
Measuring Child Development to Leverage ECD Policy and Investment

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Healthy brain development during early childhood is essential to the overall health, well-being, and competence of populations. All societies need to understand the importance of this connection in order to cope well with the global changes under way—the exponential growth in new knowledge and technologies, globalization and its socioeconomic effects, population growth and new demographic patterns, and constraints on resources (Mustard 2006). Communities and governments that appreciate the importance of brain development in early childhood and invest in programs to foster the healthy development of their children will improve the quality of their populations and advance their socioeconomic development.

The most promising tools and measures for assessing the outcomes of early childhood will be those that incorporate the latest scientific evidence of early brain development and are intended for use in populations. For communities and countries, assessments that are both science- and population-based will yield valuable data on children’s vulnerability and readiness for school—as they enter school. With these data, public and private citizens and organizations can leverage culturally relevant, evidence-based, early child development (ECD) policies *and* targeted investments to improve the potential of a nation’s young children.

Several efforts to construct population-based outcomes of early childhood are under way. One tool, the Early Development Instrument: A Population-based Measure for Communities (EDI), is an inexpensive and simple-to-administer assessment for children in communities. This tool has been well tested and is being adapted and applied in industrialized and developing countries. Wider use of this instrument in different communities and countries will yield critical comparative data on children’s early development and the effectiveness of ECD policies and investments.

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Early Child Development and Human Development

Early child development links closely with human development. Van der Gaag (2002) states the connection precisely—

Early child development refers to the combination of physical, mental, and social development in the early years of life...Human development refers to similar dimensions—education, health (including nutrition), social development, and growth—but at the scale of a nation.

He goes on to say:

Four critical “pathways” link ECD to HD. The first pathway runs through *education*. Interventions during the early years of a child have multiple benefits for subsequent investments in the child’s education, ranging from on-time enrollment in elementary school to an increased probability of progressing to higher levels of education. The second pathway is through *health*. Like education, investments in health are an investment in human capital and have long-term benefits. The third pathway links the notion of improved social behavior (as a result of being enrolled in an ECD program) with the formation of *social capital*...In the fourth pathway, ECD is linked to HD by the potential of ECD programs to address *inequality* in society. And, ultimately, education, health, social capital, and equality are linked to economic growth and, hence, to HD.

In the continuum of life, the cumulative (past) experiences of early childhood form the bases for children’s outcomes by the time children enter kindergarten or primary school (by age 8, or ages 5–7), and these outcomes set trajectories for children’s health, learning, and behavior throughout adolescence, adulthood, and later life. This conceptual continuum—from early experience to early child development to human development—is borne out by new knowledge from the neurosciences, biological sciences, psychology, health sciences, economics, social sciences, and education.

Early Experience and Brain Development: Lifetime Effects

The very early experiences of childhood, beginning in utero, stimulate and affect brain development. This linkage, as noted recently in *The Economist* (2006), reflects the confluence of genes and environment in brain development. The referenced article captured the latest neuroscience research by Michael Meaney and Moshe Szyf, McGill University, Montreal, Canada, who are studying the effect of maternal care on epigenetic imprinting in rats and humans. As *The Economist* notes, this school of researchers holds that “early experience [i.e., events in childhood] does profoundly mould the brain...[and] What it actually moulds is the way genes work.”

During the past decade, new knowledge from the neurosciences has increased considerably, to better define the development of the brain and the link to the early years of childhood—and the formation of human capital and competence of populations. Neuroscientists note that “the

effects of early experience on the wiring and sculpting of the brain's billions of neurons last a lifetime" (McCain and Mustard 1999).

Experience-based brain development lays the foundation for a full range of human competencies. Several messages are clear:

- Brain development is a continuous process, and each developmental step influences the next (Ellis, Jackson, and Boyce 2006).
- The sequence of brain development which relates to experience (i.e., the stimulation of sensing pathways—seeing, hearing, touching, smelling, tasting) is hierarchical and occurs in a series of stages. These sensing pathways develop very early and link with other pathways to influence learning, behavior, and physical and mental health.
- Negative, as well as positive, experiences in early life affect the development of neural circuits that mediate cognitive, linguistic, emotional, and social capacities.
- Children's early development has important effects on later physical and mental health risks, as well as education and learning.

The Early Years: A Prime Investment Opportunity

Economists, researchers, and finance ministers agree that early child development is a prime investment opportunity for society. As van der Gaag (2002) notes—

Human development, broadly defined, is the overarching objective of most international and multinational development programs. Because it is so closely linked to ECD, investing in ECD is the *natural starting point* for these programs and for the public policy that frames these programs.

The Nobel laureate in economics James Heckman eloquently summarizes the knowledge that supports this investment interest—

There is a striking convergence of four core concepts that have emerged from decades of mutually independent research in economics, neuroscience, and developmental psychology. First, the architecture of the brain and the process of skill formation are both influenced by an inextricable interaction between genetics and individual experience. Second, both the mastery of skills that are essential for economic success and the development of their underlying neural pathways follow hierarchical rules in a bottom-up sequence such that later attainments build on foundations that are laid down earlier. Third, cognitive, linguistic, social, and emotional competencies are interdependent, all are shaped powerfully by the experiences of the developing child, and all contribute to success in the workplace. Fourth, although adaptation continues throughout life, human abilities are formed in a predictable sequence of sensitive periods, during which the development of specific neural circuits and the behaviors they mediate are most

plastic, and therefore optimally receptive to environmental influences (Heckman 2006).

In brief, in the continually changing global marketplace, the success of modern economies depends in part on societies having well-educated and adaptable workers who are capable of learning new skills. As McCain and Mustard (1999) documented in the Early Years Study in Canada, early childhood—

...is as important for an educated, competent population as any other period. Given its importance, society must give at least the same amount of attention to this period of development as it does to the school and post-secondary education periods of development.

From the perspective of society, the rationale for investing in young children is at least threefold. Investments in young children—

- Assure equality of opportunity—ECD programs help to overcome socioeconomic disparities by ensuring equality of development for all children *before* they enter primary school.
 - Promote efficiency in society—Investing in ECD programs yields a much higher rate of return than investing in later remedial interventions (e.g., to reduce grade repetition, dropout from school, delinquency, crime).
 - Foster economic growth and development—in a continually changing global market, societies depend on having well-educated and adaptable workers with strong problem-solving skills, emotional resilience, and capacity to work with others to remain competitive.
- See “*A Productive Investment: Early Child Development*,” by Rob Grunewald and Arthur Rolnick, and “*Early Child Development Is a Business Imperative*,” by Charlie Coffey in this publication.

Societies are beginning to identify alternative options for garnering public and private investments for ECD programs. This creativity is occurring across all regions—Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, the Middle East and North Africa, and Sub-Saharan Africa. In this publication alone, we note that—

- Indonesia is exploring public financing of community-driven ECD programs.
- Brazil is partnering with foundations and private banks to build capacity in ECD caregivers.
- The Open Society Institute continues to provide catalytic funding and assistance across 30 countries.
- Jamaica is initiating legislation and policies to stimulate funding for early child development.
- The Dominican Republic has established a Competitive Fund for Educational Innovations.

Yet, much more action is needed to close the gap between what is known about early child development and what communities and governments are doing to improve early child development.

Action—Inaction

Two reasons currently impeding accelerated action to improve early child development worldwide are the lack of shared understanding—across disciplines and sciences—about the importance of children’s early development and inherent difficulties in evaluating the effect of ECD programs.

Toward a Shared Understanding

The importance of early child development seems so obvious—as articulated clearly by economists such as van der Gaag (2002) and Nobel laureate Heckman (2006) and many other scholars (Acheson 1998; Keating and Hertzman 1999)—based on the synthesis of knowledge across disciplines in the natural and social sciences with respect to the determinants of human development. Nevertheless, many individuals still question whether the early years of brain development can have a profound effect on learning, behavior, and health—and whether investments in early childhood programs, without well-controlled evaluations, can be beneficial.

The current understanding of the importance of the early years of human development on individuals’ competence, coping skills, and health throughout life is not shared across all disciplines. Wilson (1998) has emphasized the necessity of integrating knowledge from the natural and social sciences to more fully understand the effects of environment on developmental health and quality. In *Consilience: The Unity of Knowledge* (1998), he notes in particular that the lack of a common language (i.e., polarization) among scholars “promotes, for one thing, the perpetual recycling of the nature–nurture controversy.” As Mustard shows, this controversy is being overwritten by the new science of epigenetics.

- See “*Experienced-based Brain Development: Scientific Underpinnings of the Importance of Early Child Development in a Global World,*” by J. Fraser Mustard in this publication.

Ensuring optimal outcomes in children’s early development should be of interest to all members of society and to all families, communities, and governments. In addressing the debate on whether early childhood matters in development and health, Mustard concludes that stronger institutional capabilities are needed to build linkages among the sciences and to establish “new frameworks of understanding” (Mustard 2000).

Documenting the Effects of ECD Programs

Evaluating the effects and benefits of ECD programs is difficult.

- First, ECD programs are complex—multiple inputs arrive through multiple points of entry [i.e., health, education, social protection, and agriculture sectors converge on multiple beneficiaries (children, families, and communities)], and these inputs and entry points vary across countries and may change over time within countries.

- Second, evaluations of ECD programs consume many years of painstaking collection and analysis of data, for many program effects and outcomes are not visible until later in life (or may fade over time).
- Third, a control group often is not available. When it is available, ethical issues arise (e.g., the measuring of health problems or developmental/learning delays without suggesting or providing medical care or educational services). These issues may be circumvented in some instances (e.g., when implementing a large ECD program over time, during which groups that receive the program later can serve as initial control groups). This approach has been adopted for Colombia’s Community Welfare Homes program, Bolivia’s Integrated Child Development Project (Behrman, Cheng, and Todd 2000), and the Philippines’s Early Child Development Project (Armecin and others 2005).
 - See “Colombia: Challenges in Country-level Monitoring,” by Beatriz Londoño Soto and Tatiana Romero Rey in this publication.

Nevertheless, evaluations of the effect of ECD programs clearly demonstrate that, for children, the effects are large and yield impressive benefit-cost comparisons. In relation to long-term productivity and health for children as they mature into adults, the beneficial effects of ECD programs are overwhelming.

- See “Outcomes of the High/Scope Perry Preschool Study and Michigan School Readiness Program,” by Lawrence J. Schweinhart, and “The Abecedarian Experience,” by Joseph Sparling, Craig T. Ramey, and Sharon L. Ramey in this publication.

Moreover, the combination of longitudinal evaluations of large randomized, controlled ECD studies and scientific evidence on brain development is strongly supportive of a *causal relationship* between a child’s participation in an ECD program and the effects observed. This evidence base is being further strengthened by new understanding of the molecular and epigenetic effects of children’s early experiences (i.e., stimulation, lack of stimulation) (Mustard 2006). The strong indication of a causal relationship between children’s participation in and benefits from ECD programs is a basis for extending and scaling up these programs for populations.

Why Measure Early Child Development?

To accelerate action and apply new understanding about early child development, ECD researchers and practitioners must be able to measure, systematically and comparatively, the outcomes of early childhood and ECD programs across communities and populations. Measuring the outcomes of early childhood is the closest we can come as yet to measuring children’s brain development. With a common assessment tool(s) and measures that incorporate the latest scientific findings about early brain development, ECD researchers and practitioners could obtain data that would—

- Foster unity of knowledge about the importance of early child development to populations' health, well-being, competence, and quality
- Build a new framework of understanding about early child development across disciplines and sciences
- Identify the need for and benefits of ECD programs within and across populations.

Data are essential—to promote shared understanding of early child development and to document the effect of ECD programs.

Without data, some may see no problem; without a problem, there is no action—and without action, there is no change.

Moreover, unless systematic and comparative data about children's development become available, community and government actions may continue to be sporadic and national and regional efforts may not be effectively scaled up. McCain and Mustard (1999) have noted the paradox—whereas the early years of child development are most crucial to human development, most countries do not yet have a suitable database to inform them about the status of their families and societies.

Communities and governments need to have a database of their children's outcomes, with and without ECD programs. Although local governments may be cognizant of the many reasons for investing in ECD services, they need a common assessment tool to obtain essential data that could be used to:

- Stimulate discussions about early child development among teachers, parents, schools, community groups, and policymakers
- Identify communities and neighborhoods where children may be at risk developmentally
- Plan and evaluate ECD initiatives
- Establish best practices and refine criteria for successful programs
- Identify programs for expansion and extension to other settings and communities
- Document the effect, efficacy, and cost-effectiveness of ECD programs.
- Leverage better-informed ECD policies
- Match programs with investment opportunities.

As emphasized at the World Bank's symposium on Early Child Development: A Priority for Sustained Economic Growth and Equity, in September 2005, the need for a common assessment tool and measures is urgent and must be addressed now, because—

- The public and private sectors recognize increasingly the value of ECD programs as a productive investment and business imperative.
- The documented lessons from evaluations of ECD programs in industrialized countries are fueling efforts to expand and scale up ECD programs in developing countries.

- Countries and nongovernmental organizations (NGOs) are taking up the challenge of monitoring ECD outcomes.
- Low- and middle-income countries are pursuing innovative options for financing ECD initiatives.

The opportunity to expand ECD efforts and funding to support young children’s development is greater now than ever before. The global ECD community is in a unique position to take advantage of burgeoning philanthropy—and to make a case for investing in young children, but only if it has solid evidence to support its claims. With appropriate and adequate data, the ECD community could foster action to perhaps now meet McCain and Mustard’s (1999) challenge when they said—

As a society we spend large sums of money measuring the performances of businesses and the economy and next to nothing on the indicators that are most crucial for our children and for the future performance of our population. In view of the importance of the early years on the future of our population which is pivotal to the success of our economy, it is time that governments closed the crucial gap in our information base.

Toward a Population-based Assessment of Early Child Development

Early child development, like health, is a *population* phenomenon with equality as a goal. “Population-based” means incorporating or taking into account a whole population, as opposed to sampling or targeting specific subgroups.

“Population health” and “public health” are population-based concepts that take into account the complex interactions (biological, social, cultural, environmental) determining the health of individuals, communities, and entire populations. In countries, the goal of a public health system is to apply this knowledge to improve the health of both populations and individuals and to offer, monitor, and ensure equality of health for all populations.

Similarly, the determinants of early child development at family, neighborhood, and societal levels are complex and are expressed differently in different settings. Using population-based assessments, we can answer the question, “What, and where, are the differences that determine different outcomes”? The goal of ECD efforts is to apply this understanding to improve the developmental trajectories for individuals and populations and to offer, monitor, and ensure equality of opportunity to all children for life.

While yielding benefits for individuals, public health and ECD efforts are, first and foremost, population enterprises with long-term effects. In either case, changes in a nation's policies or investments effect changes in human capacity and competence.

In *public health*, the measures of change within and across populations include infant mortality rate, incidence of low birthweight, and child or maternal mortality rates. These population measures of health reflect not only the quality or quantity of health care, but also the larger socioeconomic environment contributing to the population’s level of well-being.

Similarly, in *early child development*, the measures of change within and across populations reflect brain development—for example, physical health and well-being, social competence, emotional maturity, language richness, and general knowledge and cognitive skills. All these measures relate to subsequent learning, behavior, and health in a population and are influenced by children’s early experiences in the *total* environment, which includes the many socioeconomic factors to which they are exposed.

Interestingly, public health measures used to assess children’s health and well-being focus on negative outcomes (i.e., pathology, mortality) and are deficit models addressing only one dimension of outcome (e.g., medical, health). In contrast, outcome measures of early child development focus on positive outcomes (e.g., well-being, competence) and interrelated development that combines and crosses broad domains of human function.

As a “public health” tool, a population-based assessment of the outcomes of children’s early brain development would:

- “Tap into” and reflect all aspects of the environment influencing child development—not simply factors that can be manipulated easily
- Indicate to communities, regions, states, and countries where and how to improve early child development
- Be highly responsive to change and could be used to assess whether ECD efforts are succeeding in a population
- Help policymakers assess whether ECD efforts have improved children’s outcomes
- Yield information that could be used to leverage ECD policy and investments for all children and, especially, for vulnerable and at-risk children
- Stimulate broad action to improve the competence and equality of populations.

Early child development encompasses all aspects of a child’s life (e.g., health, nutrition, education). Because early child development has important effects on health risks in later life, the assessment of it is as much an assessment of health as it is of education and learning. A population-based assessment of early child development would be a powerful and comprehensive tool for examining and predicting the overall health, well-being, and competence of the next generation.

At School Entry

Within a country, a population-based assessment of all children’s outcomes in the early years is most feasible when children first enter the school system (at approximately ages 5–7 years) based on the existing institutional structure. At this time, all children in industrialized countries are universally enrolled in kindergarten or primary school.

Some may ask, “Why wait until school entry, given what we know about brain development?” Development of an assessment tool to measure children’s outcomes at age 3

years would be valuable, but application of such a measure for an entire population of children is not easily done in industrialized or developing countries because of the lack of institutional structures in which to canvas all children of this age.

Two Concepts: Optimal Brain Development, Readiness for School

Early child development is not just about readiness for school. It is about setting trajectories in the early years to affect health, learning, and behavior throughout life.

The predominant measures of education attainment or outcome have tended to focus on administrative, school-based data—perhaps reflecting the conventional paradigm of education, which emphasizes formal institutions and cognitive measures of achievement. In contrast, very little attention has been given to measuring children’s development during their early years.

With research proving that early experience influences the development of neural circuits that mediate cognitive, linguistic, emotional, and social capacities—all of which are critical for learning in school and beyond—we must move forward to develop population-based measures for assessing the overall outcomes of children’s early development.

Optimal brain development—a broad, encompassing concept—captures the science of early child development. Its adoption and use, however, will depend on researchers and educators achieving a shared understanding that the early years of children’s development are closely linked with the competence, coping skills, and health of individuals and populations throughout life.

Until this concept is more widely understood and accepted, readiness for school (or school readiness) is being used as a proxy measure for optimal brain development. Both readiness for school and readiness to learn are widely used concepts in education. Although neither captures the full implication of the importance of brain development during the first years of life and the long reach (i.e., close link) of this early child development to human development, readiness for school—

- Is a promising measure of early child development for practical reasons—entry into school is the first time after early childhood when all children are enrolled in an institutional structure where data on their development can be collected.
- Serves as a common framework to underscore the importance of early child development—that is, children’s performance in the school system is influenced to a large extent by the time children enter school.

School readiness is distinct from readiness to learn. As historically understood—

School readiness implies fixed standards of physical, intellectual, and social development that enables children to fulfill requirements and to assimilate a school’s curriculum (Cronic and Lamberty 1994; Kagan 1990; Lewit and Baker 1995; West, Denton, and Germino-Hausken 2000).

Readiness to learn implies “level of development at which an individual (of any age) is ready to undertake the learning of specific materials. When applied to a

population or group, it refers to the age at which the average individual has the specified capacity” (Lewit and Baker 1995).

Stated more simply, “readiness for school...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, and remembering and following rules” (Janus, in this publication). These abilities vary among children, reflect children’s early brain development, and are measurable and specific.

Still, use of “readiness for school” may be controversial and confusing. As Goelman and Hertzman (n.d.) explain—

To some it [readiness] is a meaningful way to describe the collection of cognitive and social skills, the knowledge, dispositions, and personal experiences that children bring with them when they enter kindergarten [or first grade]. For many...school boards, teachers, parents and policy makers – the term “*readiness*” is descriptive, accurate, and neutral....for...early childhood educators, infant development consultants, and child care professionals – the word “*readiness*” carries a very strong negative association with it. This stems from a long-held set of beliefs in ECE [Early Childhood Education] that child development is a continuous process with no sharp dividing lines between “not *ready*” and “*ready*” and that children develop at different rates, especially in their early years.

Early childhood educators also are wary that readiness may be used to set standards for kindergarten entry. Some educators, researchers, and policymakers have skewed the use of the term to focus only on the linkage among early child development, school readiness, and success in the school system. However, the brain does not develop in the framework of administrative structures that we have established in our societies such as preschool and school. Hence, the institutional separation of the preschool period from the school period is illogical.

In summary, all children are born ready to learn. It is their early development that distinguishes their readiness for school. The term readiness for school captures the majority understanding which can be translated into a “measure” of early child development.

Assessing Readiness

Both the notion of *testing* (assessment) and the tests (tools to assess) themselves have been controversial and much debated. The controversy stems from a concern that if readiness implies specific skills and abilities that a child must possess before entry into school, then “assessing readiness” may act as a gatekeeping function to keep young children from school. A danger in using assessment tests is the potential misuse of the tests to decide on placement.

Among scholars addressing school readiness, the only accepted fair and ethical criterion for school readiness is legal chronological age. Because of the large variability in children’s development individually, age is an arbitrary determination, but it nevertheless applies to all children equally and thus fosters equity of access to school (Kagan 1990).

Having information about all young children as they enter school is tremendously valuable. The data on readiness distill a picture of “what children know and can do” when they enter kindergarten and the many differences that already exist among groups at the time children enter

school. Many studies confirm that disparities among children are set early—by the time children enter school—and widen during the school years. For many children at risk, kindergarten may even be too late to intervene and improve their trajectories in education.

The aim in measuring children’s development when they begin school is *not* to set standards for entry into kindergarten, but to measure the outcomes of early development and of participation in efforts to enhance children’s early development.

A population-based assessment tool is used to collect and analyze data on a *group* of children (e.g., in a school, neighborhood, community, state, province). It is *not* used to:

- Screen or diagnose children for special education
- Recommend children for special education, extra assistance, grade retention
- Recommend special teaching approaches for individuals
- Design a curriculum for an ECD program.

Using the Results

A population assessment of the outcomes of early child development provides valuable data beyond the status of children on entry into school. For example, the results of an assessment could be useful in tracking children’s development longitudinally, stimulating education policy and action, and enhancing equity of opportunity within and across communities.

Longitudinal Tracking

Having a capability to interpret information about children’s early development at school entry both forward (prospectively) and backward (retrospectively) is an important feature in measuring outcomes. With retrospective tracking, researchers could assess and understand the qualities of early development for children, from birth until entry into kindergarten or primary school, within and across geographic areas or socioeconomic classes. With prospective tracking, researchers could help communities and/or government monitor and support children’s continued development in the school system, from entry into kindergarten and beyond, as linked with the students’ actual performance in school.

The tracking of progress and changes longitudinally is essential for monitoring the effect of ECD programs and the accountability of resources spent on programs. The trends in early child development over time are useful evidence for development of ECD initiatives and programs and for relating policies to action (e.g., monitoring the effect of ECD policies). All of these data are useful not only to ECD researchers and practitioners, but also—and most importantly—to communities and policymakers who can take corrective action to improve the development of young children.

Policy and Action

Data on the status of children when they enter school is informative for a nation’s overall education policy and practice and for efforts targeted to meet the needs of diverse population groups. For example, a number of investigators have measured child development at the time of

school entry, specifically to examine the relationship between early child development and performance in school.

The results provide the rationale for change. Two informative findings in the United States, for example, are that—

- Kindergarten test scores (in the Early Childhood Longitudinal Study, Kindergarten Class of 1998–99) predict 60 percent or more of the variance in tests administered in the 3rd grade (Rock and Stenner 2005).
- In 41 U.S. states, Fuchs and Reklis (1994) found a strong correlation in the results of a ready-to-learn measure of students at the time of entry into kindergarten and their mathematics performance in 8th grade.

As Willms (2004) notes, communities and governments that organize to act on this type of information should be able to produce evidence that they have improved early child development and raised the “learning bar” (i.e., raised student performance overall and reduced gaps between students of different socioeconomic backgrounds) in the school system within 4 years. A well-constructed assessment tool for measuring the outcomes of early child development would be useful for obtaining, tracking, and documenting this evidence over time. In Australia, for example, communities that implemented local solutions under the national Early Years Strategy framework used an outcome measure to understand how well children were developing and the strengths and vulnerabilities of children and communities.

The information from this population assessment also could indicate the extent to which existing ECD programs and initiatives enhance children’s development and which communities have large differences in the number of children who are healthy and ready for school. Communities need to be able to assess the effectiveness of their actions within the family, neighborhood, and community, all of which influence children’s development.

In addition, policymakers need to know whether, and which, ECD efforts are succeeding in particular communities and populations—in order to accommodate resource constraints and priorities and socioeconomic realities. With a population assessment, policymakers can determine the type and level of effort(s) that is most promising and cost-effective universally and/or for targeted groups of at-risk, vulnerable children.

Equality of Opportunity

Poverty and poor child outcomes are closely correlated. Disparities (or gaps) in both socioeconomic status and children’s development (e.g., health, behavior, cognitive skills) emerge early in a child’s life, widen during the early school years, and remain constant after age 8. Studies show that schooling and school quality account for only a small portion of the gaps in children’s development and the widening or narrowing of disparities over time. An important finding is that parenting behavior and socioeconomic conditions are both associated with school readiness (Rock and Stenner 2005).

In fact, a family’s socioeconomic status is a proxy for many underlying factors affecting school readiness—parents at a lower socioeconomic status are less likely

to talk to or read with their children than are parents at a higher socioeconomic status.

When researchers control for variables pertaining to children's early family environment, the gaps and disparities between children narrow greatly (Rock and Stenner 2005). An assessment of the outcomes of early child development should thus include, or at least correlate with, socioeconomic factors known to relate to early child development. Communities and countries could use this assessment to improve their understanding of children's experience early in life, to identify groups of children at particular risk, and to underpin initiation of ECD policies and programs that could profoundly affect children's later achievement.

State of Research and Application

The development and application of population-based tools for measuring the outcomes of early child development, on entry into kindergarten, have begun. Canadian researchers are leading the way. In parallel, the United Nations' Children's Fund (UNICEF) has launched a multicountry initiative to identify a set of standards of early learning and development.

Both efforts address five similar domains (i.e., dimensions of early child development). A clear distinction between the two is that the Canadian effort applies a population-based tool to assess early child development, whereas the UNICEF effort is developing culturally sensitive early learning and development *standards*.

A third effort is in the United States where researchers are surveying, for the first time, a nationally representative sample of children to obtain baseline data on the children's development as they enter kindergarten and through 5th grade. The three efforts are described below.

Canada: The EDI

In the 1990s, a team of Canadian researchers led by Magdalena Janus and the late Dan Offord, at McMaster University, Hamilton, Ontario, developed the Early Development Instrument: A Population-based Measure for Communities (EDI). This population-based tool assesses the overall state of child development among kindergartners.

The EDI is one instrument that is a population-based assessment tool available to assess groups of children's holistic development. It offers the most promise of any instrument for obtaining essential and comparative data on early child development in industrialized and developing countries. The EDI already is widely used in Canada and has been adapted for use in seven other countries—Australia, Chile, Jamaica, Kosovo, Netherlands, New Zealand, and United States.

The Canadian researchers developed the EDI specifically to meet the need for an instrument that could measure the outcomes of early child development and be used to:

- Respond to policymakers' questions concerning how well society and families are doing in assuring the healthy and positive development of young children
- Identify communities and regions where the state of early child development is less than it should be

- Guide community and government leaders in planning programs to enhance children’s growth and development.

The EDI approximates a macrolevel assessment relating brain development in childhood to outcomes in behavior, learning, and health in adulthood. Similar to the use of birthweight as a universal measure of population health, the EDI results could serve as a universal measure of early child development in respect to adult life, health, learning, and behavior. The EDI results relate to the understanding gained from longitudinal studies of health, learning, and behavior. This connection is one of the reasons the EDI is useful.

The EDI includes the following five dimensions of development:

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

Kindergarten teachers administer the tool (a 104-item questionnaire) during the second half of kindergarten, after they have known the children for several months. To complete the questionnaire takes approximately 20 minutes per child, and each teacher can complete the assessments for an entire class generally in 1 day. In 2005, Janus developed a shorter version of the EDI (60 items), and a prototype of this version is being pilot tested and adapted in selected developing countries.

- See *“The Early Development Instrument: A Tool for Monitoring Children’s Development and Readiness for School,”* by Magdalena Janus, and *“Canada: Longitudinal Monitoring of ECD Outcomes,”* by Jane Bertrand, in this publication. See also <http://www.offordcentre.com/readiness/index.html>

Figure 1 depicts how the EDI captures the complexity of children’s brain development and developmental trajectories.

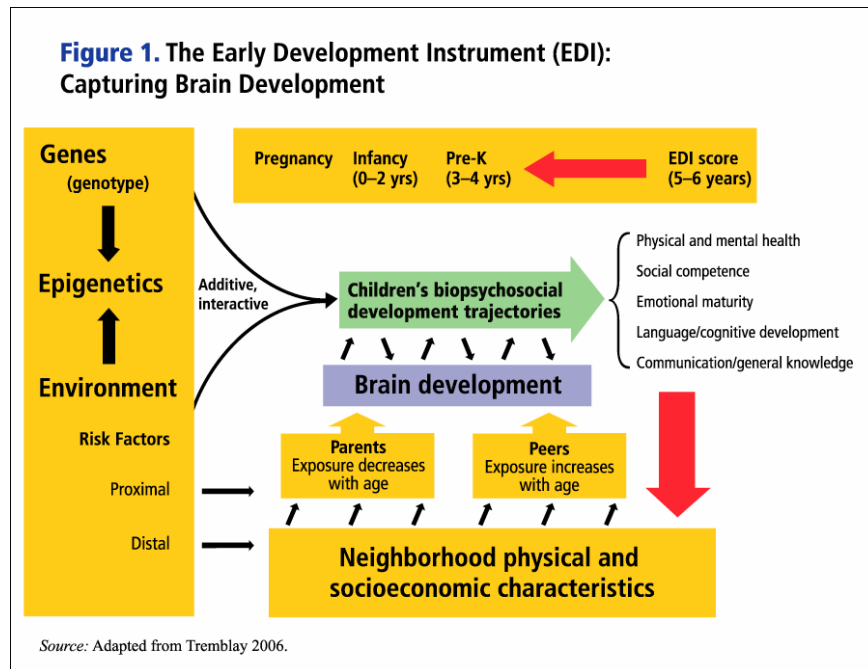
A Population Assessment Tool

The EDI differs from other tests administered during early childhood in that it is a population measure, rather than an individual measure, of child development. There are many other early-childhood tests that are used for different purposes—such as diagnosis, screening, research, and planning of intervention services.

Tests for diagnostic purposes are administered to individual children to obtain a comprehensive picture of a child’s function in a number of areas. Tests for screening purposes are used to identify individual children who may be at risk for learning disabilities or developmental delays, or to evaluate the effect of a specific program.

As a population-based assessment, the EDI is not a diagnostic or screening tool. It must *not* be used to label individual children, identify children with specific developmental problems, recommend children for special education, specify

teaching approaches for individual children, or measure the success or failure of a child's preschool experience.



In countries, such as Canada, that have universal enrollment in kindergarten, the EDI could be administered throughout a school system. In many developing countries, however, less than 25 percent of children attend kindergarten and perhaps 50–80 percent attends primary school beginning in 1st grade.

For these and other countries that do not have universal kindergarten, the EDI, which is specifically offered in kindergarten, would have to be complemented by alternative survey techniques (e.g., to sample the population by socioeconomic gradients and/or geographical boundaries) to gain a true population-based assessment of early child development. In developing countries where universal enrollment in kindergarten or even primary school is far from the reality, researchers would need to combine the EDI with household surveys such as the Demographic and Health Surveys and Multiple Indicator Cluster Surveys.

The EDI yields information about the number of vulnerable children and the types of vulnerability present across a neighborhood, community, city, state, or country. The data obtained may be interpreted for groups of children. For example, the EDI may be used for:

- Accurate measurements of ECD outcomes
- Assessments of variation in ECD outcomes over time; across jurisdictions, social classes, and ethnic groups; and between genders
- Causal studies to understand the determinants of ECD outcomes through, for example, research on the effects of family, physical environment, socioeconomic status, and access to health care

- Action-oriented or applied research to assess the efficacy of national and community-based programs and policies to improve ECD outcomes.

Using the EDI: Examples

The EDI has been applied broadly across Canada among kindergartners and in Australia among 1st graders. Australia and Canada are using the EDI to map patterns of vulnerability among children across communities. Two brief examples are—

Longitudinal Survey of Vulnerable Children Ages 4–6 Years. In Vancouver, British Columbia, Canada, researchers have matched EDI data with school census data and children’s achievement test results longitudinally. This tracking showed that primary schools which had the greatest proportion of children entering with low EDI scores also had the poorest results in 4th and 7th grades on British Columbia’s Foundations Skills Assessment (Hertzman and others 2002).

With this type of information, communities, provinces/states, and regions could design initiatives to enhance the development and academic performance of vulnerable children and, thereby, improve competence, health, and well-being of the population across all sectors. In British Columbia, the results of EDI assessments (Hertzman and others 2002; Kershaw and others 2005) have been mapped against community resources and socioeconomic data to yield an overall view of early child development that is being used in planning community initiatives and public policies.

- See “Canada: Longitudinal Monitoring of ECD Outcomes,” by Jane Bertrand in this publication.

Children’s Transition to School. Australia has adapted the EDI as the Australian Early Development Index (AEDI) and is using this tool, in conjunction with census data and other statistics, to learn about the vulnerabilities and strengths of children across the country. The eventual goal is to support children’s development before they enter primary school in order to increase the chances of a successful transition to school and improved learning outcomes. In 2004–07, as many as 60 Australian communities will implement the AEDI.

The AEDI National Support Center is coordinating the country-wide effort and offers to each participating community a full range of support. The center provides Community Preparation Guides, to help communities implement the AEDI, and technical support in data collection for Local AEDI Project Coordinators, schools, and teachers. The center maintains a web-based data entry system, downloads the data entered, and analyzes the data by each child’s postcode or suburb. Within 2–3 months, the center sends to the communities an AEDI Community Report and Profile, which summarizes the geographically mapped AEDI data. The center also provides a Dissemination and Action Guide and evaluation materials and assistance.

Other Research: UNICEF and the U.S.A.

In 2003, UNICEF initiated a multicountry initiative entitled “Going Global with Early Learning and Development Standards.” The aim is to identify and establish standards that specify, by country, what children know and can do (Kagan and Britto 2005). Ultimately, these country

standards could lead to global standards. The five dimensions of development used for preschool children are:

- Physical health and motor development
- Social-emotional development
- Approaches toward learning
- Language and literacy
- Cognition and general knowledge.

Each of 11 countries already participating in this effort is following a defined process for identifying and establishing standards. The rationale for adopting this country approach is to ensure development of culturally sensitive and appropriate standards. The process includes:

- Recommendations by national experts about what the nation’s children should know and be able to do
- Recommendations by experts about the ages at which children should accomplish a specific item
- Validation of proposed standards
- Potential development of tools (e.g., for curricula development, assessment, monitoring, evaluation) based on the standards.

In the United States, school readiness first became an education priority in 1989—as the first of five national goals for education. During the 1990s, educators debated with vigor the definition of school readiness. This lack of consensus was due in part to the dearth of data on the status of children at school entry. Readiness might, for example, refer to how ready to learn children are as they begin school *or* to how well equipped schools are to receive children and measure their development (Kagan 1990).

The United States still has not developed a population-based tool to assess child development, at school entry or earlier, or to measure children’s readiness for school. In 1998, the country took a significant step forward by initiating The Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K) to obtain baseline data (a “picture”) of the varying level of children’s development on entry into kindergarten (see box 1).

This study promises to add much needed information to the knowledge base on the construct and measurement of school readiness. The ECLS-K moves away from traditional, unidimensional cognitive assessments to break new ground by taking a comprehensive view of school readiness comprising four dimensions:

- Cognitive skills and knowledge
- Social skills
- Physical health and well-being
- Approaches to learning.

Researchers are using multiple measurement approaches and multiple instruments to assess the extent to which children may be prepared to succeed in school. The data derive from three sources: direct assessment of children’s performance (in reading, general knowledge,

mathematical concepts); ratings by teachers of children's behavior and persistence with tasks; and ratings by parents of children's pro-social and task behaviors.

Box 1. Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K)

In 1998, the U.S. Department of Education launched this first national survey of the status of kindergartners in the United States. Researchers measured the home and academic environments, opportunities, and achievements of a nationally representative sample of approximately 22,000 children in kindergarten and through 5th grade.

The study is based on a broad construct of readiness that includes children's knowledge, skills, behavior, and attitudes. (Until the mid-1990s, policymakers, educators, and parents equated readiness primarily with academic skills.) Data collection for this longitudinal study will end in 2007 when the cohort has progressed to 8th grade. An initial report, entitled *America's Kindergarteners* (West, Denton, and Germino-Hausken 2000), presents a detailed description of this first-ever profile of American children on entry into kindergarten.

It is expected that the profile of school readiness will illuminate the level of U.S. children's early development and learning, on entry into kindergarten, and help to advance the concept of school readiness. ECLS-K data on the kindergarten class of 1998–99 are available for kindergarten and 1st, 3rd, and 5th grades at <<http://nces.ed.gov/pubsearch>>.

Population-based Assessment Tools for Developing Countries

Population-based assessment tools, such as the EDI, are applicable to developing countries to obtain data on early child development within and across countries. As is being done in Australia and Canada, these data could be linked with other population data—such as socioeconomic status (e.g., income, level of education), child health (e.g., health risks, outcomes), and availability of and access to community resources (e.g., prenatal, maternal and child health, ECD programs)—to better understand children's variability and vulnerability in school readiness across districts, provinces/states, regions, and countries. This understanding is a foundation for action.

Examples of Applications

The EDI, as noted, is being adapted for use in several developing countries. This tool, as well as other population-based instruments, could be used to monitor children's outcomes in ECD projects and to assess children's school readiness prior to their entry into school. Two examples of ongoing efforts—

Monitoring Children's Outcomes in ECD Projects. In the Dominican Republic and Jordan, two World Bank–supported ECD project teams have piloted a population-based instrument to collect baseline data on early child development specifically to monitor the ECD projects. The teams are collecting data on the outcomes of child development across five dimensions in age cohorts of children over time (onset, mid-term, and completion of the study).

The intent is to obtain valuable information to help policymakers assess the effect of the projects and the potential of this monitoring as a powerful planning tool. The two pilot efforts could enable the countries' ministries of education and other ministries to:

- Obtain accurate data on which to base decisions about whether ECD programs have improved children’s outcomes over time, at community and regional levels
 - Begin to establish a national model for monitoring young children’s outcomes throughout the country
 - Conduct research on early child development to improve the effectiveness of community programs and schools
 - Promote awareness of the importance of quality care and stimulation during early childhood—among families, schools, and communities.
- See also “Dominican Republic: Competitive Fund for Educational Innovations,” by Clara Baez and Guadalupe Váldez in this publication.

Assessing Children’s School Readiness. In Jamaica, the Early Childhood Commission, under the Ministry of Education and Youth, has used both the EDI and another population-based tool in a pilot effort that relates school readiness to school performance. The intent is to assess children’s school readiness prior to school entry and to determine the magnitude of children at risk of poor school performance. The results of the analysis of the data are pending.

- See also “Jamaica: Recent Initiatives in Early Childhood Policy,” by Omar Davies and Rose Davies in this publication.

Key Questions and Challenges

Population-based measures to assess ECD outcomes offer great potential for understanding the state of children’s development in developing and industrialized countries. Box 2 summarizes some of the main advantages of the EDI in this regard.

<p>Box 2. Early Development Instrument: Advantages</p> <ul style="list-style-type: none"> ▪ Covers internationally recognized domains of early child development ▪ Population-based and usable for international comparisons ▪ Valid at the group level ▪ Implemented successfully in high- and middle-income countries ▪ Benchmarks established ▪ Not very expensive and is adjustable to local economies ▪ Sensitive to socioeconomic determinants and change over time ▪ Stimulates intersectoral community development ▪ Useful for high-level planning ▪ Raises teachers’ and school systems’ awareness of early child development.

Countries or groups that are considering applying the EDI or another population-based measure will want to address several key questions—

- ***Who administers the measure***—teachers or education surveyors? The person reporting on the children’s skills and behaviors should be an individual who knows the children well in the early learning setting. One concern often raised is that the data reported by teachers may be biased and favor the children’s development. Although trained surveyors may not know the children as well as teachers do, they could administer the measure effectively. Parents should not administer the measure—their response data may not be reliable.
- ***What age group*** should be assessed? The EDI, for example, is designed primarily for 5-year-old children (± 1 year). Yet, in some instances and countries, children may be 7–8 years old when they enter kindergarten or 1st grade. Although some may question whether the EDI is relevant and applicable to 7–8 year olds, the EDI was used with 7-year-olds in Australia and Kosovo and proved to be valid for this age group in both contexts.
- ***Is the measure appropriate*** regardless of a child’s birthplace, socioeconomic status, or ethnicity, or is it biased toward Western values and high-income countries? Early child and brain development follows the same path everywhere, regardless of a child’s birthplace or ethnicity. Janus (2006) notes that despite variation in the timing of developmental milestones, the indicators of brain development in children are universal. In the UNICEF initiative (Kagan and Britto 2005), individuals representing 11 countries and a wide variety of cultures and languages have identified indicators that are impressively universal in general domains—everyone identified five common domain areas (physical health, social and emotional competence, language, communication, numeracy), and some individuals added domains, such as moral awareness and religion.
- ***Is the measure useful where school enrollment is not universal?*** The EDI is a school-based assessment and is optimally useful in settings that have at least high, if not universal, school enrollment. However, as already noted, not all children in developing countries attend school. Sole use of this population assessment in these settings would result in an undersampling of children and an inadequate description of the state of early child development. Alternative approaches would be needed to complement use of the population-based assessment. Two main possibilities are:

The Demographic and Health Surveys (DHS)—which are used in developing countries and supported by the U.S. Agency for International Development. The DHS are nationally representative household surveys of a large sample of households (5,000–30,000). Conducted every 5 years to allow for comparisons over time, the surveys yield data on a wide range of indicators for monitoring and evaluating household population, health, and nutrition.

The Multiple Indicator Cluster Surveys (MICS)—which were developed and are supported by UNICEF. The MICS yield household data on relevant

indicators selected to track the world's progress toward major international goals (e.g., Millennium Development Goals, World Summit for Children goals).

Box 3 lists some of the challenges in specifically using the EDI in a developing country.

Box 3. Challenges in Using the Early Development Instrument in Developing Countries

- Need access to primary teacher of children at age 5 years
- Age of 5 years may be too late
- Need to fit with household surveys (e.g., DHS, MICS)
- Content of the ECD domains may vary among countries
- Need organization to coordinate and synthesize population-based data
- Need skill in mapping—to yield the best data
- Need to guard against the instrument to deny school entry.

Next Steps

Enhancing the investment in early child development is difficult for governments because the benefits to society—in terms of populations' health and competence—will not be realized for 20–25 years. The EDI instrument yields a rough estimate of child development and the trajectories for health, learning, and behavior through adulthood. Demonstrated improvements in EDI assessments of child development are an indication of improvements to come in adult health and behavior.

Governments that support programs to enhance early child development could point to improved EDI outcomes as a main rationale for investing in ECD programs and for taking this necessary step to improve the quality of the future population.

To make progress in early child development and to meet the growing demands for accountability, nations need to:

- Establish a strong monitoring system for assessing children's developmental outcomes
- Cultivate a culture of evidence-based decisionmaking in social policy
- Develop capacity for assessing the efficacy of national and community-based programs.

Communities that are already implementing ECD programs could use a population-based outcome measure to raise awareness of socioeconomic factors influencing child development and to promote community development. In developing countries, a population-based measure could be particularly powerful for leveraging ECD policy and increased investments in ECD programs.

As noted, population-based outcome measures are available and are being tested and used in a variety of settings. The EDI has had the most exposure and is the best documented to date. Expanded application, study, and discussion of this instrument and others are needed now to resolve important questions and to advance understanding and action in early child development.

Being able to evaluate children’s development comprehensively, longitudinally, and comparatively are achievable goals in the near future.

A few of the next steps on the ECD agenda are—

1. Develop a policy framework that incorporates current understanding of parenting and child development services and encompasses the prenatal–early childhood–primary school timeframe.
2. Use the ability to measure child outcomes to leverage ECD policy. Researchers are developing tools and measures to monitor and evaluate the outcomes and efficacy of large-scale ECD programs. The question to ask is not whether ECD programs are effective, but rather, how and under what circumstances proven ECD programs can be taken to scale while maintaining their effectiveness.
3. Adapt the EDI, specifically and systematically, to other local contexts. The EDI must be applied and evaluated in more and different settings before it can be considered or adopted as a measure for globally assessing the outcomes of early child development. A number of countries are piloting an outcome measure for early child development, and several developing countries are adapting and piloting the EDI.

The broader applicability of the EDI and other ECD measures has yet to be determined. ECD experts are detailing the steps for adapting and piloting the EDI, for example, in developing countries. The overall steps include—

- **Translation** (as needed) and back translation of the EDI assessment, with review by the original developers of the tool (The Offord Centre, McMaster University, Hamilton, Ontario, Canada).
- **Consultation** with local experts to ascertain and ensure the relevance of items on the EDI questionnaire. The local experts in child development to consult are university faculty, clinicians, teachers, and education administrators.
- **Modification** of the EDI items, as possible and within the limits of comparability for the sub-domains.
- **Translation** of the EDI Guide and amendments.
- **Specification of local purpose** for using the EDI. For example, a country or community may wish to use the tool to monitor or evaluate ECD programs, investigate differences among groups receiving varying levels of ECD services, or establish a population baseline of children’s developmental status within a school system or region. A different framework for implementation would apply in each case.
- **Pilot implementation** with teachers or early childhood educators—to ensure that the items reflect children’s skills accurately and that the respondents can answer the questions with ease.

- *Assessment of validity and reliability* of the EDI locally.
4. Analyze and evaluate the local outcomes and use of the EDI. Systematically assess the outcomes and effectiveness of ECD efforts, as indicated by the EDI. Also address particular issues regarding use of the EDI locally. These might include, for example, the age or grade-level of assessment, the type of individuals (teachers/surveyors) administering the EDI, and the value of the EDI as a measure of school readiness and/or children’s vulnerability.

Potential Benefits

The evidence we have now—from scientists, policymakers, and practitioners—is clear. ECD programs have high returns for individuals, families, and societies. By being able to measure the population effects of early child development and the outcomes of ECD programs, we can accumulate results-based data to leverage ECD policy, increase ECD investments, and direct funding to support proven, targeted, and/or scaled-up ECD efforts. At local and national levels, the data may well serve to stimulate efforts to improve the health, well-being, and competence of populations.

The quality of a population hinges on the development of its children—which underpins broader human development and overall economic growth and progress. If countries cannot improve the quality of their populations in all sectors of society, then the world’s experiments in civilization may falter (Mustard 2006). There simply have to be substantial ECD investments in communities, beginning *before* children enter the school system.

In a global, interdependent world, all nations—developing and industrialized—need to embrace enlightened family and institutional policies and unprecedented investments in human capital (Greenspan and Shanker 2006). The global workplace favors individuals who have intellectual flexibility, problem-solving skills, emotional resilience, and capacity to work with others in a continually changing and highly competitive economic environment. The need to maximize the human potential has never been greater.

Countries around the world now have a special opportunity, in the new millennium and information age, to promote the full development of their children by drawing on the scientific evidence concerning child development and promoting effective ECD strategies and programs. Some may say that this opportunity is a requirement—because countries must invest in their children now if they want to be full partners in the fast-emerging global marketplace.

The right word is “invest”—for governments must commit themselves now to policies and funding that both support and sustain ECD programs throughout their countries.

Web Resources [as of November 2006]

Australian Early Development Index: Building Better Communities for Children:

<http://www.rch.org.au/australianedi/com.cfm?doc_id=6212>

Early Childhood Longitudinal Study, Kindergarten Class of 1998–99:

<<http://nces.ed.gov/pubs2000/2000070.pdf>>

EDI website: <<http://www.offordcentre.com/readiness>>
The Founders' Network: <<http://www.founders.net/>>
World Bank ECD website: <<http://www.worldbank.org/children>>

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<[http://www.earlylearning.ubc.ca/documents/What_the_EDI_is_\(not\).pdf](http://www.earlylearning.ubc.ca/documents/What_the_EDI_is_(not).pdf)>
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