

Improving Literacy and Numeracy in Poor Schools: The Main Challenge in Developing Countries

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Abstract

The most important educational challenge in most developing countries is that of radically improving early literacy and numeracy in their more deprived schools, many of them located in isolated rural areas. These schools may easily account for more than 30% percent of the student population in many countries; therefore any progress made on this problem may have a significant impact on a nation's human resources. The ability to write fluently, understand written text in their native language, and do basic mathematics is a basic level of achievement that will immensely influence the children's intellectual development and therefore their future working opportunities.

This paper describes the Enlaces strategy designed to help the Ministry address this problem at a national level using ICT as a tool and as a resource for teachers and students. Given the social, economical and cultural context of these schools, Enlaces has been working on a number of teacher support activities, special ICT tools (mainly software) and relevant content related to literacy and numeracy. Its goal is to motivate children, providing them with content that is significant to them and with software tools that may improve their present levels of achievements:

1 Introduction

Despite Chile's long standing educational reform, aiming to improve the quality and equity of its educational system, national tests show that children in poor schools score far below average students in reading, writing and mathematics (Bellei 2001, Mineduc 2002). Close to 20% of the fourth graders have an inadequate reading level and more than 30% cannot properly solve very simple addition or subtraction problems that are regarded as normal for their age and educational level. The Chilean Ministry of Education is focusing on this problem as one of its major challenges for the next five years. To this purpose, the Ministry has studied those few Chilean schools that have achieved high scores in literacy and numeracy

despite their scarce resources and the low social and economic background of their children. It has also analysed the available international experiences.

Information and communication technologies (ICT) have played a major role in the Chilean educational reform. A special project, called "Enlaces" (Hepp 1998, Hepp 1999), has been training teachers, providing ICT resources and developing curriculum content for more than a decade. Today, 100% of Chilean secondary schools and 85% of primary schools have computers. More than 70% of the teachers have received training on ICT and close to 75% of all schools have Internet access (Laval and Hinostroza 2002). Therefore, the Ministry of Education has decided to use the available ICT infrastructure and human resources to help address the literacy and numeracy problems in those schools with low educational standards.

This effort is still at an experimental level with a number of research issues in progress. It started in 2002 with a low number of schools; therefore, there are no conclusive results so far but a number of testimonies of a selected group of poor schools that have improved their scores show promising avenues for the design and implementation of this policy at a national level.

2 Successful Schools

The Ministry has set up a task force to deal with early literacy and numeracy problems in those subsidised schools that have low scores in the national tests. One of the first missions of this task force was to analyse the conditions that exist in similar Chilean schools with good results. This analysis was further extended to consider successful schools particularly in Cuba and in the United Kingdom, but also from other countries (Arancibia 1993, Schreens and Bosker 1997, Beard 2000). A few conclusions from this mission in the Chilean schools are as follows (Mineduc 2002).

Successful schools tend to combine high levels of demands for teachers and students, which is closely related to the high level of expectancies declared by the school leaders related to the teachers' professional capacity and of the student's educational potentials. This translates into strong pedagogical support in each subject designed to achieve good results with all children. This tight coordination between demands and supports is a common pattern among successful schools and is reflected in a number of measures:

- Early reading routines for all children in first grade: this has proven to be highly motivating to students and produces a positive perception of the school by the parents.
- Support to students with learning deficiencies: the school is aware of those students who become low achievers and reacts promptly with supporting measures to level them with their peers. Measures are normally related to special learning material, professional assistance from specialists or more exercises in specific subjects supervised by teachers.
- The school administration has clear plans not only for every subject throughout the year, but also implements with the teachers monthly and weekly technical plans that are very focused and systematic. These plans are often laid out in detail for each lecture.
- The school administration role does not end with the design of the plans; it also has a very active role inside the classroom in monitoring the development of the plans. The goal of classroom observations is to assist the teacher pedagogically; it is a learning opportunity for them, which they get used to gradually.
- Learning resources are carefully chosen and are coherently integrated into the lesson plans, with the clear goal of achieving good learning results from the students.
- Schools show efficient use of the available teaching time. Lectures are well prepared, resources are in place and they are not interrupted. Students know the lesson structure and spend less time understanding the goals and in getting organised themselves.
- The school community has a clear understanding of all the expected learning outcomes of the students at each level, so families are well informed throughout the year of their students' progress.
- The school implements a number of pedagogical routines that are common to all subjects and levels and whose goal is to achieve certain basic skills in all students. These routines include: 15 minutes of daily silent reading or mental calculi; the daily story hour for the youngsters; the weekly hour at the library; the monthly theme around which students read, write, investigate, discuss, etc.

The international experience analysed showed a similar pattern to that in the Chilean successful schools, but in addition, they emphasized more the understanding by all teachers of the expected learning results at each level, according to the national curriculum. Also, teachers have better support with methodological orientations that are specific to their subjects and which clearly connect with the national curriculum, the classroom activities and the evaluation process. Finally, teachers have access to continuous training in their subjects and participate in networks of teachers of the same discipline.

With the background of the national and international experience of successful schools, the Ministry has devel-

oped a comprehensive strategy to address the literacy and numeracy problems in those subsidised schools with low scores according to the national tests. This strategy is explained in detail by Mineduc (2002).

3 Enlaces Strategy

The fundamental idea behind the Enlaces strategy for literacy and numeracy is to support the Ministry's plans and activities with the schools, avoiding the proposition of "parallel plans" that may confuse teachers and school leaders. The goal is to provide a consistent message for all participants. Therefore, the Enlaces team has been working very closely with experts from the Ministry of Education to integrate ICT into the general plan. The role of ICT is mainly focused on specific learning tools and resources for K-4 students as well as teaching resources and training opportunities for the teachers.

To select the ICT tools and contents for K-4, Enlaces has also taken advantage of the available national and international experience (Scrimshaw 1993, McFarlane 2001). A summary of the selected tools are as follows:

3.1 Writing

Learning to write requires a number of steps that include motion and coordination skills. Once the basic skills have been acquired, teachers proceed to expand the grammar and orthography rules as well as the student's vocabulary. McFarlane (2001) stresses the importance of visualising a text as a product under revision and evaluation. Scrimshaw (1993) identifies a number of steps in the process of writing, including planning, creating, editing and others, which are not necessarily sequential in order. The word processor seems to be a particularly helpful and effective tool for visualising text and for implementing each of the required steps to produce a piece of well written text. The editing capabilities of word processors make them particularly suitable for moving, adding, deleting words and whole sentences and thus empowering the revision step. It can also be used to exercise group and individual work skills. Another important aspect is that the word processor can be used with the whole class during a "shared writing" activity in which the teacher projects a piece of text visible to all children in order to have them contribute with additions and changes. This is one of the preferred activities in the Chilean schools and the word processor and screen projector have proven to be very useful tools. According to Cochrane-Smith (1991), students spend more time working with texts when on the word processor; the results are clearer and have fewer errors, but are not necessarily of a better quality. Another useful feature of word processors is the facility for easy printing and publishing of text, providing a sense of identity to the group of children that produced the text (Garvey 2000). It also makes the text more "real" for students.

Another powerful tool for writing is e-mail, which provides students with a real audience, thus motivating purposeful writing that has to be understood by other persons. It also fosters the writing of different types of text, including eventually pictures and images. Enlaces is strengthening the network infrastructure in all schools

and is trying alternative e-mail user interfaces for small children. There are also a number of international collaborative projects under way, in which teachers organise short projects for small children to exchange ideas of their preference such as sports, food and music. These projects motivate youngsters and provide them with a desire to better understand written text and to express themselves clearly in order to communicate with other persons (Burniske and Monke 2001).

3.2 Reading

The basic skills in the first two school years can be grouped into two main areas: learning to read and understanding written text.

Learning to read, includes a number of skills and habits, including phonetic learning and reading fluidity. In this area, the multimedia capability of computers together with their capacity to provide rapid feedback to students, allows an easy association and interaction between images and sounds. One of the software programmes produced in Chile and available in all schools is *Abrapalabra* (Enlaces 1999), which is designed for children at the early reading stages, with a number of multimedia tools for exercises with letters and words. The *KidPix* programme (<http://www.broderbund.com/>) is also used by teachers to associate letters with sounds and images. Digital interactive books, are also used by teachers to have children listen to well spoken stories, with good pronunciations and with associated images (Jara 2003). The Internet can also be a useful (and inexpensive) source of interesting text particularly suitable for children, including short stories and newspapers written specially for youngsters. Finally, there are a number of software tools, designed to be playful, where children play with letters and words to achieve specific goals, for which they are rewarded and feedback is always on hand. They can be used to expand the vocabulary and to exercise phonetic rules, among other topics. They are suitable for both individual and whole class work, when using a screen projector.

3.3 Communication Skills

Even though oral skills are not as relevant as reading and writing in the Chilean curriculum, the literature provides a variety of interesting material on how to use ICT to expand these skills. Among these skills, students are expected to learn how to follow a conversation, share opinions and concepts and achieve a common understanding with respect to the object of the conversation. For these skills the computer might have a motivational role where particular software, such as *Decisiones Decisiones* (Dockterman 2002) which has proven helpful in providing interesting circumstances for the students to interact orally, guided by the teacher.

3.4 Mathematics

During the first two years of school, students are expected to learn about the meaning of quantity in a number, to be capable of basic arithmetic operations, to acquire some problem solving strategies, and to identify and manipulate

geometrical forms. Use of tables, graphs and fractions are also in the curriculum but they are rarely achieved by many students during the first two years.

Software can help in providing multiple representations of an abstract concept, and in manipulating these representations on the computer screen interactively, receiving immediate feedback and help if necessary (Ainsworth, Bibby *et al.* 1997). A number of software titles provide this functionality for young learners, particularly *Logo* but also electronic spreadsheets. Both of these software programs are present in Chilean schools.

According to Selinger (2001), spreadsheets can help teachers with “what if” questions, designing easy exercises that can be shared by the whole classroom. For example, spreadsheets facilitate the use of exercises in which students can try different numbers in an equation, without having to do the calculation but concentrating on patterns of numbers while searching for a solution. Trial and error with immediate feedback are also a method that teachers tend to favour. Spreadsheets also have excellent graphing functions which can be easily mastered by the teachers. However, Fraser (2000) emphasizes that teachers need to know well how and when to use these new tools. For example, when entering data into a spreadsheet, teachers must clearly understand what question is involved in the exercise, how to represent data in a meaningful way to the students and how to work with them to achieve a correct interpretation.

McFarlane (1996) describes the benefits of using graphing functions, which provide great flexibility for representing information in different ways and with less effort from the students. This is an advantage over hand made graphs where most of the time is spent in the drawing process and less time is devoted to the analysis, discussion and understanding of the quantities represented.

Other pieces of software might help in developing counting, adding and subtracting and ordering skills, which are central to the curriculum (Clements 2002). Some of this software can be used as individual or group games, even with the whole class, when the teacher has a screen projector or an electronic whiteboard. More complex concepts like fractions and decimal numbers can also be worked with software. However, some authors (Clements 2002) note that this software is more effective when students already have a basic understanding of the concepts with which they have to play. The *Tima: Stiks* is software that might help with the concept of fraction (Olive 2002), starting with whole numbers. Some of this software is presently being tested by Enlaces.

For problem solving skills, Whitebread (1996) emphasizes the role of adventure games that can be used during lecture times. They tend to be highly motivating for students and who normally willing to continue playing with them after school hours. Understanding and representing a problem tend to be difficult tasks for students, but they are facilitated by the game because of the context where the game takes place and the help provided to understand what is going on. To play the game, students will have to collect information, design an action plan, generate and test different hypotheses and make decisions. Games also

require the use of problem solving tools such as diagrams, maps, notes, etc.

4 The Technology

Most of the classroom examples that use ICT are more comfortable for teachers when working with the whole class in a familiar environment. The computer lab is not a familiar setting for teachers who perceive it as “complex and intimidating,” because they have to deal with a large quantity of unstable technology (and therefore prepare contingency plans). In addition they lose most of the control to the software and they need to book the lab for a whole hour when most of the time they only want to use technology for a particular exercise or a demonstration for short periods of time.

Experience is showing that teachers feel comfortable with a screen projector and one computer in the classroom, to be used only when needed and switched off the rest of the time. Electronic whiteboards are a step forward towards a more interactive and less intrusive technology which offers ample opportunities for teachers and students to share information and learn together. In this scenario, computer labs are used only in special cases for whole-hour teaching purposes and are mostly devoted to after classroom exercises or group work, remedial needs or free use by student clubs and parents.

Enlaces is presently experimenting with these and other technologies to offer better and less intimidating tools for the teachers together with powerful opportunities to enhance the learning environments and use ICT as a lever for change. These experiments are in line and in coherence with all other initiatives from the Ministry of Education whose central aim is to improve the teaching process.

5 Conclusions

Many Chilean students in low-income schools are under achievers in early literacy and numeracy and are therefore at a disadvantage for further learning in other levels. The Ministry of Education has identified a number of factors that are common to “good” schools in Chile and other countries and which can be applied to all those schools that need to improve their standards. The strategy designed has a number of coherent messages, resources and teaching aids for all teachers in those schools. Part of this strategy includes the use of ICT in the classroom and the training of teachers to understand when, how and why to use ICT tools to achieve their educational goals

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Referenced Software

ABRAPALABRA. Unlimited, <http://www.unlimited.cl>.

DECISIONES DECISIONES. Tom Snyder Productions, <http://www.tomsnyder.com>.

KIDPIX. Broderbund, <http://www.broderbund.com>.