2

Literacy and Numeracy Skills among Children in Developing Countries

Jessica Ball, Scott G. Paris, and Rangachar Govinda

Abstract: Young children in developing countries are at risk—due to no, little, or low quality education, and limited family resources and constrained opportunities for culturally meaningful learning. The risk is even greater for children who do not speak the majority language, endure poverty, and are members of marginalized groups including girls and religious minorities. This chapter identifies some of the foundational literacy, numeracy, and cognitive skills that children need to acquire in order to gain access to advanced educational and economic opportunities, and strategies to support these skills especially for children who are not well served by existing teaching and curricula. We identify some promising programs, research gaps, and areas where policy reforms are needed. Throughout the chapter we show how parental support, appropriate curricula, including use of the child’s first language, and effective teachers are crucial for educational achievement of all children.


Introduction

Ensuring basic literacy and numeracy is critical for improving learning in school and throughout life. Reading, writing, and mathematics are not only foundational skills for learning but are correlated with greater quality of life, personal well-being, national stability, and prosperity. Lack of learning opportunities or achievement difficulties during the early stages of acquiring literacy and numeracy cumulatively impede children’s academic progress and motivation, resulting in further lack of achievement.

Although the world has witnessed unprecedented expansion of school infrastructure and enrollment of children in recent years, many countries fail to support the acquisition of literacy and numeracy. Far too many children leave school prematurely, and many children who complete their studies do not master basic competencies in literacy and numeracy.

In this chapter, we highlight what is known about literacy and numeracy development—both for children enrolled in school and for the estimated 53 million children in the developing world who are not enrolled. It is important to note that most research on literacy and numeracy has been conducted in high-income countries. Many contextual factors may limit the universal applicability of findings in high-income countries to learners in low-income countries. As a result, any potential initiatives for educational success must account for gender, socioeconomic, political, rural-urban, and language differences.

Definitions

Although there are no universally agreed upon definitions of competencies that constitute basic literacy and numeracy, the Programme for International Student Assessment (PISA) uses the following definitions in evaluating education systems worldwide:

*Literacy* (or reading literacy) is the capacity to understand, use, and reflect on written texts in order to achieve one’s goals, develop one’s knowledge and potential, and participate in society.

*Numeracy* encompasses a range of skills from basic arithmetic and logical reasoning to advanced mathematics and interpretative communication skills.
Early childhood

The role of early childhood care and education programs in the acquisition of literacy and numeracy

Learning is a cumulative, developmental process in which the skills acquired during early childhood can affect the acquisition of other skills at later ages. Early childhood care and education (ECCE) are critical because they enable children to acquire foundational cognitive, social, and emotional skills that make learning possible and more efficient later on. Children who participate in quality ECCE programs have higher levels of cognitive development and are better prepared to learn when they enter primary school. They also have lower repetition and dropout rates in the early grades, higher levels of overall achievement, and higher completion rates.

Studies in the United States have documented a positive correlation between children's attendance in pre-primary programs and increases in intelligence quotient (IQ) scores, their performance in reading and math tests, as well as subsequent employment prospects. These findings have been confirmed by recent randomized trials of large-scale ECCE programs, such as Head Start, which indicate that "a single year of pre-primary education can result in an increase of 0.20–0.33 standard deviations on cognitive development." In the short to medium term, ECCE interventions have been shown to enhance school readiness and educational outcomes, improve physical and mental health, and reduce engagement in high-risk behaviors. In the long term, ECCE investments yield productive and socially well-adjusted adults who contribute to their country's economic growth and help break intergenerational cycles of poverty. ECCE programs are critical to future educational opportunities, especially for the poorest and most marginalized children, who are most likely to benefit from early intervention.

Poor and otherwise disadvantaged children often cannot reach their development potential during early childhood as a result of the cumulative effects of multiple risk factors, including less responsive parenting, less stimulating environments, higher incidence of maternal depression and stress, lack of access to adequate nutrition, higher incidence of intra-household violence, poor housing, dangerous neighborhood, and pollution. Consequently, marginalized children are less likely than others to enroll in primary school at the right age and more likely to attain lower achievement levels or grades for their age, to arrive at school ill-prepared for a new learning and social environment, and to have poorer cognitive ability throughout their lives.

The benefits of participation in ECCE for vulnerable children appear to be attributable to the effectiveness of high quality teaching practices in promoting "learning readiness." High quality ECCE programs provide both instructional support to promote emergent literacy and numeracy skills (cognitive readiness) and emotional support for self-regulation and positive socialization that will enable motivated, goal-oriented learning (behavioral readiness).

Although evidence is less robust, evaluations of ECCE programs in developing countries have found similar improvements in educational outcomes. In a review of nine ECCE effectiveness and program assessments in developing countries, eight indicated that children who attended preschool had higher scores than those who did not in one or more measures of child development, such as literacy, vocabulary, and mathematics. Further, being enrolled in higher quality or improved preschool programs compared with standard programs was associated with better learning outcomes in all studies and program assessments that compared them.

Further, a number of randomized evaluations have shown the positive effect of ECCE on literacy, numeracy, and future cognitive development. In Bangladesh, children who attended rural preschool programs improved literacy and numeracy skills and enhanced school readiness. A randomized impact evaluation of early childhood development in rural Mozambique found that primary school enrollment rates increased significantly in communities that received ECCE programs. Participation in the preschool program resulted in significant improvements in a number of child development outcomes, including consistent improvements in cognitive and problem-solving abilities.

Recently, there has been increased research focus on learning outcomes of mother-tongue-based instruction starting with ECCE programming. Save the Children's preschool programs in Vietnam and Bangladesh emphasize mother-tongue literacy and awareness. Research in Uganda and Lesotho have linked mother-tongue instruction with improved cognitive skills and literacy rates.

Most evidence on ECCE has come from developed countries and more recently from countries in the Latin America and Caribbean region. Very few rigorous evaluations of ECCE programs have been conducted in developing
countries, which constrains effective programming as well as potential policy dialogue with governments, donors, and other key stakeholders.23

The role of parents in supporting literacy and numeracy during early childhood

Research shows that parenting education and support can improve children’s cognitive and psychosocial development early on, especially for marginalized children. Results of various studies generally support the view that home characteristics affect learning readiness in part through their effect on early language skills. Verbal environments influence language learning. Children who hear a high proportion of examples of a complex language form learn that form faster than children who receive less exposure to such forms.23 Other studies have shown that the depth of vocabulary used by adults in the home, exposure to print at home, and parents’ engagement in conversation and reading activities with the child are correlated with children’s oral language skills at school entry and their later literacy outcomes.44

Interventions to promote maternal/paternal literacy have been shown to improve children’s literacy, especially if parents engage in joint storybook reading and other language- and print-mediated social interaction with their children.24 Evaluations of an intensive parenting intervention in Turkey, which combined a home training program for mothers with either a center-based or custodial daycare program for children, showed a strong correlation between mothers’ participation in the program and children’s scores on cognitive tests.25 In Bolivia, a program that combined workshops for parents on development, health, and hygiene with a skills-based literacy program and home visits showed positive results.26

Even with the aforementioned positive findings, identifying the demand and readiness for ECCE programs within community contexts is also necessary, as public support and ownership are critical for programmatic success and sustainability.

Learning during primary school

Factors that affect the acquisition of literacy and numeracy

Although only a small number of the very poorest countries participate in well-known international learning assessments, a number of organizations have conducted their own assessments that indicate most children are learning too little during their primary years. For example, in the Gambia, only 5 percent of Grade 3 students met the reading fluency benchmark of 50 words a minute.28 In Pakistan, only half the children in Grade 3 could answer basic multiplication questions, and 69 percent were unable to add a word to complete a sentence.29 In rural India, only 53 percent of students in Grade 5 could read a Grade 2 text, and research shows that the ability of children in India to do basic arithmetic has declined over recent years.30

Literacy in the lower primary grades is a good predictor of later education success, and studies have shown that the failure to learn to read is associated with falling behind or dropping out of school altogether.31 Early achievements in literacy and numeracy have also been shown to contribute to higher retention rates, especially for low-income girls.32

In the United States, a federally funded review33 identified three obstacles to children’s early reading: difficulty using and understanding the alphabetic principle, failure to transfer comprehension skills of spoken language to reading, and lack of motivation for reading. A second review34 identified five essential components of reading: the alphabetic principle, phonemic awareness, oral reading fluency, vocabulary, and comprehension. Relative proficiency of these five skills in grades K-2 predicted subsequent reading development.

One global consequence of these reports has been more direct instruction on phonics for beginning readers, and another has been more instructional time devoted to building fluent oral reading. These national reports have also reinforced the importance of vocabulary and language for early reading.35 The number of words that children understand and speak helps their word decoding efforts and may facilitate growth of phonological awareness.36 Likewise, instruction based on word study can increase children’s understanding of orthography, spelling, and vocabulary.37 Initial instruction on vocabulary and related conceptual content can facilitate children’s subsequent reading comprehension.38

Reading and writing have reciprocal influences and benefits, and they become more integrated throughout formal education. As children learn to write, they acquire phonological awareness about letters, they acquire morphological and syntactic knowledge about words, and they acquire new vocabulary as they learn to express their own thoughts.39 One meta-analysis found that reading comprehension improves when students
spend more time writing, especially when writing is accompanied by explicit and supportive instruction.

Many studies have shown that young children and struggling readers do not spontaneously use these successful learning strategies. Explicit instruction is needed to encourage their use and to foster comprehension.\textsuperscript{46} Studies have demonstrated that direct explanation of metacognitive features of strategies promotes primary students' comprehension.\textsuperscript{47} Other studies have shown that peer tutoring based on explicit use of key strategies in which students alternate roles of teacher/coach and student/reader can enhance comprehension.\textsuperscript{48} Key features of these intervention studies are: (a) the provision of explicit information about what strategies to use, how to apply them, and when and why they are effective; and (b) metacognitive conversations about the importance of the strategies. Similarly, interventions based on graphic organizers, features of genre and text structure, and the kinds of inferences required to answer questions about text also show students how they need to actively construct models of the text and situations implied by text as they read. Strategies for reading, writing, and studying provide a foundation for higher order thinking skills because the metacognitive abilities to plan, reflect, and evaluate are fundamental to higher order skills such as analyzing means-ends problem solving, forming logical arguments, and understanding different points of view.\textsuperscript{49}

While developing countries have produced a modest body of evidence-based research on literacy and numeracy at the primary level, less is known about specific strategies to improve learning and critical thinking skills of children who have, to date, been under-served by existing systems of education. Future research should focus on issues regarding the importance of entry-age, the essential skills needed as foundations for lifelong learning, and the method of instruction and assessing cognitive skills and strategies during primary school.

The role of parents and communities in achieving literacy and numeracy

Home and community environments are also important to achieving meaningful learning outcomes in primary school. Successful interventions often provide level-appropriate reading materials to children and communities and foster a culture of literacy and learning, thereby engaging parents and community members. Evidence shows that reading achievement is higher at the primary level when children's parents are engaged in early home literacy activities, such as reading books or playing with alphabet toys. In Nepal and Malawi, Save the Children's Literacy Boost program provided village-level book banks, curricula for reading awareness workshops, and training for community members to manage the book banks. Children in these countries showed progress in oral reading fluency: Nepalese children demonstrated progress in letter identification, and children in Malawi were better able to comprehend connected text.\textsuperscript{50}

More research is needed on parents' attitudes about the value of literacy and numeracy, and how these attitudes are conveyed to children and influence their engagement with skill acquisition. Once we know more on this topic, we can begin to identify ways to better engage families and communities in the provision of quality learning.

Benefits of secondary school

Increased primary enrollment and completion rates across the globe, combined with the need for more sophisticated workers,\textsuperscript{51} have led to higher participation and demand for secondary education. However, there are signs that many developing countries are struggling to deliver quality learning to students at the secondary level that equips them with higher order thinking skills necessary to participate in the knowledge-based economy.\textsuperscript{52}

Research suggests that eight years of basic education is essential for students to acquire the foundational learning necessary to become productive members of society. UNESCO found that 10 percent of children are literate after three years of education, 70 percent reach literacy after six years, and 100 percent attain literacy with ten years of basic education.\textsuperscript{53} Thus, longer enrollment is associated with greater retention of literacy skills.

The provision of literacy and numeracy skills at the post-primary level is especially critical for girls, and even more so for girls living in conflict-affected contexts. Evidence indicates that extending the school life expectancy of girls beyond primary education positively impacts the permanency of literacy, HIV/AIDS awareness, fertility rates and childbearing patterns, childcare, and the school attendance of future generations.\textsuperscript{54} Studies in Uganda and Zimbabwe have shown that girls...
who received primary and some secondary education had lower HIV infection rates than those who did not attend school, a trend that extended into early adulthood.\textsuperscript{49} Despite these outcomes, in sub-Saharan African countries, only one in five girls enrolls in secondary school,\textsuperscript{40} and boys continue to have higher transition rates to secondary school than girls. Enrollment rates in secondary school are nearly one-third lower in conflict-affected countries compared with other developing countries and far lower still for girls.\textsuperscript{41}

Post-primary education is fundamental to building the "core competencies" needed to produce a flexible, adaptable, multi-skilled, and trainable youth cohort prepared for employment in the formal and informal sectors of the economy and higher education and training.\textsuperscript{42} These skills help young people transition to adulthood, participate as active citizens, and care for their families.

Secondary and post-primary education has the power to lift developing countries out of poverty and boost and sustain their economic growth and development.\textsuperscript{43} Research from India shows that secondary and higher education—more than primary education—is inversely related to poverty.\textsuperscript{44} In Pakistan, it has been found that monthly earnings of an individual worker increased by 7.3 percent with an additional year of schooling. Earnings increased by 37 percent with the attainment of ten years of schooling against no education. Moreover, each additional year of schooling increased earnings by 3 percent at primary level, by 5 percent at secondary level, and by 7.1–8.2 percent at higher/tertiary level. Each additional year of technical training increased earnings by 2.5 percent.\textsuperscript{45} In a study of several developed and developing countries, having a mother who had completed all secondary or post-secondary education could raise a child's reading score by 34 and 47 points, respectively, compared to a pupil whose mother had little formal education.

Future research is needed to determine (a) the effective policy measures to improve transition rates between primary and secondary school; (b) the best ways to ensure that the content of upper secondary education is relevant to the demands of the labor market; and (c) how upper secondary education can meet the specific social and economic needs of individual contexts. Another topic that warrants more research is the relationship between the acquisition of literacy, numeracy, and higher order cognitive skills and economic growth.

### Issues in learning across age groups

#### The quality of teaching and learning achievement

Available evidence from both developed and developing countries suggests that one of the main drivers of the variation in student learning at school is the quality of the teacher and that the negative impact of low-performing teachers is severe, particularly during earlier years of schooling. Research conducted by McKinsey & Company found that high-performing school systems in the developed world consistently do three things well: (a) recruit the right people to become teachers; (b) develop those teachers into effective instructors; and (c) ensure that every child can benefit from excellent instruction.\textsuperscript{46}

Clearly, teachers play a critical role in supporting quality learning through the development of literacy and numeracy for all children. Based on evidence from developing countries, teacher-focused interventions should concentrate on reducing teacher absenteeism and maximizing the amount of time spent on learning as well as providing teachers with training and ongoing mentoring on effective methods of reading instruction and numeracy (including multilingual education and language transition). Research across 50 countries, including 13 developing ones, found that an increase of one hour of instruction per week in mathematics, science, or reading improves test scores, with a larger effect for girls and students from lower-income families.\textsuperscript{47}

Several studies in developing countries have shown that teachers can enhance literacy and numeracy skills among their students. The Early Grade Reading Assessment (EGRA) Plus program, an evidence-based reading instruction program, is one of the few randomized impact evaluations conducted in the developing world.\textsuperscript{14} In Liberia, the program focused on improving reading skills at Grades 2 and 3 and presents compelling evidence that targeted reading interventions aimed at improving the quality of reading instruction can have a large impact on student achievement in a relatively limited amount of time.

Other studies emphasize the importance of supporting teachers with instruction on how to teach and what to teach as well as providing them with skilled trainers. Teacher training pilots conducted in several low-income countries indicate that the provision of instructional materials, support, and specific lesson plans led to improved reading scores for children.\textsuperscript{19} Second graders in Kenya read twice as fluently after teachers
were provided with a detailed instruction plan on how to teach reading and were supported by school visits from trainers.60

In addition to general professional and pedagogic skills, a teacher’s subject knowledge is also critical for effective classroom teaching and has been found to be a good predictor of student achievement.61 However, as the 2005 Global Monitoring Report on Education For All pointed out, in many developing countries, levels of subject knowledge remain a problem.62 For example, a study in seven southern African countries found that some primary-school mathematics teachers possessed only basic numeracy skills, actually scoring lower on tests than students.63 A recent study in India also found serious shortfalls in teachers’ performance on tests of basic literacy and numeracy skills.64

Research is needed in diverse developing country contexts to identify effective approaches to prepare teachers to draw upon local funds of knowledge and local actors (e.g., parents, local knowledge holders) to create locally meaningful content to populate learning activities. There is also a need for studies of the effectiveness of teacher training methods, instructional approaches, classroom activities, and home–school partnerships that support student engagement and success.

Language of instruction

It has been seen that 50 percent of the world’s out-of-school children live in communities where the language of instruction in school is different from their home language.65 Research shows that children develop literacy skills most easily in their first language and that learning to read in an unfamiliar language often results in merely reciting or copying text, instead of understanding it.66 For example, literacy levels are very low in countries where learning to read usually takes place in a second language, such as Pakistan.67 In poor rural areas of low- and middle-income countries, large numbers of children drop out of school because of an unfamiliar language being used in the classroom.68 Children must become fully proficient orally and in reading and writing in one language, achieving cognitive academic language proficiency, before instruction in a second language can be introduced.69

When children are provided high quality mother-tongue-based education in ECCE and throughout the first six years of primary school, and then introduced gradually to instruction in a second language in secondary school, studies have demonstrated “additive” results, not only in bilingual proficiency but also in overall academic achievement.70 Using a language that is familiar to students beyond lower primary as the medium of instruction also provides a strong foundation for complex knowledge transfer from the familiar language to other languages. Studies conducted in Ethiopia, Tanzania, Nigeria, and Burkina Faso indicate that strong mother-tongue foundation promotes better learning and higher achievement among students.71

This evidence supports the view that quality education that facilitates cognitive development of children can be enhanced through the effective design and implementation of mother-tongue bilingual education programs.72

Although there is a growing trend among developing countries to allow for mother-tongue-based education, many children from minority and Indigenous communities start preschool or primary school in a national language that they do not know.73 For example, Nepal, Bhutan, and Bangladesh have national language policies that confirm the importance of preserving home languages, but they also require children to switch to an unfamiliar language immediately upon school entry—exactly the time when it is most detrimental to the development of their literacy and numeracy skills.74 Despite the fact that developing countries have adopted overall macro-level policies promoting the Education For All (EFA) targets, there is still a great risk of disconnected policies and practices for effective implementation of multilingual education, and the consequences are most negative for language minorities and marginalized groups. It is especially important to determine effective ways of tackling the many challenges that teachers face regarding linguistic diversity within their classrooms.

The importance of relevant curricula

Programs that provide active learning through a relevant curriculum have achieved results. Many of these programs rely on partnerships among local communities, non-government actors, and government agencies. For example, the Reflect program in Bangladesh and Pakistan75 focuses on learners’ own literacy objectives, motivation, and skills.76 Real texts from the local environment are used along with texts created by program participants.77

A study on curriculum conducted by UNICEF shows that where literacy skills are taught as a separate subject, in a language course, the approach tends to be linear—first teaching aural skills, then speaking, reading, and writing skills. In contrast, where literacy skills are
developed through other subjects, such as social studies or science, there is a greater focus on language as a tool for social development; situations from daily life are incorporated into activities that foster the acquisition of reading and writing skills. This underscores the importance of paying attention to the approaches adopted in school curricula because the acquisition of literacy skills is significantly influenced by the learning context, local educational goals, and the prevalent pedagogies. In developing countries, there is tremendous variability in school curricula and pedagogies that reflect cultural, linguistic, religious, and geographic customs and values, including some that appear to focus much more on memorization than is common in classrooms in developed countries.

Teachers need to understand the content of the curriculum and be able to communicate it to students of varying ability. It is also important that students are not taught with a narrow curriculum that only encourages memorization and a passive approach to learning, rather than an approach that stresses higher order general reasoning and problem-solving skills. Students require relevant and meaningful literacy, numeracy, and higher order cognitive skills, which call for curricula that are geared to participants' lives and livelihoods. For example, the Foundation for the Application and Teaching of the Sciences program in Colombia integrates the needs of rural life and livelihoods into the secondary school curriculum. As a result, students acquire knowledge of both traditional rural vocational skills, such as agriculture and animal husbandry, and skills that link to a globalizing world, such as creating a microenterprise.

Traditionally, literacy programs have suffered from standardization of curriculum content and teaching methods and from recruitment of instructors unfamiliar with the language, culture, and social context of learners. Programs that align literacy curricula with local needs have been developed in Senegal, Burkina Faso, Chad, and Mali. The Escuela Nueva program, launched in Colombia in 1975, provides teachers with extensive in-service training on how to develop curriculum based on the needs of rural communities and guide students, while allowing them to acquire and construct knowledge on their own. Studies indicate that Escuela Nueva students scored significantly higher in third-grade mathematics and Spanish than their counterparts in traditional schools, and the program has been expanded to thirteen countries in Latin America and one in Africa.

### Conclusions

Future research efforts need to expand beyond concerns, methods, and interventions conceived in the United States and other northern contexts to encompass a broad view of literacy, numeracy, and an understanding of local goals, barriers, resources, opportunities, and supports for children's learning. A multi-dimensional program of research emphasizing longitudinal, randomized control trials and in-depth case studies can help to identify the kinds of parent and learner engagement strategies, teacher development, and instructional approaches that are most effective for various populations of girls and boys in specific circumstances and conditions to acquire skills needed for lifelong learning.

### Notes

1. Levy and Murnane (2001); Schleicher (2010).
15. Aboud and Hussain (2011); Malmberg, Mwaura, and Sylva (2011); among others.
20. Ibid.
22. Young et al. (2002).
Pratham (2010).
Snow et al. (1998).
National Reading Panel (2000).
Storch and Whitehurst (2002).
Bear et al. (2004).
Pressley et al. (1989).
Palinscar and Brown (1984); Vaughn, Klinger, and Bryant (2001).
Dowd et al. (2010).
UNDP (2005).
Afeiti et al. (2008).
Awan et al. (2011).
Tilak (2005).
Nasir and Nazli (2000).
Lavy (2010).
Piper and Korda (2010).
Gove and Cvelich (2010).
Bhattacharjea, Wadhwa, and Banerji (2011).
Smith and Huisman (2008).
Pinnock (2009).

Pratham (2010).
Bialystok (2001); Lindholm and Aclan (1991); Thomas and Collier (2002).
Heugh and Skutnahh-Kangas (2010); Alidou et al. (2006).
Porter (1990); Rossell and Baker (1996).
Phyak (2011).
Riddell (2001).
Aderiinaye and Rogers (2005).
Furniss and Green (1993).
Robinson (2011).
Kellaghan, Greaney, and Murray (2009); Harlen (2007).
Diagne and Sall (2009); Lind (2008).
McEwan and Benveniste (2001).