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COST EFFECTIVENESS STUDY OF NUEVA ESCUELA UNITARIA (NEU) AND INTERCULTURAL BILINGUAL EDUCATION (DIGEBI)

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EXECUTIVE SUMMARY

A Introduction

A primary focus of the Basic Education Strengthening (BEST) project in Guatemala has been the development of low cost innovative educational reforms for the classroom A multigrade classroom pilot activity (*Nueva Escuela Unitaria*), based on active learning principles has targeted the rural dispersed population which has been difficult to reach with full primary education services The bilingual education program (DIGEBI) has targeted the Mayan-speaking population which has traditionally been delayed in its educational progress because of inability to understand Spanish, the language of instruction in primary schools This document summarizes the final results of a cost-effectiveness study of these two classroom interventions

B Method

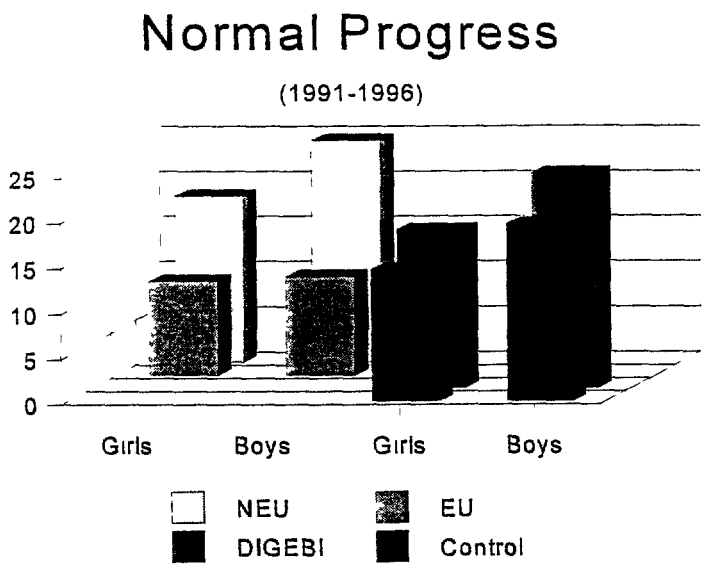
The study used Ministry of Education statistics on per- student costs over the six-year period that the two innovations have been supported by the BEST project These data were augmented by the per-student costs for operating the programs throughout the project The research and development costs of the innovative programs were also considered All schools for which data were available in the *Nueva Escuela Unitaria* (NEU) program and all complete schools in the National Bilingual Intercultural Education (DIGEBI) program are included in the analysis

The indicators of cost-effectiveness were the percentage of children in the base year (1991) who progressed normally through primary education and the average cost per student to produce a sixth-grade graduate in 1996 The cumulative costs per student for all years were divided by the number of students in sixth grade in 1996 These costs were compared to those for a population of children in similar rural schools operating in the same Departments as the two programs

C Major Findings

NEU and DIGEBI have been more efficient than similar schools without the innovative programs

Both NEU and DIGEBI schools had higher percentages of children making normal progress through the primary grades than comparison groups In both cases, the innovative programs had higher percentages of first graders who were enrolled in second grade than the comparison schools and in each case this translated into higher percentages of children in sixth grade As can be seen in Exhibit A, the differences favoring NEU children in sixth grade were 13 4% for boys and 7 9% for girls For DIGEBI these differences were 4 2% for boys and 2 9% for girls



NEU and DIGEBI were more cost-effective than similar schools without the innovative programs

The greater efficiency of the two innovative programs resulted in a lower per-student cost for each child who made normal progress to sixth grade This occurred despite the additional operating costs that totaled Q239 64 for NEU and 22 94 for DIGEBI for each student each year Even when research and development costs, which will in reality be spread over a much longer time frame than the six years included in this study, were included, the innovative programs were cost effective for male students

There is a "gender effect" in Guatemalan primary schools that has not been overcome by the BEST project classroom innovations

In Guatemalan schools in general relatively fewer girls make normal progress through the primary grades than their male counterparts Although both NEU and DIGEBI were successful in increasing the normal progress of girls when compared to female students not participating in the programs, their progress did not match that of the male classmates nor of rural male students in general

B Recommendations

Continue to monitor the efficiency and cost-effectiveness of NEU and DIGEBI

This study only encompassed the six years for which consistent national statistics were available As the Ministry of Education MIS now routinely produces national statistics the success of both innovative programs in relation to appropriate comparison groups should be continued This is especially important with NEU which has dramatically improved efficiency in a relatively short time As the program is now in place it is likely that costs will go down and efficiency will continue to improve

Increase emphasis on the importance of girls' schooling

Both DIGEBI and NEU have integrated girls' education to some degree into their programs Given the different success rates of boys and girls in the innovative programs, these efforts should be continued Efforts to promote girls' should also be expanded to the entire rural primary school population, given the lower success rates and higher cost of producing a female sixth grader

Conduct targeted cohort studies to determine the characteristics and experiences of children making normal progress compared to those who do not

This study was a quasi-cohort study in that groups rather than individuals were followed over a six year period Small cohort studies involving individual students should be initiated to determine those aspects of children's successful experience that can be replicated

Utilize the Ministry MIS to conduct cost studies for policy decisions

As reliable historical data exist for a six-year period studies of cost-effectiveness for the system as a whole can be conducted These would include urban rural comparisons and the cost to the national of drop-out and repetition

I INTRODUCTION

This document presents the final results of a cost-effectiveness study of the two principal classroom interventions supported by the USAID Basic Education Strengthening (BEST) project The study uses Ministry of Education statistics on per student costs over the six year period that the two innovations have been supported by the BEST project This is augmented by the per student costs for operating the pilot programs throughout the project The research and development costs of the innovative programs are also considered All schools for which data were available in the *Nueva Escuela Unitaria* (NEU) program and all complete schools in the National Bilingual Intercultural Education (DIGEBI) program are included in the analysis These schools are compared to the population of similar rural schools operating in the same Departments as the two programs The study was carried out by members of the Academy for Educational Development (AED) technical assistance team for the BEST project as part of the regular evaluation and monitoring activities for the project

A BACKGROUND

The primary focus of the Guatemala BEST project has been to improve the efficiency, coverage, and quality of basic education services to underserved populations By focusing on populations that have traditionally had less access to primary education and less success in primary schools, the project has also addressed issues of equity The activities of the BEST project were undertaken in close collaboration with other donor agencies to maximize the impact of project activities The target populations for BEST project activities have been Mayan-speaking indigenous people, isolated rural populations, and girls, especially those in Mayan areas

The project focused on the development of low cost innovative educational reforms and on strengthening the Ministry of Education's ability to manage the education system Under classroom innovations, the multigrade classroom activity (*Nueva Escuela Unitaria*), based on active learning principles, targeted the rural dispersed population, which has been difficult to reach with full primary education services The bilingual education program targeted the Mayan-speaking population which has traditionally been delayed in its educational progress because of inability to understand Spanish, the language of instruction in primary schools In addition a girls' education program supported by BEST developed activities aimed at improving the ability of the education system to keep girls in school, ensuring their advancement through the primary education system, and increasing their achievement Owing to the shorter duration of the girls program, the results are reported elsewhere (see Chesterfield and Rubio 1997)

The combined effect of these programs has been to address the needs of a widespread target population in rural Guatemala The technical innovations were to be cost-effective when fully developed, they were designed to teach children how to learn, and to help children to complete school on time Community participation and the involvement of local organizations formed an important part of each activity Each program included building coalitions for increasing participation in basic education

The NEU and DIGEBI innovations are designed to change the learning environment of the school to improve quality As the success of the programs in meeting their classroom objectives is discussed elsewhere (see Chesterfield and Rubio 1996 and Rubio 1996), this study focuses is on the effects of such changes in terms of the programs' efficiency in assisting children to advance to a new grade each year In order to examine equity, the other objective of the BEST project, the student population of each intervention has been separated by gender

The following pages discuss the procedures used to carry out the analysis Subsequent chapters present the findings of the cost effectiveness study by program and gender and draw conclusions and recommendations based on these findings

B METHOD

1 Indicators

The indicators of cost-effectiveness were the percentage of children in the base year (1991) who have progressed normally through primary education and the average cost per student to produce a sixth-grade graduate in 1996 The indices of normal progress and the average cost to produce a sixth-grade graduate in each intervention were contrasted with the same indices for appropriate comparison groups

2 Procedures

Cost Per Student The annual planned budgets were used for the study, as this information was available in the statistical yearbooks published each year by the Ministry of Education Figures on executed budgets were not available Initial enrollment by gender and by area (rural/urban) of the official or public sector by year as published in the statistical yearbook was used The following steps were taken

1) The yearly budget for children's primary education was taken from the statistical yearbook In order to determine the total budget for rural primary education, the budgets for rural primary education and rural bilingual education were added together

2) The Ministry of Education s administrative budget was taken from the statistical yearbook To calculate the amount allocated for administration by area, this budget was multiplied by the percentage of the budget for primarv education allocated to each area

3) The budget for investment and other budget items were not included

4) The number of children in the official sector was calculated by gender and bv area for each year In the absence of data by sector for 1991 the percentage of students in the official sector in urban and rural areas in 1992 was used to estimate the number of students in the official sector in 1991 in each area

5) To calculate the cost per child by area the total Quetzales allocated by area each year was divided by the total number of students in each area For the national figure, the respective national values were used

6) Finally, the average cost for six years was calculated to obtain the sole annual cost which was applied to each year

Program Costs For NEU and DIGEBI, all of the costs incurred by year for all items, except technical assistance, were included Technical assistance was not included as the work of such individuals generally extended to schools and children bevond a specific program and did not necessarily take place on a yearly basis The costs technical assistance were estimated by totaling the number of children in schools influenced bv the technical assistance effort and dividing this number by the total cost of technical assistance for each program

The total costs obtained for all years, less technical assistance was divided by the total number of children served during this period In the case of NEU, this total included the children served in NEU schools during the pilot phase of the program and the total number of children served in NEU schools in the consolidation phase For DIGEBI, it includes all of the children in the primary grades of the complete schools served by DIGEBI Although DIGEBI has an extensive pre-primary program, these children were not included for consistency with the comparison group

All program costs were charged exclusively to the programs That is, the costs of developing, validating, and printing materials or training packages was charged to the programs, even when such materials or training were used outside the programs or had been produced for use in future years

As with the national statistics, the cost per child in each year was calculated This was added to the average cost per child in rural schools in general to create a cost per child by program No adjustments to the value of the Quetzal due to changes in the cost of living were made

Cost Effectiveness Lists of program schools, as reported by the programs were used to determine the universe From these lists all those schools which had reported data to the Ministry's MIS from 1991 to 1996 were selected A school may not appear in the MIS for distinct reasons Among these reasons are a school did not exist in 1991 but rather began to function later, a school existed but was not officially registered, a school did not have a teacher for one or more years and the teacher(s) or supervisor did not turn in reports in one or more years

Nineteen ninety-one was taken as a base year For each year an indicator of effectiveness was estimated using the following formula

$$I\,E = \text{Students by grade}_{I} \text{ in Year}_{I} / \text{Year}_{b}$$

where

I E = Indicator of effectiveness

Students by grade $_I$ in Year $_I$ $_I$ = total students in the respective grade in each subsequent year

Year $_b$ = Total number of students in the base year

The I E used corresponds to 6th grade in 1996 The number of students in each grade for each respective year was multiplied by the estimated cost per child This amount was then totaled for each of the six years of the study This quantity was divided by the total number of students in sixth grade This provided the cost of one sixth grade graduate in six years

3 Operational Definitions

Normal progress= The percentage of students in a given cohort who are found in the next grade in the subsequent year

Cost per sixth-grade enrollee= The total number of students in a cohort enrolled in the next grade over a six-year period, multiplied by the average cost of operation for the students, divided by the number of students in sixth grade Sixth grade enrollees were used as data for 1996 graduation rates were not available As 1995 sixth grade graduation rates were uniformly high (93%) across the educational system, enrollees were considered an adequate proxy indicator

Cost of operation= Average cost per rural student which has been reported during the years under study (The sum of the costs for rural bilingual education and rural primary education divided bv the total number of students enrolled in these two sectors)

System costs= The operational costs plus administrative costs during the vears studied

Program costs= Operational costs plus the donation over the life of the project minus the cost of technical assistance

Enrollment= Total number of students reported in a given grade in a given year (taking into account the cost of grade repetition)

C Assumptions

As it was impossible to track individual children owing to cost considerations several assumptions are built into the analysis They are

The groups of children advancing in grade are made up largely of children who were promoted and are continuing in school rather than children who have dropped out and are returning to school or who are repeating a grade This seems to be a valid assumption given the consistency of promotion reported by teachers in other BEST studies with subsequent year enrollment rates used in this study

The rate of grade repetition is similar throughout the rural education system and across programs Again, previous studies suggest that this is a valid assumption It should be recognized, however, that by including repeaters in the analyses, normal progress rates for sixth grade graduates are somewhat inflated in all programs

II FINDINGS

A Nueva Escuela Unitaria

As mentioned the percentage of children in each program who began first grade in 1991 and enrolled in the next higher grade each year until completing primary school in 1996 was used for the analysis Table 1 illustrates this indicator of normal progress for girls and boys in the NEU and comparison group As can be seen, in the crucial first year when the greatest loss of students takes place, NEU had a greater percentage of children enrolled in second grade in 1992 than did similar unitary schools (*escuelas unitarias*) not implementing the NEU program

This initial advantage in efficiency was maintained and both boys and girls in NEU had significantly higher percentages of children who made normal progress through primary school than the comparison group The normal progress indices of 18 3% and 24 5% compare favorably with those for all Guatemalan rural primary schools which are 17 9% and 21 9% respectively It must be pointed out, however, that over three-fourths of the boys and above 80% of the girls do not make normal progress through rural primary schools in Guatemala

Table 1 NEU Normal Progress Rates for First and Sixth Grade by Gender

Gender/ Promotion Rate	GIRLS		BOYS	
	NEU	EU	NEU	EU
Percent of First Grade Cohort in Second in 1992	58%	53 2%	66 3%	51 9%
In Sixth Grade in 1996	18 3%	10 4%	24 5%	10 9%

As can be seen from Tables 2 and 3 the greater efficiency of the NEU program is translated into lower costs on the indicator of normal progress through sixth grade The cost of a male student reaching sixth grade in six years is almost 2000 Quetzales less (Q1807) than that for traditional unitary schools As the NEU program was less successful in assisting girls to make normal progress through primary school, the cost efficiency is less dramatic for female students However, the NEU program still results in a savings of Q666 for girls reaching sixth grade in six years over traditional one-room school programs The cost saving for the NEU program, as a whole, is Q1379 25

Table 2 Cost Effectiveness of the Nueva Escuela Unitaria

Year	Grade	Total*	NEU Girls	NEU Boys
1991	1st Grade	Q581 340 46	Q263,036 82	Q318 303 64
1992	2nd Grade	Q573 282 50	Q240 451 06	Q332 831 44
1993	3rd Grade	Q415 384 12	Q209 002 42	Q206 381 70
1994	4th Grade	Q286 968 84	Q110 070 24	Q176 898 60
1995	5th Grade	Q220,140 48	Q 78,621 60	Q141,518 88
1996	6th Grade	Q199 174 72	Q 76,000 88	Q123 173 84
Cost per 6th Grade Graduate		Q7 487 80	Q8,423 99	Q6 910 15

*Cost per NEU Student = Q655 18 (Q415 54 + Q239 64)

Table 3 Cost Effectiveness of the Escuela Unitaria

Year	Grade	Total*	EU Girls	EU Boys
1991	1st Grade	Q1 908,575 22	Q819,029 34	Q1,089,545 88
1992	2nd Grade	Q1 001,866 94	Q435,901 46	Q 565,965 48
1993	3rd Grade	Q 628,296 48	Q272,178 70	Q 356,117 78
1994	4th Grade	Q 364,013 04	Q147,516 70	Q 216 496 34
1995	5th Grade	Q 249 739 54	Q103,469 46	Q 146,270 08
1996	6th Grade	Q 204 030 14	Q 85,185 70	Q 118,844 44
Cost per 6th Grade Graduate		Q8 872 75	Q9,089 18	Q8 717 62

*Cost per student = 415 54

It is difficult to estimate the research and development costs of pilot programs While the costs in terms of international development projects are those of technical assistance, and can be measured easily The scope of a technical assistance effort is generally broader than only the schools in a given pilot program The NEU technical assistance providers, for example, worked with programs having a total of 1203 schools, in addition to the 200 schools in the NEU program The materials developed with technical assistance have been used in many of these schools and will be

used for three to five years in the future by cohorts of children not included in this analysis

In order to examine the cost-effectiveness of the NEU program with research and development costs, the total cost of NEU technical assistance (Q9,426,948 or slightly more than 1 5 million dollars) was divided by the total number of children in schools influenced by the technical assistance effort (48 120) This resulted in a cost per student of Q163 The cost effectiveness data were then reanalyzed adding this additional cost to the cohort of students This resulted in costs of Q8345 27 for male sixth graders who made normal progress in NEU The cost for female students was Q9961 45 Thus even when all research and development cost were ascribed to a single cohort of NEU students the program was more cost-effective for male students than for students in similar schools without the NEU program As girls were less successful than boys in making normal progress to sixth grade they did not overcome all of the research and development costs and had costs Q872 higher than comparison girls The overall NEU program cost was less than one hundred Quetzales higher than the comparison group (Q8961 97 versus Q8877 83)

B DIGEBI

As shown in Table 4, DIGEBI had higher percentages of the 1991 cohort of first graders enrolled in school than did similar schools operating in the same areas of the country Over five percent more of the 1991 female first graders were in second grade in 1992 than in the comparison group For boys, the figure was over 7%

While DIGEBI boys and girls both continued to have higher percentages of the 1991 cohorts enrolled in sixth grade, the advantage diminished to 4 2% and 2 9%, respectively This suggests that the first year of bilingual education is especially important for indigenous children The normal progress indices of 17 5% and 23 8% are slightly below that of 17 9% for all girls in Guatemalan rural primary schools and somewhat above that of 21 9% for boys

Table 4 DIGEBI Normal Progress Rates for First and Sixth Grade by Gender

Gender/ Promotion Rate	GIRLS		BOYS	
	DIGEBI	Comparison	DIGEBI	Comparison
Percent of First Grade Cohort in Second in 1992	68 4%	63%	75 5%	68 3%
In Sixth Grade in 1996	17 5%	14 6%	23 8%	19 6%

As shown in Tables 5 and 6, DIGEBI was more cost effective than the comparison group in terms of children reaching sixth grade in six years A male DIGEBI student costs Q620 28 less than a male sixth grader who makes normal progress in the comparison group Girls are Q317 18 less costly and costs for the program as a whole are Q513 68 less The additional operating for DIGEBI are much less than those of NEU both because of the greater size of the program which distributes the costs over more students and the longer lifespan of the bilingual education program As DIGEBI started prior to 1991 it did not have the start-up costs associated with NEU which was a new intervention

Table 5 Cost Effectiveness of the DIGEBI Program

Year	Grade	Total*	DIGEBI Girls	DIGEBI Boys
1991	1st Grade	Q4 394,885 04	Q1 983 683 52	Q2 411 201 52
1992	2nd Grade	Q3 177 664 56	Q1,356 218 64	Q1 821,445 92
1993	3rd Grade	Q2,368,230 48	Q 959 394 24	Q1,408,836 24
1994	4th Grade	Q1 709 633 52	Q 646,758 00	Q1 062 875 52
1995	5th Grade	Q1 227,744 00	Q 453,826 80	Q 773,917 20
1996	6th Grade	Q 921,246 48	Q 346,399 20	Q 574,847 28
Cost per 6th Grade Graduate		Q6,568 02	Q7 273 77	Q6 142 73

*Cost per DIGEBI student = Q438 48 (Q415 54 = Q22 94)

Table 6 Cost Effectiveness of the DIGEBI Comparison Schools

Year	Grade	Total*	Girls	Boys
1991	1st Grade	Q53 359 906 94	Q24 343 995 36	Q29 015 911 58
1992	2nd Grade	Q35 931 743 80	Q15 088 257 40	Q20 843 486 40
1993	3rd Grade	Q28 095 074 94	Q 9 741 088 68	Q18 353 986 26
1994	4th Grade	Q17 000 572 48	Q 6 782 028 34	Q10 218 544 14
1995	5th Grade	Q11 901,481 14	Q 4 655 294 62	Q 7 246,186 52
1996	6th Grade	Q 9,119 025 30	Q 3 510 066 38	Q 5 608 958 92
Cost per 6th Grade Graduate		Q7 081 70	Q7 590 95	Q6 763 01

*Cost per student = Q415 54

When research and development costs were included in the cost effectiveness analysis, the same pattern as that of NEU was found Although the cost-effectiveness analysis was limited to children in DIGEBI complete schools where normal progress could be tracked, DIGEBI also supports preschool programs and schools in which the program only operates at the early grades Obviously these children benefit from materials and training developed with technical assistance As the total number of students participating in DIGEBI is estimated at between 150,000 and 200,000, the conservative estimate, which would result in higher per student costs was used Technical assistance costs totaled Q5,910,462 ($985 077) over the life of the BEST project Applying these costs to the 150,000 students in the program results in a cost per student of Q39 40 This quantity was added to the cost-effectiveness analysis giving a cost per sixth grader of Q6703 15 for boys and Q7910 69 for girls Thus, as in NEU, boys costs are below those of the comparison group, although only by about Q60 Girls, on the other hand, are Q320 above the comparison group Overall program costs for children reaching sixth grade in six years are Q7910 69, or about Q77 more than the comparison group

III CONCLUSIONS AND RECOMMENDATIONS

A Conclusions

NEU and DIGEBI have been more efficient than similar schools without the innovative programs

Both NEU and DIGEBI schools had higher percentages of children making normal progress through the primary grades than comparison groups In both cases the innovative programs had higher percentages of first graders who were enrolled in second grade than the comparison schools and in each case this translated into higher percentages of children in sixth grade The differences favoring NEU children in sixth grade were 13 4% for boys and 7 9% for girls For DIGEBI, these differences were 4 2% for boys and 2 9% for girls

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There is what might be called a "gender effect" in Guatemalan primary schools that has not been overcome by the BEST project classroom innovations

In Guatemalan schools in general, relatively fewer girls make normal progress through the primary grades than their male counterparts Although both NEU and DIGEBI were successful in increasing the normal progress of girls when compared to female students not participating in the programs, their progress did not match that of the male classmates nor of rural male students in general

B Recommendations

Continue to monitor the efficiency and cost-effectiveness of NEU and DIGEBI

This study could only encompass the six years for which consistent national statistics are available As the Ministry of Education MIS now routinely produces national statistics the success of both innovative programs in relation to appropriate comparison groups should be continued This is especially important with NEU which has dramatically improved efficiency in a relatively short

time As the program is now in place it is likely that costs will go down and efficiency will continue to improve

Increase emphasis on the importance of girls' schooling

Both DIGEBI and NEU have integrated girls' education to some degree into their programs Given the different success rates of boys and girls in the innovative programs, these efforts should be increased Efforts to promote girls' should also be expanded to the entire rural primary school population

Conduct targeted cohort studies to determine the characteristics and experiences of children making normal progress compared to those who do not

This study was a quasi-cohort study in that groups rather than individuals were followed over a six year period Small cohort studies involving individual students should be initiated to determine those aspects of children's successful experience that can be replicated

Utilize the Ministry MIS to conduct cost studies for policy decisions

As reliable historical data exist for a six year period studies of cost-effectiveness for the system as a whole can be conducted These would include urban rural comparisons and the cost to the national of drop-out and repetition