eisert & Lamorey, 1996). Preliminary work has been conducted and has been receiving attention at conferences. For example, Karr (1998) conducted a study using children who were developing normally and compared their results from BSID-II and TPBA. Data from each measure were converted to standard scores for ease of comparison. Results indicated a significant correlation between the two measurement techniques. In a related study, Cornett and Farmer-Dougan (1998) analyzed the use of open-ended versus objective scoring procedures in TPBA. They found that objective scoring procedure produced more consistent results across raters than the open-ended procedure.

While empirical interest is on the rise, studies to date have not compared the results obtained from BSID-II and TPBA with at-risk populations. Despite criticisms, BSID-II continues to hold a prominent position in early childhood assessment. TPBA is gaining in popularity even though the technique has not been studied empirically. Some practitioners are attempting to use standardized tests and alternative assessments for more than what they were designed to do, others are choosing to abandon standardized measures entirely, and some are using a combination of standardized and alternative assessment techniques. Furthermore, some practitioners are using the two instruments interchangeably without first considering the purpose of the techniques.

Therefore, studies comparing BSID-II and TPBA are highly relevant and important.

The purpose of the present study was to examine the relationship between the Mental Developmental Index (MDI) score from BSID-II and the results of play-based assessment in an at-risk population. Since no studies of this relationship between the two techniques have been attempted with children who are at-risk, this project was exploratory in nature. Understanding the relationship between techniques intended to measure cognitive functioning is an important first step to providing relevant information to practitioners. The cognitive domain is of pivotal interest in determining eligibility for early intervention services. Therefore, the transdisciplinary component was omitted and hereafter the process will be referred to as Play-Based Assessment (PBA). In sum, the main question was whether or not the two different assessment approaches provide similar results and identify the same children as eligible for special education services.

## **Method**

### Participants

Thirty-eight two-year olds were recruited from the Neonatal Intensive Care Unit (NICU) follow-up clinic at a large midwestern children's hospital in the United States. The average age, adjusted for prematurity, was 24 months 15 days (range 23 months 10 days to 27 months 26 days). These infants were all below 1500 grams at birth and required significant medical intervention during their first months of life. The sample included 20 males and 18 females who were predominantly Caucasian and from middle- to upper middle-class families. The purpose of the clinic was to monitor the developmental progress of the infants deemed most at-risk for physical or cognitive problems to occur. The follow-up clinic routinely evaluated children at approximately 6, 12, and 24 months of corrected age to determine cognitive, motor, and language development, as well as medical needs. If deemed necessary, children were referred to their local school district for consideration for early intervention services.

### Procedure

Data were collected at the Neonatal Intensive Care Unit follow-up clinic. Specific information about the two assessment techniques is described followed by a thorough explanation of the PBA scoring procedures.

#### Assessment Techniques

*Bayley Scales of Infant Development-Second Edition* - BSID-II consists of three scales (mental, motor, and behaviour) that are used to assess development in young children aged 15 days to 42 months. The test was standardized in the United States with a representative sample of the target population. Standard scores are derived from the results with a mean of 100 and a standard deviation of 15. The psychometric properties of the instrument are reportedly high for all scales. Reliability coefficients for MDI range from .78 to .93 and PDI ranges from .81 to .91. Adequate short-term test/retest stability and interrater reliability are also reported (Bayley, 1993).

As a routine component of the clinic, BSID-II is administered to every child by advanced graduate students in school or clinical psychology under the supervision of a licensed psychologist. In the present study, the Mental Developmental Index (MDI) was used as the measure of cognitive functioning that could be compared to the results from the PBA. The Physical Developmental Index (PDI) was included to provide a discriminant validity check to determine if the measurement technique or the construct being measured had a larger impact on the relationship between scores.

*Play-Based Assessment* - The second phase of data collection, PBA, also took place in the clinic setting and was conducted by a School Psychologist trained in the procedures. The technique is stated to be appropriate for young children from 6 months to 6 years of age. The model for PBA used in this study was a modification of the procedures proposed by Linder (1993). A variety of toys (see Appendix), appropriate for children ages 6 months to 3 years, were arranged in a small room and were selected to encompass varying developmental levels that participants may display. The toys were arranged in the room the same way for every child according to function (e.g., all kitchen items together).

The child entered the playroom and was instructed to play with any of the toys. The investigator built rapport with the child but was not involved in the initial play. After the child played freely for approximately 10 to 15 minutes, she or he was prompted to participate in specific play activities that encouraged skills not yet observed. The play facilitator suggested that the child play with additional toys that might promote additional behaviours that could be coded at a higher level on the observational guidelines. The facilitator attempted to encourage the child to play with all the toys during the session, but not all children played with every toy. At the end of each play session, the child was given paper and crayons and asked to draw. The play facilitator drew lines and circles with the intent of the child imitating them. Children were observed as they played and data were recorded utilizing Linder's observational guidelines (Linder, 1993). The play sessions lasted 20 to 30 minutes.

The sessions varied from Linder's TPBA model in two ways. First, only cognitive functioning was evaluated and, thus, the transdisciplinary component was eliminated. Second, Linder suggests that the session end with a snack in order to analyze fine motor skills. Because the information was not pertinent to the current study, no snack was provided.

*Play-Based Assessment Scoring* - PBA provides information about children's play in several subdomains or specific categories of cognitive functioning including: Early Object Use; Symbolic and Representational Skills; Imitation Skills; Problem-Solving Skills; Discrimination/Classification Skills; One-to-One Correspondence; Sequencing Abilities; and Drawing Skills. The PBA observational guidelines are based on the developmental sequences demonstrated by typically developing children. Children's play skills are observed and age scores determined for each of the subdomains. Within each subdomain play behaviours are listed in a developmental sequence. Several behaviours are listed for each age range. For example, six different play behaviours may be listed in the 18 to 24 month age range for the Symbolic/Representational Skills subdomain.

General age scores from the PBA are described in terms of age ranges and these age ranges can be derived for each of the subdomains. Age scores can then be averaged to obtain an overall age-equivalent score.

Age-equivalent scores were determined by the first author according to the method described below. The Age Equivalents (AEs) from the play data were based on the age range guidelines for the cognitive domain (Linder, 1993). No specific method for calculating AEs is available in the guidelines but this technique may prove to be an innovative method of analyzing the results of PBA.

AEs were utilized for the purpose of analyzing the data in this study so it could be compared to standardized techniques. Each subdomain was analyzed separately and then averaged to determine the overall PBA AE. Specifically, if a child displayed all the behaviours listed in a specific age range for a subdomain and none in the next, he or she received a designation of the highest age level specified by that subdomain. For example, if a child demonstrated all the skills in the 18 to 24 month range for the subdomain of Problem-Solving Skills, but none of the skills in the 24 to 28 month range, his or her AE for Problem-Solving Skills would be 24 months. If, however, the child displayed four of the six skills in the 18 to 24 month range in Problem-Solving Skills, the AE would be prorated to 22 months. An overall AE score for cognitive functioning was calculated by averaging the subdomains. Total AEs were rounded to the nearest whole number. The overall age-equivalent score from the PBA was standardized by converting it to a ratio score using the basic formula of mental age, represented by the AE score, divided by chronological age and then multiplied by 100 (Karr, 1998). The PBA standard scores were then used in the analysis with the mental (MDI) and motor (PDI) scores from BSID-II. The comparison of the PBA and BSID-II scores is appropriate because they were both utilizing the same scaling method.

It should be noted that one of the PBA subdomains, One-to-One Correspondence, was removed from the data analysis because these skills are not rated until the 24-month level. Many of the children in the current study did not display the skills in this domain. Thus, including the scale would have inflated the PBA score. In addition, the Sequencing Abilities subdomain was not used in the present study because this skill begins at approximately the 36 to 42-month level.

## **Results and Discussion**



Three separate analyses were conducted to investigate the relationship between PBA MDI and to determine whether the two measures of cognitive functioning can be used interchangeably. First, means and standard deviations for each of the three measures were calculated. The average of the PBA scores was 94.56 (SD = 21.35). The MDI average score was 85.66 (SD = 17.40) and the average of the PDI scores was 85.55 (SD = 16.65). Of primary interest was comparing the PBA and MDI standard scores to determine if the children received similar scores on the two measures. A *t*-test was then conducted that revealed a significant difference,  $t(37) = 4.00, p < .001$ , between the PBA and MDI standard scores with the PBA resulting in higher scores.

Overall, these results suggest that children may demonstrate their optimum skills during the play assessment and be more restricted by the standardized format. A possible explanation for the results is that the nature of the two assessment techniques may have affected how children performed. PBA allows for more flexibility and follows the child's lead. In contrast, BSID-II is adult-directed. Since two-year olds often have difficulty complying with directions, they may perform better when they are able to select their own activities. Behavioural difficulties and noncompliance are more likely to negatively affect the BSID-II score than PBA.

Alternative explanations of these results are related to the nature of the data collection and analyses. The PBA data are less standardized, more subjective, and may be more influenced by the rater than BSID-II. PBA procedures also include an enabling aspect that is not present in the BSID-II administration. An adult can encourage or coach a child to play with toys in a specific manner that might lead the child to play at a higher developmental level. No coaching can occur with BSID-II. Thus, the higher PBA scores might be attributed to adult facilitation. The enabling may make even more of an impact for special populations who receive considerable direction from adults (Beckman, Lieber, & Strong, 1993; Roach, Barratt, Miller, & Leavitt, 1998). Furthermore, the ratings are based on subjective judgments of adults and may be biased. The fact that two different persons administered BSID-II and PBA may also have influenced the results. Finally, because of the possibility of chance occurrences of the play behaviours, the PBA scores may be inflated. The scoring procedures utilized in this study are preliminary and need further research to confirm this methodology.

Because of the differences in scores from the two measures, a second analysis was performed to determine if the same children would have been found eligible for early intervention services through special education using the two different measurement techniques. A cut-off score of 70 on the PBA and MDI standard scores was utilized for the purposes of this investigation. This is the most frequently used cut-off for determining eligibility as a child with a cognitive delay.

This analysis of the data revealed that 31 (82%) of the children would not have been identified for early intervention services, because of delays in cognitive development, based on results from both PBA and MDI. Four of the children (10%) would have qualified for services according to results from both techniques. Three of the children (8%) had discrepant findings from PBA and MDI. All three of these children would have qualified based on their results from BSID-II but not PBA. With the philosophy of early intervention services being preventative in nature, this may not necessarily be a positive result for PBA. The risk of not finding children who may need services is of concern. As previously stated, some practitioners are using PBA for identification purposes and they should be aware of the potential for under-identification.

Of additional interest was investigating the relationship among the PBA, MDI, and PDI. Therefore, the third analysis conducted was a simple correlation used to explore these relationships. The results indicated that the PBA was significantly correlated ( $p < .001$ ) with the MDI ( $r = .747$ ) and PDI ( $r = .746$ ). The highest correlation of the three standard scores was between the MDI and PDI ( $r = .874; p < .001$ ). As previously stated, the correlations between the PDI and MDI and between the PDI and PBA were explored to provide discriminant validity information. More specifically, the purpose was to find if the two measures of cognitive functioning (MDI and PBA) were more closely related than the two scores that were based on similar, standardized assessment techniques (MDI and PDI). The results indicate that the method of assessment (i.e., standardized vs observational) may influence the outcome of the assessment. In the present study, the two tests that measured different constructs but that used a standardized testing approach (i.e., MDI and PDI) were more closely related than dissimilar testing approaches that measured the same construct (i.e., MDI and PBA). Clearly, practitioners need to be aware that the assessment

procedures may influence the results and that they may not be measuring identical constructs if procedures are different.

Our results have several implications for professionals working with young children. When early childhood personnel are selecting assessment instruments, it is important to know how the techniques compare in terms of the type of information provided and whether the same children are identified for eligibility. Because the relationship between the two measures was strong but not perfect, practitioners must realize that the measures may define different strengths and weaknesses in children and that more children may be identified for services when using BSID-II than when using PBA. The two measures should not be used interchangeably without careful consideration of the impact of the results.

Although the present study did not utilize a transdisciplinary format, the results are not thought to be greatly influenced by this alteration of the original method. In both the original and the modified version of the play assessment, one trained professional rates the child's cognitive functioning. The presence of additional professionals rating other developmental domains would have minimal, if any, impact.

In sum, these results indicate that a positive relationship exists between the two measures but that enough differences exist to suggest that they cannot be used interchangeably. Fewer children may potentially be found eligible for special services when using PBA than the MDI from BSID-II. Given the tremendous implication for early prevention, much more research is necessary. Replication studies are needed that include a larger age group, more varied sample, and examine other developmental domains such as communication, social behaviour, and motor development in a transdisciplinary format. The restricted sample used in the present study limits the generalizability of the results. The scoring procedures used in the present study deserve additional investigation and the results should be replicated before further conclusions can be drawn. Finally, and most importantly, reliability data must be collected on the PBA techniques to determine if the procedures possess adequate psychometric properties. Specifically, studies of test/retest and interrater reliability are essential. Without these data, PBA cannot be considered as a psychometrically sound approach for measuring cognitive functioning.

In conclusion, the purpose for using a measure of cognitive development in the assessment of a young child should guide the selection process in determining which measure to use in assessing cognitive functioning. BSID-II provides the standard score that is often needed for placement in special programs. PBA does not provide a standard score but gives more detailed information in planning interventions and may also be the preferred method to monitor the progress of an individual child.

The present study should caution those who may currently be using PBA as a measure of cognitive functioning. We are not dissuading its use because we believe PBA holds potential for being a valuable tool in an assessment process. Because of the paucity of existing research, our ultimate goal is to motivate others to conduct additional studies so that PBA can be used with confidence in early childhood.

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## Appendix

Toy List  
Blocks  
Shaper sorter  
Play telephones  
Pop-up toy  
Baby dolls, stroller, bottle  
Nesting cups  
Pop beads  
Play dishes, kitchenware and food  
Gumball machine  
Toy cars  
Ring stacker  
Puzzles  
Music box  
Crayons

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