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THE EFFECTIVENESS OF MULTIGRADE SCHOOLS IN COLOMBIA

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Abstract — This paper evaluates the effectiveness of the Colombian New School (*Escuela Nueva*) program in raising student achievement in Spanish and mathematics. Typical program strategies include multigrade instruction, flexible student promotion, and community involvement. The paper finds that New Schools are better endowed with inputs like textbooks and place greater emphasis on active learning than traditional rural schools. Nevertheless, many New Schools have not implemented all the reforms. New Schools are found to have positive and statistically significant effects on Spanish and mathematics achievement in third grade and Spanish in fifth grade. Findings replicate previous evaluations. © 1998 Elsevier Science Ltd. All rights reserved

INTRODUCTION

Over 17,000 rural schools in Colombia, almost half, have adopted the New School (*Escuela Nueva*) methodology. New Schools generally have one or two teachers for the five-grade primary cycle, promoting participatory learning and a rural-oriented curriculum. Students advance at their own pace and need not repeat school years, while communities and parents are intimately involved in their children's schooling. This contrasts sharply with traditional rural education which emphasizes passive learning with an urban-biased curriculum and often does not provide a complete primary education. Schedules are rigid, so that students who leave to participate in agricultural activities must repeat the year. Finally, traditional schools have low levels of involvement in their surrounding communities.

Since its nascent beginnings during the unitary schools movement of the 1960s and its later institutionalization as a program, *Escuela Nueva* has sought to expand educational coverage in rural areas, raise levels of student achievement, improve student flows by reducing repetition rates, and bolster creativity, self-esteem, and civic behavior among students.[2] Mention of the program is ubiquitous among educational consultants, and it has been widely promoted as a model for other countries (see, for example, World Bank, 1995: 61–62 and Lockheed and Verspoor, 1991: 158–161). Despite its wide acclaim, there are few evaluations of how effectively *Escuela Nueva* has achieved its objectives.

This paper attempts to fill that gap by evaluating the effectiveness of the New School program in raising student achievement. Section 2 of this paper reviews the state of rural education in Colombia. In Section 3 the rationale for multigrade schools is examined, and the New School program is briefly described. Section 4 reviews the findings of the evaluations already conducted. Divergences between the ideal and actual implementation of New School methodology are identified in Section 5. In Section 6 the educational effectiveness of New Schools versus traditional schools is gauged, first with an analysis of average Spanish and mathematics test scores, and then with a regression analysis controlling for student and family background. The paper concludes by summarizing key findings.

THE STATE OF RURAL EDUCATION IN COLOMBIA

In terms absolute and relative to urban areas, the quantity and quality of rural education are lacking in Colombia. Primary education coverage has increased substantially among all income quintiles and regions of the country since the early 1970s. Nonetheless, coverage is still superior in urban areas, and some 20 percent of rural children aged 6–12 are not attending school at all (see Table 1). Students in rural Colombia have, on average, 1.7 years

Table 1. Net primary enrollment rates by income quintile and zone of residence

	Percent ages 6–12, 1974		Percent ages 6–12, 1992			
	National	Rural	Urban		Rural	
Quintile	Male/Female	Male/Female	Male	Female	Male	Female
1 (low)	54.1	51.2	78.4	79.9	73.0	77.0
2	61.4	44.5	85.6	86.4	80.2	80.0
3	66.3	56.5	89.1	91.1	76.3	83.0
4	78.1	56.2	94.8	95.7	81.6	84.0
5 (high)	86.3	60.0	95.4	96.8	88.2	90.5
Total	64.9	51.9	86.1	87.2	78.2	80.9

Source: Molina *et al*. (1993).

of schooling, compared to 3.8 for their urban counterparts, which qualifies many rural students as functionally illiterate (Colbert *et al*., 1993: 53).[3]

Other indicators paint an equally dismal picture. Drop-out rates in rural areas have remained fairly constant in the period 1978–1987, while promotion rates have risen slightly (see Table 2). The urban/rural gap is again evidenced, with the urban drop-out rate in the first grade some 7 percent lower than the rural rate. The promotion rate is particularly striking, with only 59 percent of rural first-graders advancing to the second grade, compared with 74 percent of urban students. Achievement test scores also point to poor educational quality in rural areas. A nationwide educational quality survey found that mean scores on tests of Spanish and mathematics at the third and fifth grade levels are higher in urban areas in most Colombian departments (Colombia, Ministerio de Educación Nacional, 1993: 63, 71, 78, 85).[4]

In general, basic inputs like textbooks and a well-equipped school building are deficient in rural areas. Schedules are often quite rigid, such that students cannot leave to participate in agriculture without being forced to repeat the entire year. Pedagogy in language and mathematics is passive, centered around rote memorization and imitation. Many teachers are not trained in multigrade teaching methods, even though the vast majority of teachers contend with groups of students heterogeneous in age and ability. Teachers are often estranged from the rural community, living apart from it and receiving little supervision or support from educational authorities. Finally, rural communities and parents participate little in their children's education.[5]

MULTIGRADE SCHOOLS AND THE NEW SCHOOL PROGRAM

The Rationale for Multigrade Schools

There is a large literature, much of it focused on developed countries, which explores the

Table 2. Drop-out and promotion rates in rural primary schools

	1978				1987			
	Drop-out rate		Promotion rate		Drop-out rate		Promotion rate	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Grade 1	11.9	16.8	67.7	55.6	12.1	18.9	73.8	59.2
Grade 2	8.9	14.2	75.4	65.9	8.5	14.5	82.3	72.4
Grade 3	9.3	14.2	77.5	71.2	7.6	13.6	83.4	76.4
Grade 4	8.3	14.1	80.4	73.5	7.1	13.2	83.5	77.9
Grade 5	7.5	12.6	84.9	78.6	6.1	11.6	87.9	83.4

Source: Colombia, Departamento Administrativo Nacional de Estadística (1993).

rationale for employing a multigrade methodology in the classroom.[6] The multigrade classroom is posited as an alternative pedagogical approach that brings together students of different ages and abilities in order to cope with children's different rates of development. It is an environment where peer tutoring and cooperative learning encourage independence, leadership skills, self-esteem and intellectual growth among students. Teachers, as they remain in the same classroom for more than one year, become better acquainted with students and can tailor individualized instruction.

Teachers must be trained in group learning and delivering an integrated curriculum that applies to children at different developmental stages (Stone, 1995). New skills regarding careful lesson scheduling and planning, effective use of time, peer tutoring and self-directed learning are fundamental for effective instruction (Miller, 1991). Classroom organization and management must be conducive to teaching more than one group (Hayes, 1993). Educators must also have adequate materials, such as self-instructional textbooks and access to a library, that lend themselves to independent study (Thomas and Shaw, 1992).

The multigrade classroom is a demanding environment for the teacher. The greater the student diversity, the greater is the need for careful planning and organization. Traditional instruction — lecturing, recitation, seatwork, copying from the blackboard — generally proves to be ineffective in a multigrade setting. All students must be engaged at all times; otherwise, 'time on task is reduced, achievement falls, discipline degenerates, and the teacher becomes frustrated and feels overworked' (Thomas and Shaw, 1992: 27).

Multigrade methodologies can be employed in urban or rural areas. Nonetheless, in developing countries they have come to be associated almost exclusively with rural schooling. This is perhaps because multigrade schools with one or two teachers are seen as a cost-effective alternative to expand educational access in thinly populated areas (Bray, 1987). It may also be due to the diffusion of experiences with New Schools, located almost exclusively in rural areas.

The New School program promotes innovations in school organization, curriculum and instruction, staff training, and community relations. The program is principally, though not exclusively, concentrated on encouraging an effective application of multigrade methodologies. Notwithstanding the academic literature just cited, the process by which the program adopted its particular mix of educational strategies proceeded in the manner of trial and error. McGinn (1996) notes that in the initial stages of the design and implementation of the *Escuela Nueva* program — in fact, before it was even referred to by that name — teachers were intimately involved in the process of curriculum design. He uses the word 'organic' to refer to the iterative, grassroots process of program design:

> the methods that were tried were not deduced from the theory but rather the theory was induced from the innovations of individual teachers and the *Escuela Nueva* inventors in Colombia, working together, observing and reflecting on their actions. The actions were theirs. The process was 'organic,' a lived experience (McGinn, 1996: 23).

It was only later that the New School was 'frozen' into a discrete package of inputs, in order to facilitate the scaling up of the program. In 1986, for example, the program received financial assistance from the World Bank and an official New School 'kit' was designed. The following paragraphs describe the key elements of that kit.[7] The description is drawn from official program documents. The degree to which the strategies are actually implemented in schools is examined in Section 5.

School Organization

New Schools usually operate with one or two teachers per school. In sparsely populated areas, student populations may be inadequate to justify a separate teacher for each grade level. If educational outputs are not reduced (and, in fact, they may be increased) by multigrade instruction, the system can be a cost-effective way of increasing primary coverage in rural areas. Students complete academic units at their own pace through group and individual work, which may take more or less time than allotted. If they leave school to assist in agricultural activities and later re-enter school, they do not start the year anew, implying savings to schools through reduced repetition rates.

Curriculum and Instruction

Individual student work, emphasized in traditional schools, is combined with work in small groups. In a multigrade setting, group work relieves the teacher of the need to constantly monitor or lecture to students, providing a way to keep students on task. Instruction of younger students by older students or parent volunteers is often used as a cost-effective means of providing assistance to students that have fallen behind.

Self-instructional learning guides in mathematics, Spanish, science, and social studies direct group and individual work. They are accompanied by teacher guides. Units in the book state the learning objective, guided activities to be completed, and free activities which require application of the knowledge gained. Some involve creative exploration and application of regional-specific knowledge. For instance, local recipes, oral traditions, or flora are collected and studied. Materials related to the different curricular areas are gathered in 'learning corners' organized by students, where other children can benefit from them. As students advance through activities and exercises in the guides, they are shown to the teacher who authorizes students to advance. Students may advance at different paces and only do so upon exhibiting sufficient mastery of concepts. The requirements for advancement are explicitly stated and available to students.

An integral part of the New School is a small library which teaches basic research skills. It complements the self-instructional guides, and provides additional opportunities for motivated or advanced students. A student council is organized by the teacher. Students divide into committees, thus learning skills of organization and cooperation. The committees address a variety of issues, including cleaning and maintenance of the school, care of the library, school discipline, and peer tutoring. Other elements of New Schools include a classroom decorated with the alphabet, numbers, and student art, a suggestion box where student input is solicited, and varied recreational activities.[8]

Staff Training

Basic teacher training is divided into three one-week courses conducted throughout the first school year. Courses use a detailed manual organized similarly to student learning guides.[9] The first session addresses the aims and methodology of the New School, organization of the building and classroom, developing the learning corners, establishing a student council, and basic methods of group work. Instruction is conducted in much the same way as it is in the functioning New School, so that teachers 'learn-by-doing' instead of passively attending lectures. Once the school is organized and the community has been mobilized, the second workshop takes place two or three months later. It focuses on learning to effectively use the student learning guides, work in a multigrade setting, and as many other innovations as the teacher is ready to implement. The final workshop covers the use of the school library as well as a final review.

Once completed there are follow-up workshops as needed in 'microcenters'. Centers are located in a demonstration school where the New School methodology is thought to be particularly well-implemented. There teachers are free to exchange ideas and questions with other teachers and a supervisor in an informal, non-hierarchical group setting.

A workshop is also held for administrators at the department level and at the level of 'school clusters', or smaller groups of New Schools located in the same area. In addition to exposition of the New School program, it is designed to encourage a mentoring and collaborative relationship between administrators and teachers.

Community Relations

New Schools are designed to be resources for the community. Substantial latitude is left to the teacher to design interventions, but several are suggested or required. Students and their family members collaborate in making a map of the surrounding community. Basic personal and demographic information is collected on each family, which allows teachers to efficiently plan for upcoming years. Teachers use this information to prepare a 'community monograph' which describes the culture, health, jobs, and other characteristics of community members. With the community, an agricultural calendar is prepared that serves a dual purpose: to provide a means of planning school schedules and a learning tool for the teacher and children. Learning guides mentioned above often explicitly require collecting knowledge and materials from the community, which can be helpful in forging

bonds. Sometimes parents collaborate in the actual construction and maintenance of the school and furniture that facilitates implementation of the reforms (i.e., desks which facilitate group work, shelves for the learning corners, etc.). Toward this end, an illustrated manual gives practical guidance.

RESULTS OF PREVIOUS EVALUATIONS

The most comprehensive evaluations of the New School program have been conducted by Psacharopoulos *et al*. (1993); Rojas and Castillo (1988). Both utilize a data set collected in 1987 in 11 Colombian departments. The data contain results of instruments measuring achievement in mathematics and Spanish, civic behavior, self-esteem, and creativity. The data also contain a variety of background information on schools, teachers, and students in 168 New Schools and 60 traditional schools. Some characteristics of the sample should be pointed out. Departments and schools were not selected randomly. First, departments were selected where the New School program was relatively more developed. Secondly, in collaboration with regional coordinators of the program, New Schools were selected where the program had been in place for at least three years, and which had faithfully implemented the methodology (i.e, teaching-training, use of self-instructional guides, library). Areas were excluded based on the small number of New Schools there or the difficulty in reaching them. This tended to favor the 'best' New Schools and probably biased the results above what a random sample of schools might have yielded. Thus, evaluations conducted with these data are a better approximation of the ideal New School's effects on educational outputs. They may not be generalizable to the universe of New Schools.

In a comparison of means, Psacharopoulos *et al*. (1993) found statistically significant differences between types of schools in third grade Spanish and mathematics achievement, creativity, civics, and self-esteem. In the fifth grade there were only significant differences in Spanish achievement. Then estimating a simple production function with ordinary least squares, they find that a New School dummy variable is positive and statistically significant for Spanish and mathematics tests in grade 3, Spanish in grade 5, and civic behavior for the pooled group of students. They find positive but insignificant coefficients for tests of grade 5 mathematics and a pooled regression with the tests of creativity and self-esteem.

Their model specification is parsimonious and excludes school and classroom level variables representing availability of New School inputs such as the library and textbooks. Because these inputs are usually applied as a package, they are likely correlated with the New School dummy. Assuming that these inputs influence outputs positively, it is reasonable to expect that their exclusion exerts an upward bias on the New School dummy coefficient. Thus, the coefficient indicates an overall New School effect. But if some traditional schools adopt New School-type inputs and some New Schools are lax in implementing reforms, the dummy variable would reflect an 'average' effect; this would probably understate the program's effectiveness in increasing educational outputs. It also prevents analysis of which program inputs are relatively more effective than others.

Besides an analysis of student achievement, Rojas and Castillo (1988) present a variety of qualitative data showing that New Schools have higher levels of participation in community activities and high levels of teacher satisfaction with the New School methodology, training courses, and self-instructional learning guides.

HOW FAITHFULLY IS NEW SCHOOL METHODOLOGY BEING IMPLEMENTED?

Data

The data used in this study were collected in a 1992 survey of primary schools in Colombia (Instituto SER de Investigación, 1993). A random sample of schools in three departments — Valle, Cauca, and Nariño, together referred to as the Pacific region of Colombia — was conducted. They are a representative sample of the population of the 'B calendar' urban and rural primary schools, both private and public, in these three departments. No private rural school was sampled, consistent with their extremely small numbers. The schools belong to the B calendar with a September to June school year rather than the A calendar which runs from February to November.[10] This study analyzes the subsample of rural schools. There are data on 52 rural schools, 24 classified as New Schools,

and students in the third to fifth grades. Survey forms were completed by each school's principal, the teacher of the surveyed classroom, and students. In addition, students were administered tests of mathematics and Spanish. Because the survey was not conducted with the explicit goal of evaluating New Schools, no criteria were used to limit a school's inclusion such as length of time participating in the program. Because there is no information on this, results could conceivably be biased if fifth grade students have not been exposed to a five-year New School education.

Effectiveness of Program Implementation

This section examines how faithfully New Schools adhere to their stated methodology and to what degree traditional schools also utilize New School-type inputs. New Schools have a higher average number of supervisory visits per year, a gauge of the quantity, if not quality of administrative advising (see Table 3). Two-thirds of New Schools have a library, surprisingly low in light of the emphasis placed on this input; however, only one-third of traditional schools have this input.[11] Between 33 and 45 percent of New School classes are utilizing the official self-instructional guides, providing cause for some concern. One might question whether a New School without the prescribed textbooks, and the curriculum and instructional techniques they encourage, could really be said to be 'New'. Nonetheless, in both grades and subjects, New School classes are better supplied with textbooks of all types. The shortage of texts in traditional schools is particularly striking in mathematics.

Despite the delivery of tangible program inputs to classrooms, the program could not be said to be 'implemented' unless core teacher practices are altered. Table 4 describes instructional methods used in New and traditional schools in Spanish and mathematics.[12] In language teaching, frequency of group work, library use, directed text reading, free reading, and student presentations are higher in New Schools in both the third and fifth grades. Frequencies of directed and free composition and dramatization are comparable in third grade, while in fifth grade New Schools start to utilize these methods more intensively. In mathematics New Schools emphasize individually solving problems, exploration outside the classroom, and group work more than traditional schools. Traditional schools emphasize solving problems on the chalkboard more than New Schools. There is little difference in emphasis on working with objects in third grade, but fifth grade teachers in New Schools emphasize this more than their counterparts. Evidence points to a greater use of active learning in New Schools, which is intended to emphasize student creativity and abilities of written and oral expression. Group work, a key aspect of New School methodology, is extensively utilized. Nonetheless, among teachers there is considerable heterogeneity in the application of different instructional techniques.[13] Teachers' ability to apply different instructional strategies may be heavily conditioned by the availability of proper class materials, such as self-instructional textbooks. Previous evidence showed that these may be in short supply in New School classrooms. Thus, evidence that New School teachers still apply innovative teaching practices is encouraging.

Other information on New School inputs is absent from this study's data. Tables 5 and 6, referring to the evaluation of Rojas and Castillo (1988), provide additional evidence on how faithfully New Schools have adhered to their prescribed form and function. In their sample, over 90 percent of schools have a library, learning corners, classroom decorations, a suggestion box, records on families of students, and a map of the community. Inputs less commonly present include the community monograph, student journals, the agricultural calendar, the student government, and the self-instructional textbooks. The absence of the latter two is troublesome, especially given their central role in New School training courses and methodology. Finally, measures of community involvement in Table 6 uniformly suggest that New Schools are an important part of their communities. They are, in general, more likely to sponsor community events such as agricultural training and health programs.

HOW EFFECTIVE ARE NEW SCHOOLS IN RAISING STUDENT ACHIEVEMENT?

The New School program is not solely intended to raise achievement in Spanish and mathematics. Its wide-ranging objectives include the creation of a democratic Colombian citizenry, the promotion of creativity and leader-

Table 3. Comparison of selected inputs in New and traditional schools

	New School	Traditional
Average supervisory visits/year	1.6	0.8
Schools with library (percent)	67	33
Classes using New School texts (percent):[a]		
Grade 3 Spanish	33	NA
Grade 3 Mathematics	29	
Grade 5 Spanish	46	
Grade 5 Mathematics	40	
Grade 3 Spanish text availability (percent):		
No students	0	29
One-quarter of students	29	25
Half the students	29	21
All students	42	25
Grade 5 Spanish text availability (percent):		
No students	0	32
One-quarter of students	38	18
Half the students	21	25
All students	42	25
Grade 3 math text availability (percent):		
No students	8	57
One-quarter of students	21	21
Half the students	33	14
All students	38	7
Grade 5 math text availability (percent):		
No students	8	53
One-quarter of students	33	18
Half the students	21	18
All students	38	11

Source: All data in this and following tables, unless otherwise noted, are from Instituto SER de Investigación (1993) and the author's calculations.

[a]Due to some discrepancies in coding of these data, they should be interpreted cautiously.

ship among students, and the improvement of students' self-image. Nonetheless, it is also broadly aimed at improving student achievement in basic areas like reading and mathematics. And among key stakeholders such as rural parents, the national government, and international donors which have supported *Escuela Nueva*, it is expected that a primary education should, foremost, teach children how to function with some minimal competency in these areas. Thus, a good first step in evaluating the program is to examine how effective it is in raising student achievement, though an achievement evaluation is only one element of a more comprehensive summative evaluation.

Mean scores on tests of mathematics and Spanish achievement, in third and fifth grades, are presented in Fig. 1. All four tests have been standardized to a mean of 50 and a standard deviation of 10. There are statistically significant differences on both tests at the third grade level in favor of the New School. In fifth grade New School scores are higher than traditional schools, but the differences are not statistically

Table 4. Instructional methods used in Spanish and mathematics

	Almost every day	Several times/ week	1 time/ week	< 1 time/ week	Total	Almost every day	Several times/ week	1 time/ week	< 1 time/ week	Total
	Grade 3 Spanish					*Grade 5 Spanish*				
Text reading	32	54	14	0	100 (T)	18	79	4	0	100 (T)
	67	29	4	0	100 (N)	61	30	4	4	100 (N)
Free reading	7	50	32	11	100 (T)	18	14	61	7	100 (T)
	21	46	25	8	100 (N)	30	26	30	13	100 (N)
Directed composition	14	36	32	18	100 (T)	4	43	21	32	100 (T)
	13	21	54	13	100 (N)	22	30	26	22	100 (N)
Free composition	7	21	36	36	100 (T)	0	32	29	39	100 (T)
	8	17	54	21	100 (N)	22	26	9	43	100 (N)
Dramatization	4	25	64	7	100 (T)	0	11	32	57	100 (T)
	4	38	54	4	100 (N)	4	39	9	48	100 (N)
Library use	0	11	14	61	100 (T)	7	14	14	54	100 (T)
	54	21	4	21	100 (N)	48	30	9	13	100 (N)
Group work	14	50	18	18	100 (T)	14	54	29	4	100 (T)
	63	29	8	0	100 (N)	74	17	4	4	100 (N)
Student presentations	4	14	32	50	100 (T)	0	14	50	36	100 (T)
	17	54	4	25	100 (N)	17	30	17	35	100 (N)
	Grade 3 Mathematics					*Grade 5 Mathematics*				
Individually solve problems	11	79	7	4	100 (T)	21	72	7	0	100 (T)
	29	46	17	8	100 (N)	33	57	10	0	100 (N)
Solve problems on chalkboard	57	36	4	4	100 (T)	52	41	7	0	100 (T)
	25	67	8	0	100 (N)	33	62	0	5	100 (N)
Exploration outside classroom	0	18	46	36	100 (T)	7	21	31	41	100 (T)
	13	46	21	21	100 (N)	14	33	33	19	100 (N)
Group work	4	46	29	21	100 (T)	10	41	38	10	100 (T)
	46	33	8	13	100 (N)	71	19	5	5	100 (N)
Work with objects	11	25	21	43	100 (T)	17	17	21	45	100 (T)
	8	38	21	33	100 (N)	0	62	10	29	100 (N)

N indicates New School; T indicates traditional school.

significant. The figure highlights the apparently declining effectiveness of New Schools at the fifth grade level. Nonetheless, a simple comparison of raw means might be misleading if, for example, other variables which affect student achievement are systematically correlated with school type.

To further test the hypothesis that New Schools are more effective in raising student achievement than traditional schools, regression models of the following general form were specified and estimated with ordinary least squares:

achievement score = *f*(school characteristics, principal characteristics, teacher characteristics, family characteristics, student characteristics)

Descriptive statistics of the variables used in the analysis are presented in Table 7. Two different sets of regression models were specified, one that followed the basic form of Psacharo-

Table 5. Percent of New Schools with suggested inputs, 1987

	Percent
Library	94
'Learning corners'	98
Classroom decoration	96
Suggestion box	91
Family records	91
Community monograph	77
Student journals	79
Agricultural calendar	61
Community map	97
Sufficient New School textbooks	67
Student government	58

Source: Rojas and Castillo (1988: 177).

poulos *et al.* (1993). This first specification includes only one variable measuring the intervention: a dummy variable indicating school participation in the program. This simpler specification, leaving out a variety of other variables which represent particular New School inputs, facilitates the replication of the previous evaluation. It also allows the estimation an 'overall' New School effect on achievement. Note that selection bias does not present a problem since schools are relatively isolated and students do not have a choice over whether to attend a New or traditional school. Results of the initial regressions in third and fifth grades are

Table 6. Indicators of school participation in community

	New School	Traditional
Literacy courses	36	28
Dressmaking courses	20	12
Agricultural training	35	16
Sporting events	55	42
Bazaars, parties, and celebrations	89	83
Health programs	83	57

Source: Rojas and Castillo (1988: 106).

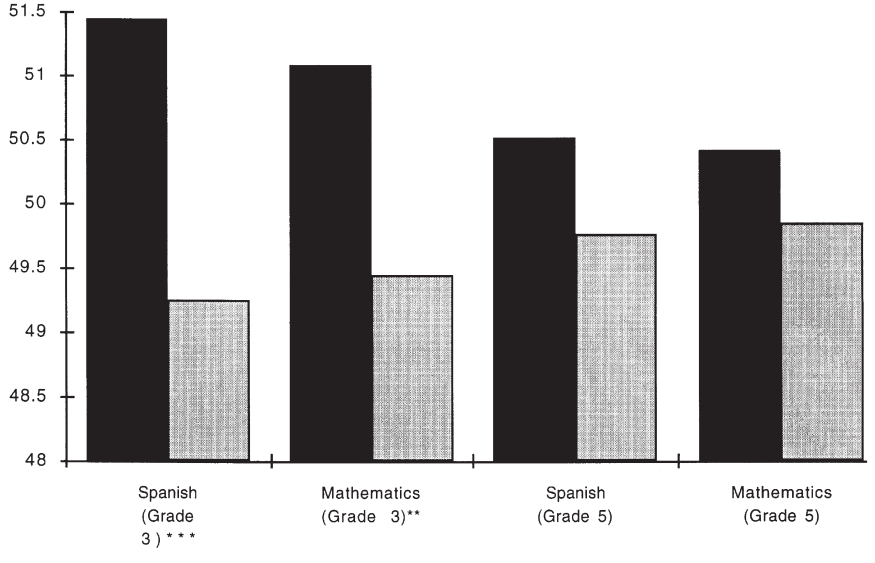

Fig. 1. Standardized mean achievement test scores in New and traditional schools. Note: test scores were standardized with the following formula: $50 + (10(X_i - \bar{X})/S_x)$. ***Statistically significant difference at 1 percent; **statistically significant at 5 percent.

Table 7. Means and standard deviations of variables used in the analysis

	Grade 3				Grade 5			
	Spanish		Mathematics		Spanish		Mathematics	
Independent variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD
School characteristics:								
Student/teacher ratio	26.24	7.15	26.24	7.15	26.50	7.41	26.52	7.37
Electricity access	0.89		0.89		0.89		0.89	
Located in Valle	0.30		0.30		0.32		0.27	
Located in Cauca	0.34		0.34		0.36		0.38	
(Located in Nariño)								
New School inputs:								
New School	0.34		0.34		0.30		0.28	
Library	0.37		0.37		0.36		0.32	
Textbook availability	1.87	1.46	1.23	1.38	1.75	1.49	1.42	1.51
Frequency of group work	2.89	0.97	2.65	1.04	3.04	0.80	2.81	0.92
Supervisory visits/year	0.98	1.08	0.98	1.08	1.04	1.17	1.01	0.92
Principal characteristics:								
Female	0.59		0.59		0.60		0.58	
University completed	0.57		0.57		0.56		0.55	
Years of administrative experience	13.97	7.57	13.97	7.57	14.28	7.61	15.04	7.52
Teacher characteristics:								
Male	0.30		0.29		0.29		0.30	
Years teaching subject	12.03	8.38	11.63	8.69	12.27		12.50	8.71
University completed	0.37		0.34		0.56		0.59	
Monthly salary/1000	115.88	57.88	112.10	55.37	145.40	70.81	150.30	74.95
Hours subject taught/week	5.28	1.32	5.36	1.43	5.24	1.43	5.32	1.22
Family characteristics:								
Family member is university graduate	0.11		0.11		0.12		0.12	
Family member is secondary graduate	0.21		0.21		0.22		0.23	
Family member is primary graduate	0.35		0.35		0.50		0.50	
(None of the above)								
Electricity access	0.86		0.86		0.90		0.90	
TV in home	0.74		0.74		0.77		0.76	
Student characteristics:								
Female	0.51		0.51		0.52		0.52	
Age	10.05	1.40	10.05	1.40	12.00	1.31	11.93	1.27
Works	0.35		0.35		0.41		0.41	
Repeated at least 1 grade	0.45		0.45		0.42		0.39	
$\geq$ 6 absences this year	0.12		0.12		0.08		0.08	
$\geq$ 1 hour TV/day	0.34		0.34		0.38		0.39	
$>$ 1 school attended	0.28		0.28		0.32		0.33	
$\geq$ 1 hour homework/day	0.41		0.41		0.61		0.60	
N	673		673		557		520	

Note: Standard deviations are not reported for dichotomous variables. Variables definitions are given in Appendix A.

Table 8. Spanish and mathematics achievement as a function of student, family, teacher, and school variables

	Grade 3				Grade 5			
	Spanish		Mathematics		Spanish		Mathematics	
Independent variables	*b*	*t*	*b*	*t*	*b*	*t*	*b*	*t*
School characteristics:								
New School	3.82***	4.34	4.98***	5.79	2.35*	1.82	− 0.05	0.03
Student/teacher ratio	0.03	0.62	0.14**	2.18	− 0.06	0.66	0.13	1.52
Electricity access	4.55***	3.58	5.41***	4.25	4.25***	2.60	2.11	1.13
Located in Valle	3.84***	3.68	3.82***	3.43	− 0.20	0.15	1.16	0.39
Located in Cauca	1.42	1.36	1.64	1.53	0.69	0.55	0.50	0.39
(Located in Nariño)								
Principal characteristics:								
Female	2.45***	3.01	− 1.86**	2.23	2.51*	1.84	6.08***	4.00
University completed	− 3.25***	3.78	− 3.31***	3.70	0.89	0.89	− 0.38	0.38
Years of administrative experience	0.16***	2.69	0.04	0.61	0.12	1.52	− 0.02	0.26
Teacher characteristics:								
Male	3.04***	3.77	− 0.14	0.16	0.87	0.62	3.63***	3.26
Years teaching subject	0.09	1.54	0.006	0.10	− 0.09	1.01	0.10	1.03
University completed	− 1.24	1.02	1.17	0.86	0.03	0.02	− 1.05	0.75
Monthly salary/1000	0.02**	2.03	0.03***	2.66	0.00	0.25	0.02*	1.92
Hours subject taught/week	− 0.48	1.59	− 1.10***	3.41	0.80**	2.14	2.32***	5.47
Family characteristics:								
Family member is university graduate	1.98*	1.73	1.98	1.62	0.40	0.23	0.26	0.16
Family member issecondary graduate	3.73***	3.83	3.09***	3.21	0.80	0.56	− 0.46	0.33
Family member is primary graduate	3.34***	3.97	2.73***	3.06	0.34	0.28	1.34	1.04
(None of the above)								
Electricity access	− 1.71	1.42	− 0.99	0.85	− 2.58*	1.65	− 0.78	0.46
TV in home	0.74	0.80	1.14	1.30	2.23**	2.23	0.82	0.70
Student characteristics:								
Female	0.98	1.40	0.16	0.23	− 0.99	1.13	− 1.83**	2.13
Age	0.38	1.40	0.98***	3.38	− 0.17	0.50	− 0.26	0.73
Works	− 1.18*	1.66	− 0.09	0.13	− 2.97***	3.31	− 3.08***	3.48
Repeated at least 1 grade	− 3.04***	4.02	− 3.25***	4.35	− 2.08**	2.37	− 2.19***	2.62
≥ 6 absences this year	− 1.96*	1.93	− 0.64	0.57	− 0.91	0.60	− 0.74	0.61
≥ 1 hour TV/day	1.60**	2.12	− 0.38	0.51	1.02	1.13	0.07	0.07
> 1 school attended	− 1.21	1.53	0.25	0.30	1.66*	1.72	0.60	0.66
≥ 1 hour homework/day	0.92	1.29	1.45**	2.01	1.08	1.29	1.47	1.62
Constant	34.82		31.77		42.80		28.57	
Adjusted R^2	0.22		0.21		0.07		0.15	
N	673		673		557		520	

Statistically significant at: ***1 percent; **5 percent; *10 percent. Column *b* is the OLS coefficient and *t* is the absolute value of the *t*-statistic. All hypothesis tests are two-tailed. Standard errors are calculated with White's heteroskedasticity-consistent covariance matrix (White, 1980).

Table 9. Comparison of New School effects on achievement in two studies

	Regression coefficient of New School dummy variable	
	Table 8	Psacharopoulos et al.
Grade 3 Spanish	3.82***	3.71***
Grade 3 Mathematics	4.98***	3.11***
Grade 5 Spanish	2.35*	1.95***
Grade 5 Mathematics	− 0.05	0.54

Note: Coefficients in the second column are from Psacharopoulos *et al*. (1993: 263). Dependent variables in each study were tests of language and mathematics achievement standardized to a mean of 50 and a standard deviation of 10. Statistically significant at: ***1 percent; *10 percent. Psacharopoulos *et al*. (1993) only report significance at 1 and 5 percent.

presented in Table 8. The New School dummy variable is positive and highly significant for third grade mathematics and Spanish. It is positive but less significant for fifth grade Spanish and negative and insignificant for mathematics. These coefficients are compared with the evaluation of Psacharopoulos *et al*. (1993) in Table 9.[14] Results are strikingly similar between the two evaluations, despite the use of different samples. Both studies point to fifth grade mathematics as an area where New Schools have little effect on student achievement.

Various reasons might explain the narrowed achievement gap at the fifth grade. New Schools, at least in grades two through five, have lower drop-out rates than traditional schools (see Table 10). Since these retained students probably achieve at lower levels, overall achievement declines. This is difficult to control since it is problematic to empirically define which students would have dropped out had they attended traditional schools. But if this explanation is correct, a narrowed achievement gap is not necessarily evidence of ineffective New Schools. Students are being educated in New Schools who would normally drop out. Assuming their achievement levels rise, albeit less than for other students, the overall stock of education in rural areas also increases.

Table 10. Drop-out rates in New and traditional schools

Grade level	New School	Traditional
Grade 1	10.5	8.6
Grade 2	5.1	9.3
Grade 3	2.9	7.8
Grade 4	0.7	7.9
Grade 5	− 3.0	11.1

Source: Rojas and Castillo (1988: 76).

Secondly, the presence of New School fifth graders that previously attended another school that used traditional methodology could bias downward fifth grade scores. The models of Table 8 included a measure of the number of schools attended by students; coefficients were positive for both fifth grade models, apparently rejecting the second explanation. Thirdly, if a New School has not used the methodology for a child's entire primary education, scores more closely resemble those of students educated in traditional schools. Lacking data, this is not controlled for in Table 8. A final explanation for the fifth grade gap is that the New School methodology, especially in mathematics, is less effective in upper grades. Perhaps the methodology of group work is less effective with older students. Or, as some anecdotal evidence collected by the author indicates, the fifth grade guides are less well designed than those of lower grades. These hypotheses cannot be readily answered by available data, but should be a topic of inquiry in future evaluations.

Because the New School coefficient is of primary interest, other results are not reviewed in detail, but some merit highlighting. Significant manipulable determinants of student achievement include electricity access — perhaps a proxy for overall quality of school facilities or community wealth — except in fifth grade mathematics. Attending a school located in

Valle, the department with the highest GDP per capita of the three under study, increases student achievement in the third grade. University education of principals and teachers is either negatively related and significant or insignificant. This could indicate that low teaching salaries relative to those of other careers attract lower quality university attendees to administration and teaching. The coefficient is, therefore, proxying unobserved aspects of teacher quality. A lower student–teacher ratio, as in much of the developed and developing country literature, is generally not a significant determinant of achievement (Fuller and Clarke, 1994). However, this result may be biased by measurement error, given the necessity of estimating the ratio by the total school enrollment divided by the total number of teachers. Among characteristics of families and students, the highest level of education attained in the family is significant, most clearly so in the third grade. Other measurements of family socioeconomic status, such as the presence of a television in the home or electricity access, were generally not significant. They were included nonetheless, given evidence that past production function studies in developing countries have missed key aspects of SES by exclusively concentrating on family education. Student repeaters are lower achievers in every level and subject, while students who hold jobs are significantly lower achievers in the fifth grade.

The second model specification is presented in Table 11. The model adds four variables which represent inputs typically associated with the New School reforms: a measure of textbook availability (although this does not distinguish between the kinds of textbooks available, such as the New School instructional guides), the presence of a library in the school, a variable identifying the frequency of group work in the classroom, and the number of supervisory visits to the school in the past year.[15] The New School dummy variable is left in the model to serve as a proxy for other inputs such as teacher training, community participation, and, perhaps, the motivation that belonging to a novel and exciting program may inspire in students and staff. In third grade Spanish, the textbook variable is positively and significantly associated with achievement; in the fifth grade, coefficients are positive but insignificant. The library coefficient is positive and significant in third grade Spanish, and negative and significant in fifth grade mathematics. The negative coefficient may indicate that the presence of a library shifts teacher emphasis away from mathematics. The number of supervisory visits was not significantly related to achievement. The frequency with which group work was used in the classroom was not significantly related to achievement in either grade. Finding no positive effect is not necessarily an indictment of group work if two requirements are met: (1) its use is not negatively related to student achievement or other unmeasured outputs, and (2) its use in lieu of lecturing gives teachers more time to concentrate on other tasks which bolster other desirable outputs of education. It then represents a gain in the efficiency with which educational inputs are allocated.

As suggested above, the New School coefficient declines slightly in magnitude in third grade regressions as these additional variables are included. It declines and becomes insignificant in fifth grade Spanish and remains unchanged in fifth grade mathematics, while coefficients of family and student variables are quite similar in both models. The result suggests that, in general, New Schools are better endowed with inputs, particularly textbooks, that contribute to student achievement. By leaving these variables out of achievement regressions, the New School dummy variable picks up their effects and, as suggested earlier, acts as an 'overall' measure of program effectiveness.

Governments or communities seeking to cost-effectively replicate the effects of the *Escuela Nueva* program might logically inquire as to which of the many program inputs are key. Perhaps a targeted investment in textbooks, as has often been prescribed by international donors, would allow a cash-strapped entity to focus its resources without investing in superfluous program elements. Likewise, reformers might inquire as to whether it even makes sense to speak of *Escuela Nueva* as a mere collection of discrete 'inputs'. Perhaps only synergies among various aspects of the program encourage the school environment necessary to promote learning. In statistical terms, there may be significant interaction effects among inputs. Naturally, one might expect teacher training to have an effect

Table 11. Spanish and Mathematics achievement as a function of student, family, teacher, and school variables, including selected New School inputs

	Grade 3				Grade 5			
	Spanish		Mathematics		Spanish		Mathematics	
Independent variables	*b*	*t*	*b*	*t*	*b*	*t*	*b*	*t*
School characteristics:								
Student/teacher ratio	0.06	1.05	0.18***	2.73	− 0.06	0.72	0.16*	1.71
Electricity access	4.42***	3.38	6.46***	4.46	4.16**	2.56	2.07	1.11
Located in Valle	3.84	1.05	3.64***	3.14	− 0.25	0.19	1.19	0.77
Located in Cauca	0.79	0.74	0.93	0.79	0.91	0.74	0.28	0.20
(Located in Nariño)								
New School inputs:								
New School	2.62**	2.23	4.50***	3.59	1.86	1.24	0.67	0.35
Library	2.17**	2.09	− 0.92	0.82	− 0.74	0.64	− 2.42*	1.83
Textbook availability	0.87***	2.88	0.98**	2.40	0.16	0.49	0.05	0.14
Frequency of group work	− 0.67	1.38	0.04	0.07	0.72	1.08	0.84	1.36
Supervisory visits/year	0.06	0.14	− 0.56	1.42	0.61	1.22	− 0.59	1.39
Principal characteristics:								
Female	3.31***	3.58	− 1.23	1.38	2.38	1.63	6.76***	4.37
University completed	− 2.19**	2.36	− 3.79***	3.97	0.51	0.51	− 1.51	1.32
Years of administrative experience	0.19***	3.15	0.03	0.42	0.09	1.20	− 0.03	0.36
Teacher characteristics:								
Male	1.84*	1.88	0.29	0.24	0.54	0.40	3.76***	3.08
Years teaching subject	0.04	0.66	− 0.03	0.34	− 0.10	1.07	0.08	0.80
University completed	− 3.84***	2.86	0.30	0.15	0.00	0.00	− 1.61	1.04
Monthly salary/1000	0.03***	3.31	0.04***	2.61	0.01	0.47	0.02	2.00
Hours subject taught/week	− 0.88***	2.84	− 1.09***	2.95	0.63	1.59	2.07***	4.57
Family characteristics:								
Family member is university graduate	1.84	1.63	1.69	1.39	0.37	0.21	0.26	0.17
Family member is secondary graduate	3.46***	3.52	3.06***	3.13	0.77	0.54	− 0.54	0.39
Family member is primary graduate	3.15***	3.68	2.70***	2.97	0.27	0.22	1.20	0.93
(None of the above)								
Electricity access	− 1.58	1.31	− 0.91	− 0.79	− 2.47	1.57	− 1.28	0.76
TV in home	0.50	0.53	1.24	1.45	2.27**	2.29	1.09	0.91
Student characteristics:								
Female	0.64	0.93	0.14	0.20	− 0.87	0.98	− 1.58*	1.86
Age	0.38	1.45	0.96***	3.34	− 0.20	0.58	− 0.28	0.79
Works	− 1.00	1.38	− 0.11	0.15	− 2.90***	3.25	− 2.96***	3.37
Repeated at least 1 grade	− 2.94***	3.87	− 3.38***	4.55	− 2.02**	2.32	− 2.16**	2.56
≥ 6 absences this year	− 2.07**	2.13	− 0.76	0.68	− 1.14	0.78	− 0.46	0.36
≥ 1 hour TV/day	1.66**	2.22	− 0.28	0.38	0.79	0.85	0.14	0.15
> 1 school attended	− 1.47*	1.84	0.03	0.03	1.68*	1.76	0.66	0.73
≥ 1 hour homework/day	0.70	0.97	1.69**	2.33	1.26	1.49	1.41	1.55
Constant	35.77		29.56		41.74		28.97	
Adjusted R^2	0.23		0.22		0.07		0.16	
N	673		673		557		520	

Statistically significant at: ***1 percent; **5 percent; *10 percent.
Column *b* is the OLS coefficient and *t* is the absolute value of the *t*-statistic. All hypothesis tests are two-tailed. Standard errors are calculated with White's heteroskedasticity-consistent covariance matrix (White, 1980).

on achievement, *ceteris paribus*; but in the presence of, say, an appropriate textbook, training's effects may well be multiplied.

The previous analysis made some attempt to separate the effects of various aspects of the program. Even after controlling for the presence of textbooks and the library, for example, *Escuela Nueva* students still had higher levels of achievement, suggesting that many other elements, both measurable and unmeasurable, also contribute to program effectiveness. Other empirical strategies might be imagined to examine these relationships. If detailed data were available on specific program inputs (such as the functioning of a student government, the number and quality of training courses given to teachers, or other elements described in Section 3), a New School implementation index could be constructed.[16] Though it would be empirically problematic to define such an index, its inclusion could be used to better reflect the complex series of interactions among program inputs. It may enter non-linearly, for example, suggesting that student achievement in a school attaining a 10 on the scale may be more than twice as great as in a school scoring a five, precisely because the program taken as a whole is greater than the sum of its various inputs. Unfortunately, such data were not available to the author. As a less satisfactory alternative, the New School dummy variable was interacted with program inputs such as textbooks and the library, under the hypothesis that such inputs might be relatively more effective in the environment of New Schools. When interaction terms were added, regression coefficients of the New School variable became unrealistically large, suggestive of multicollinearity among variables which was confirmed by subsequent analyses. These results are not reported, though they are available from the author.

CONCLUSIONS

New Schools are relatively better endowed with certain inputs like libraries and textbooks in relation to traditional rural schools. Nonetheless, many schools lack all the necessary elements of the program package: less than half use the official textbooks and one-third do not have libraries. Suggested elements such as the student council and the agricultural calendar are often missing. Measures of community involvement point to this as an area of success for New Schools. Despite the lack of instructional guides in many schools, teachers belonging to the program do seem to alter their teaching practices in accordance with the program design.

Achievement levels, especially in the third grade, are increased in New Schools, but the gap narrows considerably in the fifth grade. This finding is consistent with previous evaluations using different data. The decline at the fifth grade level is likely the result of either better retention of low-achieving students in New Schools or the declining effectiveness of upper grade education. Though this analysis suggests the former is important, the latter should be examined if data become available. Evidence from this and previous evaluations suggests that, overall, the New School program has important effects on raising student achievement in Spanish and mathematics. This is impressive in light of evidence that not all schools have been endowed with the necessary program inputs. It suggests that the New School program may be deserving of its reputation as a good practice for rural education in developing countries. And though historical accident has labeled multigrade schooling as a rural program, the application of the New School methodology to urban schools might also be fruitfully explored.

Nonetheless, this conclusion begs important questions: which sub-components of the program are relatively more or less effective? Might some be eliminated in order to maximize program effectiveness and minimize costs? Limited evidence suggested that particular elements of the program, such as textbooks and the library, do not entirely explain student achievement. Other elements, captured in the New School dummy variable, continue to have important effects. Despite a lack of evidence, it was suggested that a systematic application of the program's 'package' may yield significant interaction effects, in which one input catalyzes another. Thus, it may make more sense to approach the New School program as an example of holistic, qualitative change, rather than interchangeable applications of discrete, physical inputs. Additional research should be directed at understanding the process of such change at the classroom level.

NOTES

1. The author gratefully acknowledges the assistance of the Instituto SER de Investigación in obtaining the data. Thanks are due to Luis Benveniste, Henry Levin, Carlos Rojas, Julie Schaffner, and two anonymous referees for their useful comments.
2. See Colbert *et al*. (1993) and Schiefelbein (1992) for a short history of the program's implementation.
3. Years of attendance, especially in rural areas, are higher due to high rates of repeating.
4. The department is the administrative unit of organization in Colombia.
5. For a general description of primary education in Colombia, see Colbert *et al*. (1993: 53) and McGinn and Loera (1992).
6. See, for example, Pratt (1986); Miller (1990, 1991); Lodish (1993); Surbeck (1992). In developing countries, see the reviews of Bray (1987); Thomas and Shaw (1992); Hayes (1993).
7. This section draws on the work of Colbert (1987), Colbert and Mogollón (1987); Colbert *et al*. (1993); Schiefelbein (1992).
8. A recreational guide is given to teachers (Hernandez, 1986).
9. See Colbert and Mogollón (1987).
10. Surveys in 1991 and 1993, covering most Columbian departments, were conducted in A calendar primary schools.
11. Rojas and Castillo (1988) find that 94 percent of New Schools in their sample had libraries, consistent with the conjecture that their sample is more representative of the ideally implemented New School.
12. The information provided is self-reported by the teacher, rather than gathered from classroom observations. Thus, there is some possibility that teachers in New Schools are simply reporting what techniques they 'should' be using according to New School prescriptions.
13. This observation is corroborated in several qualitative studies of classrooms summarized in Aristizabal (1991)
14. Both studies used as dependent variables achievement test scores standardized to a mean of 50 and a standard deviation of 10.
15. Exact definitions of these and other variables are given in the Appendix.
16. This was suggested by an anonymous referee.

REFERENCES

Aristizabal, A. (1991) Análisis de las evaluaciones realizadas sobre el programa Escuela Nueva. Preliminary report, UNICEF. Mimeo.

Bray, M. (1987) *Are Small Schools the Answer? Cost-Effective Strategies for Rural School Provision.* The Commonwealth Secretariat, London.

Colbert, V. (1987) Universalización de la Primaria en Colombia. In *La Educación Rural en Colombia: Situación, Experiencias y Perspectivas.* Editorial Fundación para la Educación Superior, Bogotá.

Colbert, V. and Mogollón, O. (1987) *Hacia la Escuela Nueva: Unidades de Capacitación para el Maestro.* Editorial Ministerio de Educación Nacional, Bogotá.

Colbert, V., Chiappe, C. and Arboleda, J. (1993) The New School program: more and better primary education for children in rural areas of Colombia. In *Effective Schools in Developing Countries*, eds. H. M. Levin and M. E. Lockheed, pp. 52–68. Falmer Press, London.

Colombia, Departamento Administrativo Nacional de Estadística (1993) *Las Estadísticas Sociales en Colombia*. Departamento Administrativo Nacional de Estadística, Bogotá.

Colombia, Ministerio de Educación Nacional (1993) *Primeros Resultados: Matemáticas y Lenguaje en la Básica Primaria*. Coleción Documentos del Saber. Ministerio de Educación Nacional, Bogotá.

Fuller, B. and Clarke, P. (1994) Raising school effects while ignoring culture? Local conditions and the influence of classroom tools, rules, and pedagogy. *Review of Educational Research* **64**(1), 119–157.

Hayes, K. (1993) Effective multigrade schools: a review of the literature. Working papers, No. 2, Education and Human Resources Division. Bureau for Latin America and the Caribbean, US Agency for International Development. Academy for Educational Development, Washington, DC.

Hernandez, J. A. (1986) *Manual de Recreación*. Ediciones Programa Escuela Nueva, Bogotá.

Instituto SER de Investigación (1993) *Sistema Nacional de Evaluación de la Calidad de la Educación: Calendario B.* Instituto SER de Investigación, Bogotá.

Lockheed, M. E. and Verspoor, A. M. (1991) *Improving Primary Education in Developing Countries.* Oxford University Press, Oxford.

Lodish, R. (1993) The pros and cons of mixed-age grouping. In *The Multiage Classroom: A Collection*, ed. R. Fogarty. IRI/Skylight, Palatine, IL.

McGinn, N. (1996) Requirements for capacity building: *Escuela Nueva* in Colombia. Mimeo.

McGinn, N. and Loera, A. (1992) *La Repitencia en la Escuela Básica Primaria Oficial Colombiana*. Study conducted for the Colombian Ministry of National Education. Mimeo.

Miller, B. (1990) A review of the quantitative research on multigrade instruction. *Research in Rural Education* **7**(1), 1–8.

Miller, B. (1991) A review of the qualitative research on multigrade instruction. *Research in Rural Education* **7**(2), 3–12.

Molina, C. G., Alviar, M. and Polania, D. (1993) *El Gasto Público en Educación y Distribución de Subsidios en Colombia*. Fedesarrollo, Bogotá.

Pratt, D. (1986) On the merits of multiage classrooms. *Research in Rural Education* **3**(3), 111–116.

Psacharopoulos, G., Rojas, C. and Velez, E. (1993) Achievement evaluation of Colombia's Escuela Nueva: is multigrade the answer?. *Comparative Education Review* **37**(3), 263–276.

Rojas, C. and Castillo, Z. (1988) *Evaluación del Programa Escuela Nueva*, IFT-133. Instituto SER de Investigación, Bogotá.

Schiefelbein, E. (1992) *Redefining Basic Education for Latin America: Lessons to Be Learned from the Colombian Escuela Nueva*. UNESCO, Paris.

Stone, S. (1995) Strategies for teaching children in multiage classrooms. *Childhood Education* **71**(2), 102–105.
Surbeck, E. (1992) Multi-age programs in primary grades: are they educationally appropriate?. *Childhood Education* **69**(1), 3–4.
Thomas, C. and Shaw, C. (1992) Issues in the development of multigrade schools. World Bank Technical Paper Number 172. World Bank, Washington, DC.
White, H. (1980) A heteroskedasticity-consistent covariance matrix and a direct test for heteroskedasticity. *Econometrica* **48**, 817–838.
World Bank (1995) *Priorities and Strategies for Education: A World Bank Review*. World Bank, Washington, DC.

APPENDIX A

Description of variables

SCHOOL CHARACTERISTICS

New School: 1 if belongs to New School program, 0 if traditional school.
Library: 1 if school has library, 0 if not.
Textbook availability: 0 (no textbooks in class) to 4 (all students have texts).
Frequency of group work: 1 (used less than once a week) to 4 (used almost every day).
Number of supervisory visits: Number of times a supervisor visited the school last year.
Student/teacher ratio: ratio of total primary school students to total primary school teachers, full or part time.
Electricity access: 1 if school has electricity, 0 if not.
Located in Valle: 1 if the school is located in the department of Valle, 0 if not.
Located in Cauca: 1 if the school is located in the department of Cauca, 0 if not. The third department, Nariño, is the reference category.

PRINCIPAL CHARACTERISTICS

Female: 1 if principal is female, 0 if principal is male.
University completed: 1 if principal has completed university degree or higher, 0 if not.
Years of administrative experience: years of experience as a school principal.

TEACHER CHARACTERISTICS

Male: 1 if teacher is male, 0 if teacher is female.
Years teaching subject: years of experience teaching mathematics or Spanish.
University completed: 1 if teacher has completed university degree or higher, 0 if not.
Lives in school: 1 if the teacher lives on the school premises, 0 if the teacher elsewhere.
Monthly salary/1000: Monthly salary in 1992 pesos, divided by 1000.
Hours subject taught per week: Hours that mathematics or Spanish is taught per week.

FAMILY CHARACTERISTICS

Family member is university graduate: 1 if at least one family member is a university graduate, 0 if not.
Family member is secondary graduate: 1 if at least one family member is a secondary school graduate, 0 if not.
Family member is primary graduate: 1 if at least one family member is a primary school graduate, 0 if not. The reference category is less than primary graduation.
Electricity access: 1 if the family home has access to electricity, 0 if not.
TV in home: 1 if a television is in the family home, 0 if not.

STUDENT CHARACTERISTICS

Female: 1 if student is female, 0 is student is male.
Age.
Works: 1 if student does some sort of paid work, 0 if not.
Repeated at least 1 grade: 1 if student has repeated at least one grade in primary school, 0 if not.

$\geq$ 6 absences this year: 1 if student has been absent 6 or more times during the year, 0 if absent from 0 to 5 times.

$\geq$ 1 hour TV/day: 1 if student watches 1 or more hours of television per day, 0 if student watches less than 1.

$>$ 1 school attended: 1 if student has previously attended schools other than the current one, 0 if not.

$\geq$ 1 hour homework/day: 1 if student does 1 or more hours of homework per day, 0 if not.