The Early Development Instrument: A Tool for Monitoring Children's Development and Readiness for School

Magdalena Janus*

Children are born ready to learn, and their neurological system has a vast opportunity during the first stages of life, beginning in utero, to form connections—or lose connections—that children need to develop and grow. Unfortunately, without costly brain scans, one cannot determine to what extent a child's brain has developed. We can, however, measure the progress and outcomes of early child development. Moreover, we can operationalize these outcomes to understand children's readiness for school, drawing on the experience and data of researchers and practitioners who are most knowledgeable about child development.

Monitoring children's outcomes is especially important during their early years. Dr. Dan Offord, the founding Director of the Offord Centre for Child Studies, was a major leader in mental health and interventions for children. He tirelessly emphasized the importance of ensuring that initiatives for young children must do more good than harm, and programs for children must be available *and* accessible, especially to those who need them most.

Implementation of early child development (ECD) programs is not sufficient in itself, even when programs are designed based on the best evidence of effectiveness. Implementation must be appropriate to the setting (families and communities) and must be complemented by the tracking of progress—for the program, children and families, and community (Janus and Offord 2000). Both evaluation and monitoring of children's outcomes are essential, and although the same tools could be used for each, the methodologies are different.

Readiness for school is a key measure of children's outcomes in their early years. A proven and effective tool for monitoring children's readiness for school is the Early Development Instrument: A Population-based Measure for Communities (EDI). Developed by Janus and Offord (2000), this instrument is being applied across Canada and elsewhere to estimate and monitor children's healthy development at school entry. The EDI offers applications and adaptability that are unmatched by any other tool currently available in the ECD field.

* Magdalena Janus, Ph.D., is Assistant Professor and Ontario Chair in Early Child Development, Offord Centre for Child Studies, McMaster University, Hamilton, Ontario, Canada

The EDI: School Readiness and Developmental Health

Readiness for school differs from readiness to learn. It is a much narrower concept that focuses on children's ability to meet the demands of school tasks, such as:

- Being comfortable exploring and asking questions
- Being able to hold a pencil and run on the playground
- Listening to a teacher
- Playing and working with other children
- Remembering and following rules.

Children who have these and other similar abilities are ready to benefit from educational activities provided in school. In this sense, school readiness serves as an indicator of the health of children in a community. School readiness reflects the broader concept of developmental health, is a population-level indicator, and is useful for understanding and comparing variables and differences among groups.

Janus and Offord (2000) designed the EDI to:

- Serve as a population-level measure for interpreting outcomes for groups of children
- Be completed by teachers in kindergarten classes after several months of observations
- Yield results that could be used by communities to identify weak and strong sectors
- Encourage communities to mobilize and make plans to improve children's outcomes
- Be used to sample a community's diverse population.

The EDI is a feasible, affordable, and psychometrically valid tool that teachers can use to monitor children's readiness for school. Using the EDI, it is possible to:

- ✓ Report on populations of children in different communities
- ✓ Monitor populations of children over time
- ✓ Predict how well children will perform in elementary school.

Domains of School Readiness

During the past decade, educational researchers have identified, in numerous studies, the domains of school readiness. The following three general domains are usually cited: physical, socioemotional, and cognitive. These domains are present throughout every individual's development, from early childhood through the school years and beyond, regardless of the

person's place of birth or ethnic origin. The domains can be monitored over time based on measures reflecting the developmental milestones.

In the EDI, the three domains are expanded to five developmental domains, as follows:

- Physical health and well-being
- Social competence
- Emotional maturity
- Language and cognitive development
- Communication skills and general knowledge.

A teacher or early childhood educator can assess children's school readiness across these five domains by completing the EDI, a 104-item questionnaire, for each child, usually during the second half of kindergarten. By this time, the teacher or educator is well acquainted with the children, and the children have adjusted to their new school setting. A shorter version of the EDI, which contains 35–50 items, is being developed and tested.

The 104 items in the EDI are grouped into the five domains and their respective sub-domains (see table 1). The items reflect *developmental* milestones, rather than specific curriculum goals, and they can be adapted to local contexts.

Table 1. EDI Domains, Sub-Domains, and Sample Items

EDI domain	Sub-Domain	Sample item
Physical health and well-being	Physical readiness for school day	Arriving to school hungry
	Physical independence	Having well-coordinated movements
	Gross and fine motor skills	Being able to manipulate objects
Social competence	Overall social competence	Ability to get along with other children
	Responsibility and respect	Accept responsibility for actions
	Approaches to learning	Working independently
	Readiness to explore new things	Eager to explore new items
Emotional maturity	Prosocial and helping behavior	Helps other children in distress
	Anxious and fearful behavior	Appears unhappy or sad
	Aggressive behavior	Gets into physical fights
	Hyperactivity and inattention	Is restless
Language and cognitive development	Basic literacy	Able to write own name
	Interest in literacy/numeracy and memory	Interested in games involving numbers
	Advanced literacy	Able to read sentences
	Basic numeracy	Able to count to 20
Communication skills and general knowledge	(No sub-domains)	Able to clearly communicate one's own needs and understand others
		Shows interest in general knowledge about the world

EDI, Early Development Instrument.

In addition to the 104 items, teachers and educators can extend the EDI to include three additional sets of questions pertaining to the children's:

Table of Contents

- Special problems
- Special skills
- Preschool experiences.

Although the answers to these questions are not included in the scoring of the EDI, they are useful for determining the support children may need in the next school year, as well as the children's overall level of school readiness. Teachers and educators also may add questions to the EDI to address particular local interests or concerns.

Box 1 defines the highest and lowest percentiles for children's development in the EDI.

Box 1. Highest and Lowest Percentiles of Development in the EDI

Physical health and well-being

- Above the *90th* percentile: A child is physically ready to tackle a new day at school, is generally independent, and has excellent motor skills.
- Below the *10th* percentile: A child has inadequate fine and gross motor skills, is sometimes tired or hungry, is usually clumsy, and may have flagging energy levels.

Social competence

- Above the *90th* percentile: A child never has a problem getting along, working, or playing with other children; is respectful to adults, is self-confident, and has no difficulty following class routines; and is capable of pro-social behavior.
- Below the *10th* percentile: A child has poor overall social skills; has regular serious problems in more than one area of getting along with other children—accepting responsibility for his or her own actions, following rules and class routines, being respectful of adults, children, and others' property, having self-confidence and self-control, and adjusting to change; and is usually unable to work independently.

Emotional maturity

- Above the *90th* percentile: A child almost never shows aggressive, anxious, or impulsive behavior; has good ability to concentrate; and is often helping other children.
- Below the *10th* percentile: A child has regular problems managing aggressive behavior; is prone to disobedience and/or is easily distractible, inattentive, and impulsive; is usually unable to show helping behavior toward other children; and is sometimes upset when left by the caregiver.

Language and cognitive development

- Above the *90th* percentile: A child is interested in books, reading and writing, and rudimentary math; is capable of reading and writing simple sentences and complex words; and is able to count and recognize numbers and geometric shapes.
- Below the *10th* percentile: A child has problems in both reading/writing and numeracy; is unable to read and write simple words, is uninterested in trying, and is often unable to attach sounds to letters; has difficulty remembering things, counting to 20, and recognizing and comparing numbers; and is usually not interested in numbers.

Communication skills and general knowledge

- Above the *90th* percentile: A child has excellent communication skills, can tell a story and communicate with both children and adults, and has no problems with articulation.
- Below the *10th* percentile: A child has poor communication skills and articulation; has limited command of English, has difficulties in talking to others, understanding, and being understood; and has poor general knowledge.

Table of Contents

EDI Specifics: Reliability and Validity

The EDI has been tested to ensure its reliability and validity psychometrically (Janus and Offord 2007). Table 2 summarizes the results of the reliability tests.

Table 2. Summary of EDI Reliability Tests

EDI domain	Internal reliability of the scales (Cronbach alpha) (n = 16,704)	Test–retest reliability (n = 112)	Inter-rater reliability (n = 53)	Parent–teacher correlation (n = 82)
Physical health and well-being	0.84	0.82	0.69	0.36
Social competence	0.96	0.92	0.80	0.50
Emotional maturity	0.90	0.89	0.77	0.36
Language and cognitive development	0.93	0.82	0.72	0.64
Communication skills and general knowledge	0.94	0.94	0.53	0.41

EDI, Early Development Instrument.

Tables 3 and 4 summarize the results of validity tests. Three types of validity were established:

- Concurrent validity—comparisons with other tests
- External validity—comparisons with other measures (i.e., parent reports) of similar concepts, as well as testing of relationships with other measures
- Predictive validity—prediction of later scores.

The validity of an instrument provides evidence that the scores obtained are based on sound science and can be interpreted as an indicator of the skills being measured.

Concurrent Validity

Table 3 shows the correlation between children's scores on the EDI and three other screening tests:

- *First Step Screening Test for Evaluating Preschoolers* (Miller 1993). This test is a direct developmental assessment.

- *Peabody Picture Vocabulary Test* (PPVT) of receptive vocabulary (Dunn and Dunn 1981). The PPVT is a test of receptive language which yields a short index of cognitive

functioning. The PPVT score is considered to be a reasonably reliable approximation of Intelligence Quotient (IQ).

- *Who Am I? Developmental Assessment* (deLemos and Doig 1999). This assessment of nonverbal language gives a reliable measure of development. It is valid across cultural groups and among children whose knowledge of English is limited. The test comprises three scales: copying (a circle, cross, square, triangle, diamond), symbols (printing name, letters, numbers, words, sentences), and drawing (a picture of oneself). The test is suitable for children ages 3–7.

Table 3. Correlation of EDI Scores with Direct Cognitive Measures

EDI domain	Correlation with First Step score (n = 68–94)	Correlation with PPVT score (n = 1,700)	Correlation with Who Am I? score (n = 1,700)
Physical health and well-being	Motor 0.54	0.05	0.14
Social competence	Socioemotional 0.65	0.22	0.38
Emotional maturity	Socioemotional 0.73	0.11	0.36
Language and cognitive development	Cognitive 0.58	0.26	0.46
Communication skills and general knowledge	Cognitive 0.52	0.57	0.22

EDI, Early Development Instrument; PPVT, Peabody Picture Vocabulary Test.

External Validity

The EDI's external validity was determined through parent interviews. Interviewers asked parents questions which corresponded with the EDI domains, and the parents' responses were correlated with the children's EDI scores. For example, the questions about physical health were "How would you rate the child's health?" and "How would you rate the child's level of activity?"

The correlations in the EDI domains were as follows:

- Physical health and well-being: 0.15–0.34
- Social competence, Emotional maturity: 0.21–0.48
- Language and cognitive development, Communication skills and general knowledge: 15–0.26.

Table of Contents

All correlations were in the expected direction, and 16 of 24 (66 percent) were statistically significant.

Predictive Validity

The EDI's predictive validity was determined using three direct tests 3 years after the EDI was first implemented (table 4).

Table 4. Predictive Validity of the EDI

EDI domain	Direct test, given in grade 2 (n = 122)	Correlation with direct test score[a]
Physical health and well-being	Visual–motor integration	0.27
Social competence	SDQ emotional score	-0.19[b]
Emotional maturity	SDQ emotional score	-0.20[b]
Language and cognitive development	DTLA-4 scores	0.46
Communication skills and general knowledge	DTLA-4 scores	0.43

[a] $p < 0.05$.
[b] Higher values on the EDI indicate better scores, and higher values on the SDQ indicate lower scores; therefore, the negative correlation was expected.
EDI, Early Development Instrument; SDQ, Strengths and Difficulties Questionnaire; DTLA, Detroit Test of Learning Aptitude, 4th ed.

The EDI as a Population-level Indicator

Since 1999, EDI data have been collected for more than 300,000 children ages 4–5 years in Canada and several other countries. A subset of the database, consisting of data collected from 2000 and later, has been analyzed to establish normative values for the EDI domains. The subset comprises 116,860 senior kindergarten children.

The normative data are a representative benchmark for comparing past, present, and future data. The process for establishing the normative database and descriptive statistics are provided in Janus and Duku (2004) and on the Offord Centre website <www.offordcentre.com/readiness>.

Canadian EDI Data: Examples

Some examples from the Canadian EDI database, presented below, illustrate how EDI data are collected, analyzed, and used. The examples describe children's vulnerability in relation to family income and affluence of neighborhoods.

Vulnerability

In the EDI studies, children are defined as vulnerable if they:

- Are in the lowest 10th percentile of a population
- Score below the 10th percentile on at least one of the five EDI domains of school readiness.

Alternatively, one could use the 10th percentile boundary from EDI normative data.

Relation of Vulnerability to Family Income

Figure 1 shows the gradient in children's vulnerability in relation to family income. The data are derived from 2,039 families in six sites in Canada. Family income was rated in accordance with Statistics Canada's Low-Income Cut-Off (LICO). The following definitions were adopted.

- Very poor—families with a ratio of earnings to LICO of < 0.75 (i.e., earnings are less than 75 percent of LICO).
- Poor—families with a ratio of 0.75–1.0.
- Not poor—families with ratio of 1.0–1.25.
- Well off—families with a ratio higher than 1.25 (i.e., earnings were 25 percent or more above LICO).

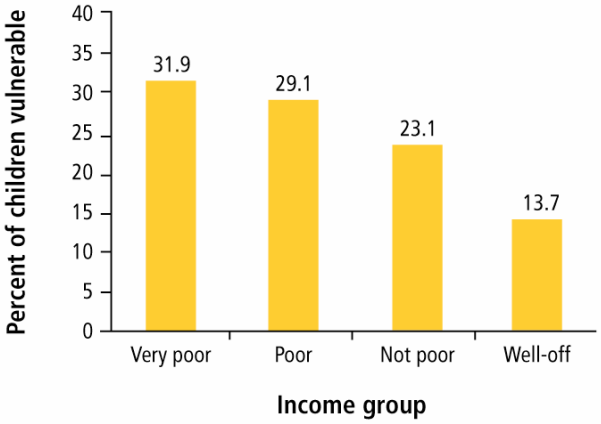
The figure shows that, proportionally, very poor families have the highest *percentage* of children who are vulnerable in school readiness.

Number of Vulnerable Children

Figure 2 illustrates that, although proportional representation is important, data on the number of vulnerable children also are informative. This figure shows that well-off families have the highest *number* of children who are vulnerable in school readiness.

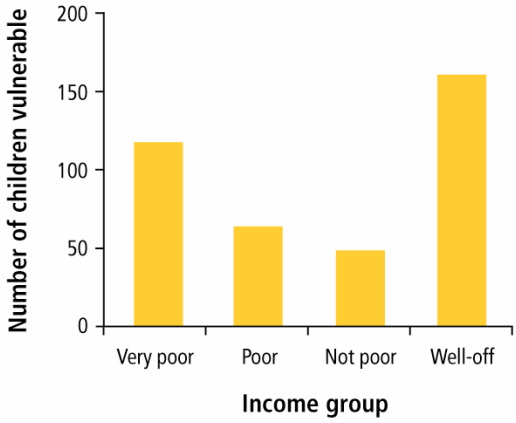
Table of Contents

Figure 1. Percent of Children Vulnerable in School Readiness in Four Income Groups (n = 2,039)



Source: National Longitudinal Survey of Children and Youth/Understanding the Early Years Initiative, 1999-2000 data; Early Development Instrument, 1999-2000 data.

Figure 2. Number of Children Vulnerable in School Readiness in Four Income Groups



Source: National Longitudinal Survey of Children and Youth/Understanding the Early Years Initiative, 1999-2000 data; Early Development Instrument, 1999-2000 data.

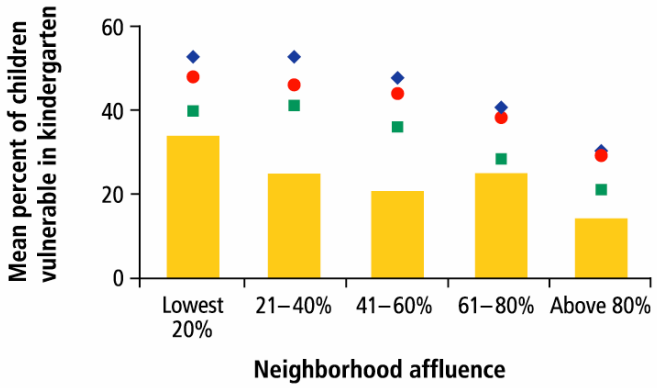
Vulnerability and Socioeconomic Status

To examine school readiness at the population level and in relation to later school achievement, the results of children's individual EDI scores were aggregated to neighborhoods and were related to the children's scores 3 years later in grade 3 and to socioeconomic variables in neighborhoods. Figure 3 shows that school readiness in relation to socioeconomic status (SES)

Table of Contents

(i.e., income) at the population (neighborhood) level follows the same gradient as it does at the individual level. School achievement at grade 3 follows a similar pattern.

Figure 3. School Readiness in Kindergarten and Grade 3 Test Results by Neighborhood Income



Source: Early Development Instrument, 2001 data; Education Quality and Assessment Office Grade 3 data, 2001; Canadian Census Data, 2001.

Table 5 shows the amount of variance in neighborhood-level grade 3 scores explained by the children's school readiness in kindergarten and their neighborhood SES. The table clearly shows that vulnerability in kindergarten contributes to children's outcomes later in school.

Table 5. Percentage of Variance in Children's Scores in Grade 3 (Aggregated to Neighborhood) Explained by the EDI and Neighborhood SES

Test	Variance by EDI	*p* value	Variance by SES variables	*p* value
Reading	8%	< 0.01	10%	< 0.001
Writing	7%	< 0.05	8%	< 0.01
Math	5%	ns	12%	< 0.01

EDI, Early Development Instrument; SES, socioeconomic status; ns, not significant.

Applications and Uses of EDI Data

Using the EDI, it is possible to obtain basic information about the school readiness of populations of children. This information includes:

Table of Contents

- ✓ Average scores for groups of children in 5 domains and 16 sub-domains
- ✓ Percentage of children at risk for not doing well in school in each domain
- ✓ Overall percentage of children vulnerable in school readiness.

The information can be used to report:

- Aggregate results on school readiness
- Comparisons among groups
- Relationships with other societal indicators.

Aggregate Results on School Readiness

The EDI results for individuals may be aggregated to various levels of complexity, provided the groupings can be categorized in a clear and meaningful way. The useful results that can be aggregated, averaged, and reported include the following:

- Demographic variables for children (e.g., gender, age, first language).

- Locally specific variables (e.g., children's participation in local programs, residence in particular neighborhoods)—to show local distribution and/or compare with normative data.

- Variations in school readiness by microlevel units of aggregation (e.g., schools, city neighborhoods, nongeographic communities such as ethnic groups)—to provide locally relevant information about children's school readiness.

- Comprehensive, macrolevel aggregations of school readiness for large geographic or jurisdictional areas (e.g., by city, state, country)—to provide useful information for many purposes. These results will not necessarily be applicable to all neighborhoods or smaller communities because of the variation among populations in large areas.

Comparisons among Groups

EDI data may be used to illustrate differences between and among groups. For example, EDI data can be used to:

- Distinguish gender differences in school readiness (e.g., average scores of boys and girls in EDI domains, percentage of boys and girls who are vulnerable)—which could be presented using statistics and simple graphics.

- Compare groups that are specified in the EDI or related dabatases across geographic areas—for example, apart from demographic variables (e.g., gender, age), comparisons could be drawn of children who did or did not participate in a specific program or did or did not attend preschool.

- Compare average scores and contrast a range of scores across neighborhoods—for example, two communities may differ slightly in the overall percentage of children who are vulnerable in school readiness, a fact that may indicate only minimal differences between the communities, but a more detailed comparison could show that the percentage range of vulnerable children across neighborhoods in one community is much wider than that in the other community.

  That is, the percentage of children vulnerable in one community could be 22 percent (with a range of 5.7–26.5 percent across the neighborhoods), while the percentage of children vulnerable in another community could be 28 percent (with a range of 10.5–46.7 percent across the neighborhoods). The second community thus has a much higher degree of inequality than does the first community.

Relationships with Other Societal Indicators

Macrolevel aggregations of EDI scores are useful data in association with other societal indicators. For example, EDI data on school readiness could be studied in relation to:

- National macrolevel indicators—for example, gross domestic product (GDP), or city, country, state/province statistics on education levels, school enrollment, and income
- Longer-term outcomes, including older children's outcomes (if presented at the same macrolevel)—for example, school dropout rates, international studies of youth literacy such as the Program for International Student Assessment (PISA)
- Environmental or geographic statistics (if the level of aggregation is comparable)—for example, pollution levels, availability of parks and playgrounds
- Policy issues (e.g., availability and duration of parental leaves) in association with international variations in EDI results
- Population-level health variables (e.g., low birthrates, childhood injuries, frequency of breastfeeding)
- Cultural differences (e.g., promotion of independence, learning styles) in association with socioemotional and cognitive competence.

➢ *See also "Canada: Longitudinal Monitoring of ECD Outcomes," by Jane Bertrand in this publication.*

Adaptation of the EDI to Local Contexts

The EDI is easily adaptable to different countries because the items included in the EDI reflect developmental milestones, rather than specific curriculum goals. Still, some expressions or skills may not be culturally or linguistically appropriate. Whenever possible, the EDI team works with local experts to adjust the EDI items to reflect the culture in which the EDI will be implemented.

Table of Contents

The EDI has been used or adapted for use with minimal changes in seven other countries (Australia, Chile, Jamaica, Kosovo, the Netherlands, New Zealand, United States). For some countries, data collection and analyses are ongoing. Comparisons of the Canadian normative data with EDI datasets from Australia and the United States suggest that the children's patterns of association in these countries are the same, a finding that renders the EDI as valid for these countries.

Adaptation of the EDI for use in other countries has been facilitated by:

- Designation of EDI sub-domains.
- Local selection of EDI sub-domain items based on their statistical relevance to the context in which the EDI will be implemented. Items that are not relevant are adjusted or replaced with other items.
- Development of the shortened version of the EDI—with up to three representative items from each subscale.

These steps are ensuring that the EDI is appropriately relevant and that the data obtained will be comparable.

Requirements for Implementation

The main requirements for implementing the EDI are as follows:

- As a population-level indicator, the EDI has most value when it is implemented for an entire group of children in a geographic community.
- The EDI also can be used as a research tool in a research or evaluation project. In this case, the interpretation of EDI results should reflect the population studied.
- To use the EDI successfully and meaningfully, the respondents reporting on children's skills and behaviors should:
  - Be individuals who know the children well in an early learning setting. Parents, for example, are not always the most knowledgeable respondents, for the EDI focuses on children's social skills and emerging academic skills.
  - Have received some education about early childhood.
  - Participate in a training and information session that informs them of the reasons for collecting the data, the data collection process, and the potential use of the results. At least minimal training will help ensure that the EDI items are interpreted accurately.
  - Be given a copy of the guide that accompanies the EDI.

Steps in Adapting the EDI Locally

Adaptation of the EDI to local contexts must be conducted systematically—to uphold the EDI standards and validity across settings and to guarantee that the assessment is relevant to each setting. The steps in adapting the EDI locally are as follows.

1. ***Consult with Local Experts to Establish the Relevance of the EDI Items.*** Local experts in child development (i.e., university faculty, clinicians, teachers, education administrators) should be consulted about the relevance of the EDI items locally. If the items need to be translated into a language other than English, these experts should be consulted about the accuracy of the translation. The local EDI coordinator must consult with the Offord Centre about any changes and modifications made to the instrument.

2. ***Modify the EDI as Determined.*** Changes and modifications are possible within the limits of comparability for the sub-domains. Changes can be made to adapt an item (e.g., modify the language) to the local context, or to remove or replace an item that is not relevant locally.

3. ***Implement the EDI on a Pilot Basis with Teachers or Early Childhood Educators.*** This step is essential, to ensure that the EDI items reflect children's skills accurately and that teachers and educators can respond to the questions readily and easily.

4. ***Assess the Local Reliability and Validity of the EDI***. Collecting data on the reliability and validity of the EDI locally is necessary to ensure that the previous steps in adapting the EDI have been successful. Reliability and validity could be assessed in several ways—for example, by:

   – Having a subgroup of teachers complete their assessment twice (test–retest)

   – Linking the EDI data with individual assessments of children's cognitive abilities (conducted separately, or previously, as is often done routinely in schools)

   – Selecting a representative sample of parents for parent interviews.

   To document reliability and validity, the data from these additional assessments should be analyzed for their level of agreement or association with the EDI results.

➢ *See also "Measuring Child Development to Leverage ECD Policy and Investment," by J. Fraser Mustard and Mary Eming Young in this publication.*

Conclusions

The EDI is a helpful tool for determining school readiness. If implemented according to the guidelines specified, it will provide a snapshot of children's abilities at the end of their first 5–6

years of life. Used in conjunction with other measures, the EDI can indicate possible causes of children's weaknesses or strengths in school readiness.

Although it is a helpful tool, the EDI does *not* provide a recipe for action. Actions to improve children's school readiness must be based not only on EDI results, but also on data gathered from other sources, and they must be developed in collaboration with the many partners involved in children's education.

In many places, as among the Canadian sites, the collection of EDI data is a first step toward mobilizing a community and gaining evidence, for political leaders and policymakers, to improve young children's opportunities for success. Improving the outcomes of early child development and helping all children grow up healthy and happy are imperatives for all countries.

Web Resources [as of November 2006]

Offord Centre for Child Studies: <http://www.offordcentre.com/readiness>
Australian Early Development Index: <http://www.rch.org.au/australianedi>

Magdalena Janus' e-mail: <janusm@mcmaster.ca>

References

deLemos, M., and B. Doig. 1999. *Who Am I? Developmental Assessment*. Melbourne: Australian Council for Education Research.

Dunn, L. M., and L. M. Dunn. 1981. *Peabody Picture Vocabulary Test–Revised. Manual for Forms L and M*. Circle Pines, Minn.: American Guidance Service.

Janus, M., and E. Duku. 2004. *Normative Data for the Early Development Instrument.* <http://www.offordcentre.com/readiness>.

Janus, M., and D. Offord. 2007. Development and Psychometric Properties of the Early Development Instrument (EDI): A Measure of Children's School Readiness. *Canadian Journal of Behavioral Science* 39(1):1–22. <http://www.offordcentre.com/readiness>.

Janus, M., and D. Offord. 2000. Readiness to Learn at School. *ISUMA* (Canadian Journal of Policy Research) 1(2):71–5.

Miller, L. J. 1993. *First Step Screening Test for Evaluating Preschoolers*. San Antonio: The Psychological Corporation.