THE MEXICAN TELESECUNDARIA:
A COST-EFFECTIVENESS ANALYSIS

by

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1. BACKGROUND TO THE STUDY

Characteristics of the Telesecundaria System

Faced with a growing school-age population and a rising demand for education at all levels, the Mexican government has turned to new educational technologies, mainly radio and television, to supplement its traditional school system. The Telesecundaria is the largest and most important undertaking of this kind in Mexico today. It uses television to provide a full, three-year secondary education to students who, for a wide variety of reasons, would not otherwise have access to schooling beyond the 6th grade.

In 1965, the number of primary school graduates unable to enter secondary school in Mexico was over 180,000, or about 37 percent of the previous year's 6th graders. This was particularly true in rural areas where primary schools are small and secondary schools are, for the most part, non-existent and economically unfeasible. For these reasons, the Telesecundaria (hereafter, TS) system was started.

After an encouraging pilot experiment, TS open broadcasting began in 1968 for the Federal District and for the seven states of Hidalgo, Mexico, Morelos, Oaxaca, Puebla, Tlaxcala, and Veracruz. Table 1 shows the rapid growth of the system.

TABLE 1

Student Enrollment in Telesecundaria

	1968	1969	1970	1971	1972
7th grade	6,569	10,916	12,175	14,499	12,432
8th grade		5,324	8,240	9,459	9,194
9th grade			5,473	6,997	7.350
TOTALS	6,569	16,240	25,888	30,955	28,976

SOURCE: Direccion General de Educacion Audiovisual y Divulgacion (DGEAD)

Unlike most other educational TV systems of the last decade, the Mexican TS aims to complement rather than reform or replace the traditional secondary schools. Its basic purpose continues to be the extension of secondary education to young people who have previously been denied such an opportunity. TS students have equal official status with the traditional students in admission and accreditation.

However, while retaining the traditional Mexican curriculum and educational goals, TS uses a mix of national and community resources. In place of large, federally-financed school buildings, TS classes meet in space provided by the local communities. The local communities often have a local patronato or parent organizations to provide for the needs of housing and equipment. Instead of fully-accredited and specialized teachers, the TS uses classroom coordinators to oversee instruction in all subjects. These coordinators are drawn from the ranks of 5th and 6th grade teachers and are paid by the federal government. They are provided with some special training in the use of television, along with a monthly outline and schedule of the telelessons. Student workbooks for the tele-

classes are prepared by the DGEAD and sold at low cost through commercial bookstores.

In a typical week, students receive 30 televised lessons, averaging 20 minutes each. The remaining 40 minutes of each class are divided between preparation and follow-up activities supervised by the coordinators. Teleclasses are usually broadcast live from DGEAD's production studios in Mexico City, from Monday through Friday; Saturday morning is reserved for special broadcasts to the classroom coordinators. All TS lessons are transmitted over XHGC-TV, Channel 5, in Mexico City; Channel 5 has donated over 40 percent of its time to TS.

The Methodology of this Study

Two distinct approaches may be taken in evaluating an educational system. The first attempts to answer such questions are these: What skills and attitudes should be developed in young people? What subjects should they be taught? How many graduates should be produced? These questions deal with what an educational system should be producing. An attempt to answer them requires that evidence be gathered concerning the cost and benefits to society of different educational activities. This is cost-benefit analysis, and it tends to assume that present (or past) costs reflect efficient uses of educational resources.

Cost-effectiveness analysis, on the other hand, examines the efficiencies of alternative methods for using educational resources. This second type of analysis provides tentative recommendations on how to produce something; it does not question what set of outcomes to produce. Thus, cost-effectiveness analysis is concerned either with minimizing the cost of obtaining a given set of outputs, or with maximizing the outputs

of a system at a fixed level of expenditure. Because the present evaluation examines how well alternative instructional systems are performing at the secondary level in Mexico, the cost-effectiveness framework was selected. Accordingly, the Telesecundaria and the Ensenanza Directa* systems are compared in terms of their relative costs and effectiveness.

Most studies of educational technology projects, even when well executed, have been of limited value to scholars and decision-makers alike because they have examined only a single instructional approach and because they have ignored costs. When the effectiveness of only one strategy is evaluated, it is very difficult to decide whether it is the most sensible one to pursue when there could well be other strategies that could do the job better. Likewise, when several instructional systems are compared on some criteria of effectiveness and one is found to be "better" than the others, it may still be very difficult to decide which one should be adopted without some consideration of the relative costs. If a new and "better" system is projected to cost substantially more than the traditional one, it is necessary to consider how well the latter would perform if the cost differential were applied to improving it.

To execute this type of analysis on Mexico's Telesecundaria and Ensenanza Directa (hereafter, ED), it is necessary to specify at the outset what is meant by effectiveness in terms of the measurable outputs of the school systems. Second, the inputs or resources that go into each alternative must be identified. Third, those inputs must be translated into their component system costs. Finally, the inputs and outputs should

*Ensenanza Directa refers to Mexico's regular academic secondary schools and not to technical or vocational schools, which also enroll primary graduates.

be linked with mathematical or statistical models that relate changes in the outputs to changes in the inputs.

It is also useful to structure such a comparative analysis on two levels of aggregation. At a disaggregated, microscopic level, the effects of a system on the individual student are considered. Student outcomes such as achievement test scores and attitude measures are examined in terms of their relationship to the type of school system and the family and social background that the student has been exposed to. The results of such an evaluation allow one to compare the instructional effectiveness of different systems.

At a more aggregated, macroscopic level, the evaluation examines the relationship between overall outputs of a system and its overall inputs. The system outputs considered at this level are measures of the system's enrollment capacities and its ability to produce graduates. Such system outputs are determined by analyzing the relative enrollment limitations put on each system by a fixed budget. It is at this level that the "cost" part of the cost-effectiveness analysis really comes into play. Given information on the component costs of a system and the particular types of input combinations the system uses, it is possible to determine the number of teachers, classrooms, and other inputs that could be provided by a certain budget. This can be translated easily into the maximum student enrollment possible with a particular system and budget. Given additional figures on drop-out, repetition, and promotion rates, this information can also be translated into the number of graduates the system is capable of producing. If a growing budget is considered, the results of the evaluation at this level will be a comparison of the enrollments and

number of graduates that could be produced by different systems over time.*

2. INPUT COMPONENTS OF THE TELESECUNDARIA AND ENSENANZA DIRECTA SYSTEMS

In this section, the input components of TS are compared with those of the older, more prestigious, and much larger, system of ED classroom teaching. To understand the similarities and differences between the two systems, and to provide a framework for later interpretation of learning and attitude output data, the systems were examined on four dimensions: school and community characteristics, student characteristics, teacher characteristics, and costs.

First, random samples of 9th grade classes were selected from both systems. The classes represented the Federal District of Mexico and the states of Mexico, Hidalgo, and Morelos. These areas were selected because: (1) they were large and diverse enough in economic as well as geographic terms; and (2) because they were all close enough to Mexico City to allow classroom observations as well as test and survey questionnaire administration.

In all, fifty-eight 9th grade TS classes with 1236 students were included in the sample, along with twenty-three 9th grade ED classes with 1101 students. The sampling strategy was intended to provide a minimum of 1000 students from each system; because ED classes are customarily much larger than those in the TS (average class sizes: 47 in ED, 21 in TS),

*The model by which this macro-analysis is accomplished, as well as the general methodology discussed here, is developed more fully in Dean Jamison, "Notes on Cost-Effectiveness Evaluation of Schooling in Developing Countries," Institute for Communication Research, Stanford University, 1972.

fewer of them were needed to obtain the desired 1000 students.*

School and Community Characteristics

Included in both the teacher and student questionnaires for these sample classes were questions concerning the schools and communities where the two systems were operating. It was known that the TS had grown up largely in response to the demand for secondary education in Mexico's rural areas where regular schools were not available, and that certain qualitative differences were bound to exist between the two school systems as well as the communities in which they operated. The surveys were designed to verify and, where possible, quantify such differences. The results of this analysis are summarized below.

Although the TS and ED systems overlap in many areas, TS is generally located in poorer and more rural communities. This fact was established by checking the distribution of schools in the four sample regions and by asking teachers to estimate the average monthly family income of their students. The wider dispersion of TS throughout the states and its presence in very small communities were indications that the newer system was reaching different elements of the Mexican population than those served by the larger, more urban-based ED.

TS schools tend to be small and rather flexibly organized institutions rarely serving more than 75 students in three grades; ED schools are large formal institutions customarily serving more than 500 pupils.

*The four sample states were chosen from among the eight in which TS exists. This was done after an analysis of test scores indicated that these four adequately represented the range of achievement in all TS classes. The ED sample, although random, is not representative of all ED schools throughout Mexico. However, since ED and TS classes were sampled randomly from the same states, comparisons within the four-state region are valid.

TS is housed in a wide variety of locations, including municipal buildings and village cooperatives, as well as rented private rooms. In contrast, the vast majority of ED schools are located in buildings owned and administered by the federal government.

TS schools do not possess as many facilities or ancillary learning aids as the ED. This fact was not surprising given the small enrollments of most TS schools and their comparatively low budgets. Considering these constraints, however, the TS does seem to provide students with most of the essential learning materials, at least according to the teachers who were surveyed.

Student Characteristics

Research in many countries has revealed that differences in social class and the level of parents' formal education, as well as mass media exposure, can influence how well students learn and how long they stay in school. In the paragraphs that follow, a number of important differences between the sample student populations are summarized.

Boys outnumbered girls in both systems, but the ratio of boys to girls is substantially higher in the TS classes. In the Federal District and in the Valley of Mexico, boys outnumbered girls almost three to one in the TS classes. Throughout the ED system, male majorities also predominated, but the ratio of boys to girls never surpassed two to one.

TS students are generally older than ED students. The average age for the 9th grade TS students was 16 years 3 months as opposed to 15 years 0 months for the ED students.

Students from both systems come from large families (average of 8 persons living in the home) and, in most instances, both parents were

present in the home. There was a higher rate of fathers dead or absent for the TS students, however, with 18 percent of the students of this group claiming that their fathers were not living with them.

Parents of TS students have less formal education than parents of ED students. The levels of parental schooling are presented in Table 2. As the table shows, 66 percent of the TS fathers had not finished primary school, versus 40 percent of the ED fathers. Looking at the other end of the scale, 24 percent of the ED fathers had some training beyond the secondary level, versus less than 5 percent of the TS fathers. A parallel situation existed for mothers' schooling, though in both sample groups mothers' educational attainments were substantially below those of fathers.

TABLE 2

Parents' Education by Instructional System
(percentages)

	FATHERS' EDUCATION		MOTHERS' EDUCATION	
	TS	ED	TS	ED
Did not study	10.1	4.5	17.8	8.3
Completed some primary	56.0	35.1	53.9	38.9
Completed primary	16.0	19.3	15.4	18.6
Attended secondary	6.4	10.0	4.1	6.2
Commercial course	2.4	7.4	2.7	17.1
Advanced secondary and/or university	2.5	16.6	0.9	5.9

Fathers of ED students also have better jobs than TS fathers, a fact obviously related to their superior level of schooling. While only 11 percent of the TS fathers had jobs that required more than a primary education, 35 percent of the ED fathers held positions that could be termed middle level or professional.

Students from both systems come from homes where the mass media (newspapers, magazines, radio, television, and books) are present and are used extensively. The only noteworthy difference between the groups occurred on the variable of television ownership: 82 percent of the ED students claimed to have television sets in their homes, versus 63 percent of the TS students. Despite this difference, however, only 20 percent of the latter group said they had not seen at least some commercial television the week before.

Teacher Characteristics and Behavior

Fifty-two TS coordinators and 26 ED teachers from the sample classes took time to fill out and return questionnaires. Though from relatively small samples, the data gathered still provide some useful information.

There were more men than women in both teacher samples, and the proportion of men to women teachers was higher in the TS. The 7:3 ratio of men to women in TS and the 6:4 in ED also roughly paralleled the ratios of boys to girls in the respective systems.

As a group, TS coordinators had less general education and professional training than their ED counterparts. This finding was not surprising when one recalls that TS coordinators are drawn, generally, from the ranks of primary school teachers; teachers in the traditional systems are usually fully-qualified graduates of the National Teachers' College.

ED teachers were older and had more formal teaching experience than the TS coordinators. Whereas the majority of teachers in both groups were between 26 and 35 years of age, 27 percent of the TS coordinators

were 25 years or younger. Yet, not one of the ED group was under age 26.

As part of an extensive classroom observation study carried out by the evaluation unit of DGEAD in 1972, the teaching methods of the sample teachers from both the TS and ED systems were evaluated (Judith Mayo, 1973). TS coordinators, who teach the full spectrum of secondary subjects with the aid of television, were observed in both mathematics and Spanish, while the more specialized ED teachers were observed only in their subject specialties, in this case either mathematics or Spanish. A few of the most important findings are considered below as input characteristics of the two systems.

Despite differences in general education, professional preparation, and years of teaching experience, there are few significant differences in the classroom teaching behavior of the two teacher groups. In the vast majority of observations, teacher exposition in the form of lecture or dictation was the rule, with very little time being devoted either to dialogue with students or to the answering of students' questions. Indeed, in four out of every five observations, students never asked a question.

The blackboard is the only instructional aid used regularly by TS and ED teachers. Although most teachers claimed to have access to reference books and other learning aids, their classes demonstrated little evidence of the utilization of such materials. Again, in four out of five observations, the classroom teacher relied only upon the blackboard to clarify what he or she was saying.

TS and ED teachers allow their students little opportunity to participate actively in the learning process, and students' participation is limited almost entirely to individual work at their desks. Individual work by students was observed less frequently in Spanish (15 percent of class time) than in math classes (35 percent of class time), with little difference between TS coordinators and ED teachers. Nonetheless, an important difference was found: in TS classes, coordinators supervised their students' work an average of 23 percent of the time as compared with 6 percent of the time by teachers in the ED system.

ED teachers have more time and do a more thorough job of preparing their lessons than do the TS coordinators. This difference was most noticeable in the observations of mathematics classes where it appeared that 85 percent of the ED teachers had prepared a lesson plan, compared with less than half of the TS coordinators. ED teachers have an advantage in this respect since they are customarily responsible for only one subject matter.

The teacher behavior of TS coordinators changes markedly according to the subject they are teaching. When the teaching methods of individual TS coordinators were compared in math and Spanish, the differences between them were greater than the differences observed between single-subject teachers in the ED system. This suggests that the nature of the subject or, at least, the way it is presented in the curriculum may strikingly affect a teacher's classroom behavior.

3. COSTS OF THE TELESECUNDARIA AND ENSENANZA DIRECTA

In the previous section, differences in the community, student, and teacher inputs to the Telesecundaria and Ensenanza Directa systems were described. The use of different types of inputs generally implies different costs for any two systems. It is this difference in cost for TS and ED that will be examined in this section.

Before undertaking a cost analysis, however, there are several points that must be made by way of introduction. First, the costs summarized here and in succeeding sections are the total costs to Mexico as a whole. They include, in addition to government outlays, costs incurred by local communities, students' families, and other groups within the private sector.* Second, costs are analyzed on a component basis to enable the reader to see precisely where and why the two systems differ. Third, costs are compared on a per student basis because the great difference in size between the two systems makes a comparison of total system costs irrelevant.** Fourth, because the burden of proof is always on a new system or new technology to prove its worth, the costs of the

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* The opportunity costs of students are not considered in the analysis for two reasons. First, we felt that the costs comparison should be estimated conservatively (see above) and if opportunity costs had been included, they would have increased the cost differential advantage of the Telesecundaria because job opportunities in rural areas are fewer and lower paying than those in urban areas. Second, the relevant comparison that we would like to undertake is between TS and ED operating in the same environment with the same students (see subsection on ceteris paribus cost comparison above) and in this case there would be no differential opportunity costs.

**In 1972 the Ensenanza Directa served 1,060,000 students at a total cost of $211,664,000, while the Telesecundaria enrolled approximately 29,000 students at a total cost of $4,368,000.

older Ensenanza Directa system have been estimated conservatively (i.e. cost estimates are somewhat understated). Fifth, capital costs have been annualized as described in the Appendix using a social rate of discount of 10 percent which, although somewhat higher than that used by the Mexican government to evaluate its investments, seemed a reasonable approximation of the worth of capital and increased the conservative bias of ours cost comparison. The assumptions upon which the cost estimates rest are presented in more detail in the Appendix.

Historical Cost Comparison

In almost every educational television project, technology has been an add-on cost, for it has supplemented rather than replaced the classroom teacher and other input components of the existing system. Mexico's Telesecundaria can be viewed in such terms to the extent that television is added to the traditional components of an educational system. However, what distinguishes the Telesecundaria and makes it viable for Mexico is that the traditional components of the system are much less expensive than comparable elements found in the Ensenanza Directa.

Table 3 reveals that the cost per student in 1972 was less for TS than for ED along the four principal traditional component categories: administration, classroom teachers, facilities, and student expenses. There are relatively fewer administrative personnel throughout TS than in the ED and much less effort is put into the central administration of TS. The classroom coordinators have less training than their counterparts in traditional secondary schools and thus they receive lower salaries. The teacher cost per student differential would be even greater than that shown in Table 3 were it not that the average class size for

TABLE 3

Annual Cost Per Student of ED and TS--1972*

	ENSENANZA DIRECTA	TELESECUNDARIA
Traditional Components		
Administration	$ 50	$ 6
Classroom Teachers	94	88
Facilities--fully equipped classroom	28	11
Student Costs--books, uniforms, etc.	28	20
SUBTOTAL	$200	$125
ETV Components		
Production	$ 0	$ 19
Distribution	0	2
Reception	0	5
SUBTOTAL	$ 0	$ 26
Total Annual Cost Per Student	$200	$151

*The assumptions underlying these estimations are explained in Appendix. More detailed cost information may also be found there. Costs are given in 1972 U.S. dollars.

ED is twice that of TS, thereby spreading ED's higher teacher cost over more students.

The responsibility for providing classroom facilities in the TS system rests with the local parents asssociation (patronatos), while in the ED system the state or federal government provides such facilities. The local patronato most often finds unused space in existing buildings to house a tele-classroom, although in some instances low-cost classrooms have been constructed with the donated labor of students' families. Furthermore, the typical tele-classroom offers less than the typical ED school in the way of associated school inputs--libraries, laboratories, workshops, etc. Both these circumstances serve to lower the relative cost of the TD facility. This differential in the facility cost per student would be even greater than shown here except for the larger class sizes and more efficient use of classroom space (double sessions) by which the ED system spreads its facilities' costs among many more students. Student costs are lower in the TS because the guidebooks that are used to accompany the televised lessons are less expensive than the standard textbooks used in the ED.

In sum, traditional components of the TS system are substantially less costly than those of the ED--$126 per student vs. $200 per student, respectively. On the surface, it would also appear that the traditional components of the TS system, taken alone, would provide an inferior educational environment to that of the ED. However, TS adds educational television to the traditional components.

The costs of this innovation may be divided into three broad categories--production, distribution, and reception. Production costs

include outlays for studios, studio equipment and its maintenance, as well as the salaries of all administrative, technical, and television teaching personnel. Distribution costs are expenses incurred in the transmission of the televised lessons. They are relatively low in the TS system because Channel 5 donates the use of its facilities to the Secretariat of Public Education. The distribution costs in Table 3 reflect only the costs of the actual use of resources--the costs of power, personnel, and maintenance--incurred by Channel 5 in its broadcast of TS. Reception costs are the annualized per student cost of television receiver, a shared antenna, and their maintenance. All told, the ETV components added $26 per student to the cost of TS in 1972, yielding a total 1972 cost per student of the TS of $151, compared to $200 for ED. In other words, TS was approximately 25 percent less expensive than ED on a per student basis.

Economies of Scale

Like most other instructional technology projects, TS's per student costs would be expected to decline as its enrollment increases, provided other elements of the system do not change. This is because a part of the costs of an educational technology system are fixed costs; they do not vary with changes in the number of students in the system. The remaining costs that would accrue to TS or ED as a result of an expanding enrollment are variable costs in that they increase in proportion to the student coverage of the system.

In the ED system, as enrollment expands the cost per student remains constant (because proportionately more money must be spent for each student that is added to the system), whereas in TS, as the fixed

costs of production and transmission are spread over more and more students, the cost per student declines.* With only 10,000 students in the system, TS becomes less expensive than ED, the difference becoming more pronounced as enrollments get higher. With 1,000,000 students in the system, the per student cost of TS approaches its minimum theoretical value of $130 (the sum of the variable traditional and reception component costs).

International ITV Cost Comparisons

Program production costs of ETV programs are often one basis for international comparisons. TS spends a total of $560,800 annually to produce approximately 3,240 twenty-minute programs yielding a cost per program of $173, or a production cost per hour of $519. Schramm (1973, pp. 95-97, 214-215) reports that typical production cost estimates for similar ETV projects in other countries range from $1,200 to $2,000 and indicates that Mexico's Telesecundaria is one of the least expensive systems of its kind in the world. Of course, variations in production costs are not necessarily indications of relative efficiency, and most probably reflect differences in program quality and consequently instructional effectiveness (although this latter linkage is far from clear, see Schramm (1972) and Chu and Schramm (1967) for summaries of the existing evidence).

Another oft-used measure of comparison of instructional technology systems that takes into account the costs of system distribution

*Although the assumption that all traditional component costs of both systems are variable may appear to be simplistic, it appears to have been true historically (see Klees (1972)).

and reception is the cost per student hour of broadcast. With an average of 360 hours of programming per grade in 1972 and a cost of $26 per student for its ITV component in that year, the televised portion of TS system costs about 7.2¢ per student hour. Jamison and Klees (1973) estimated the costs of instructional television projects to range from 1.5¢ to 15¢ per student hour, which would put Mexico's TS in the medium expensive range.* However, student hour costs are highly sensitive to student enrollment in the system; the low cost estimate of 1.5¢ per student hour is achieved by El Salvador only if they expand their system to include almost a million students. If TS enrolled a million students, the cost of its ITV component would only be $6 per student per year, or only 1.7¢ per student hour.

Cost Incidence

In comparing the costs of different educational systems, it is not sufficient to consider only the amount of money spent on them; attention should also be directed toward who is paying these costs. Although no attempt was made to examine the tax incidence for government expenditures, Table 4 does raise some interesting equity considerations in breaking down the costs of TS and ED systems according to their funding sources. The local community pays a higher percentage of the costs for schooling with the TS system than with the ED--24 percent versus 16 percent,

*The cost range estimated by Jamison and Klees (1973) utilized a 7.5 percent rate of discount, as opposed to the 10.0 percent used in this analysis; if we used the 7.5 percent rate of discount, the cost of Mexico's TS would be 6.9¢ per student hour, as Jamison and Klees report.

TABLE 4

Sources of Funding*

	ED		TS	
	Cost/Student	%	Cost/Student	%
Government	$168	84%	$113	75%
Locality--student families, patronato	32	16	36	24
Private Industry--Channel 5	--	--	2	1
	$200	100%	$151	100%

*Costs are given in 1972 U.S. dollars.

respectively. This difference is not as large as might be expected given the TS's strong reliance on local initiative and participation and it may be considered even less significant when viewed in absolute terms. Families of ED students pay approximately $32 per student per year,* while families (and patronato groups) supporting TS students must spend approximately $36. Despite the fact that there are not overwhelming differences in the funding sources of the two systems, there is indeed a question of fairness to be raised here. Why must TS students, who come from poorer families, be forced to spend more, both in absolute and relative terms, for their education than students in the ED system, who come from wealthier families?

Ceteris Paribus Cost Comparison

Telesecundaria has proven historically to be a less expensive secondary school system than the Ensenanza Directa ($151 per student vs. $200 per student) and, as we have seen, this cost differential would widen as enrollment for Telesecundaria increased. However, there is a difficulty with making a direct historical comparison of this nature because the two systems are operating in quite different environments. By and large, Ensenanza Directa functions in a more urban environment than does the Telesecundaria. Its average class sizes are larger, it often uses double sessions, and it incurs substantially higher facility and administration costs.

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*The cost to students in ED is actually $4 per year greater than might be indicated by Table 3 because the students pay a $4 annual fee. This fee is put towards meeting the component costs of the secondary school system.

Given that historical costs reflect the peculiarities of a particular environment, a more valid basis for comparison would be to imagine the two systems on an equal footing. One possibility is to examine the probable costs of expanding the ED system to serve the students currently enrolled in the TS, that is, to consider the costs of ED operating in a more rural environment.* It is difficult to forecast exactly what the costs of ED would be under such circumstances and therefore Table 5 presents both "high" and "low" estimates on a per student basis.

For the "low" estimate, it is assumed that the ED system would operate with the same administrative, facility, and student costs as the TS presently does. This would require the ED to cut down on its current level of administrative overhead, to build classrooms much more cheaply than at present, and to lower textbook costs. However, even under these favorable circumstances, the teacher cost per student of ED would rise considerably above the historical level of $94 (see Table 3) because the typical TS community would yield substantially smaller classes, while the cost of an ED teacher would be at least as high as it is at present.

If ED were to expand into communities currently served by the TS with no change in current procedures, the cost picture might more closely resemble that outlined as the "high" estimate in Table 5 . Here, teacher costs remain as in the "low" estimate, while the three

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* In order to put the two systems on an "equal footing," it would also have been possible to consider the probable cost of using TS to serve the students currently enrolled in ED. As in this paper we are concerned primarily with extending educational opportunities to rural students, the comparative analysis considering TS operating in a more urban environment is briefly considered in the concluding section.

TABLE 5

Annual Cost Per Student of ED in the Environment of TS*

COST COMPONENT	ALTERNATIVE I** "Low"	ALTERNATIVE II*** "High"
Administration	$ 6	$100
Classroom Teacher	203	203
Facility	11	90
Student	20	28
Total Annual Cost/Student	$240	$421

*Environment refers directly to the lower class sizes and classroom utilization faced in TS's situation as compared to ED's.

**Alternative I assumes ED in its new environment would face an average class size of 23 and single sessions, as well as be able to get by with administration, facility, and student costs equal to what TS now spends.

***Alternative II assumes ED in its new environment would still face an average class size of 23 and single sessions, but would have costs for the other traditional components based on historical assumptions for ED--that is, high administrative and facility construction costs and relatively higher textbook costs (see the Appendix for the details regarding these assumptions).

other cost components reflect the historical pattern of ED financing. Thus, administrative and facility costs are unchanged, but are spread over fewer students. Student costs are the same as under ED presently. In this "high" estimate, the total annual per student cost of ED rises to $421.

The "low" estimate approach points out the trade-off that can be made in an educational technology system whereby lower teacher costs can offset the costs of the technology. The teachers used in the TS system cost less than half as much as would those in ED ($88 per student vs. $203 per student) if ED operated in TS's environment. This cost differential more than covers the cost of ETV technology $26 per student in 1972).

Based on the more valid comparisons presented above--that is, estimating how the two systems would fare when asked to do that same job--TS remains a much less expensive system than the ED. Furthermore, the future cost differential is even more favorable toward TS than that found by examining only historical costs. Even under the "low" alternative, the cost per student of ED is sixty percent greater than that for TS ($240 per year vs. $151 per year). Yet costs are only part of the picture, and their meaning and true implications depend on the evaluation of the effectiveness of the two instructional systems. In the following sections, the effectiveness of the systems will be critically examined.

4. SYSTEM PERFORMANCE OF THE TELESECUNDARIA AND ENSENANZA DIRECTA

What effect have the different combinations of inputs represented by the TS and ED systems on the quantity of students receiving secondary schooling in Mexico and on the quality of that schooling? This section will consider the quantitative part of this question by evaluating the past and potential macro performance of the TS and ED. Measures commonly applied to evaluate the quantitative performance of an educational system include the number of graduates it can produce in a given period of time and its ability to satisfy educational demand. These measures are affected both by costs and rates of student flow through the system.

A direct historical comparison of the numbers of graduates is obviously not too meaningful. ED functions with a budget almost 50 times that of TS and produces many more graduates.* One way of making such a comparison is to consider the efficiency with which each system produces a single graduate. The previous cost analysis found the total cost of the TS system in 1972 to be about $4,368,000. With the system producing approximately 6,600 graduates in 1972, a cost per graduate of approximately $662 can be computed. For ED total costs in 1972 were found to be approximately $216,608,000. The number of graduates in 1972 was about 238,300, resulting in a cost per graduate of $909. In sum, in 1972 it cost 25 percent less to produce a TS graduate than an ED graduate.

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*The budget refers to the total annual cost of each system. Since not all the component costs are paid by the SEP, the budget referred to here will be greater than the amount allocated to either system by the SEP.

Although the cost per graduate reflects the overall performance of the two systems to date, they are not entirely satisfying from a comparative viewpoint. Again, they are based on historical costs which reflect the different operating environments of TS and ED. Perhaps the best basis for comparison would be to see how both systems would perform in the present operating environment of TS. This situation was already considered from a cost point of view in the previous section. As Table 5 illustrated, even under the best conditions, ED would have an annual cost per student of $240 if faced with the operating environment of TS (that is, single sessions and a 23:1 student to full-time teacher ratio). To determine the overall relative efficiency of TS and ED, we need estimates of system drop-out, repetition, and promotion rates.

Repetition in both systems is practically non-existent (due primarily to a system of make-up examinations). Survey and historical enrollment data allow us to estimate drop-out and promotion rates, and somewhat surprisingly they turn out to be identical for both systems: the average drop-out from first grade to second was 18%, from second to third was 12%, and the average graduation rate from third grade was 90%.* Given identical flow-through ratio, the relative efficiency of the systems' ability to produce graduates is given by the ratio of the systems' average costs per student ($240 for ED and $151 for TS). That is, the ED system costs 60% more than TS to produce a graduate, or alternatively, given the same budget, TS could produce 60% more graduates than could ED.

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*For ED these rates were estimated over the 1965-1970 period, while for TS they are for the year 1972 (see Klees (1975) for a more detailed look at these assumptions and the above analysis, as well as how to compare systems when flow-through rates are not identical).

Analogous results follow in terms of the relative ability of TS and ED to satisfy the demand for secondary school places, in that TS could enroll 60% more students than could ED, given the same budget. This is quite important to Mexico, as well as for other developing nations that are facing strong demands for enrollment expansion. It is also worth noting an obvious but important corollary to the above conclusions, in terms of a rather macro conception of equality of educational opportunity.

With any given budget we have seen that TS can enroll and graduate more students than ED and therefore could potentially provide education to a greater number of disadvantaged (e.g., rural) students. This translates directly into greater equality of macro schooling outcomes, in the sense that over time the distribution of years of schooling in the population will, ceteris paribus, tend toward equality faster with the utilization of TS as opposed to ED. However, despite the advantages of TS depicted in this section, before any judgments can be made as to the relative quality or equality of the two systems, it is necessary to examine the impact each system has on student learning outcomes.

5. OUTPUTS OF THE TELESECUNDARIA AND THE ENSENANZA DIRECTA SYSTEMS

The use of an input-output model in school evaluations has the advantage of relating what students learn in school with what they bring to school. Personal attributes and abilities of students can be related to what the school provides -- teachers, facilities, finances, etc. Such an analysis has two advantages: first, it helps decision-makers see that learning or, more narrowly, achievement is influenced by many factors, some under their control (curriculum, teachers, methods of instruction, etc.) and others not (community characteristics, student background, socio-economic level of the state, etc.); second, it directs decision-makers' attention to those factors that they can improve.

The disadvantage of using an input-output model is that it is often limited to a strict cost-effectiveness analysis that narrowly defines educational inputs and outputs while ignoring many other important problems within the system as a whole. Efficiency is not the sole criterion for decision-makers. An educational system that produces graduates efficiently may nevertheless have serious social and political drawbacks. Decision-makers should at least be aware of those areas that affect students, even though there is nothing directly they can do to change certain situations. Educators should at least realize that if learning is more difficult for certain isolated students, more, not fewer, inputs should be made to better equalize opportunities with more privileged groups.

To give a balanced evaluation, this section focuses on a strict output analysis. A final section reviews some of the serious problems that one or the other of the two Mexican instructional systems must face.

Description of Evaluation Areas, Instruments, and Procedures

The major output measures for the evaluation were: achievement in math, Spanish, and chemistry at the start and close of the second

semester of 9th grade; general ability tests in verbal, numerical, and logical skills; student aspirations, attitudes, and opinions about television instruction.

Achievement. Limitations of time and personnel forced two decisions on the evaluators: first, to limit the subject matter for testing to three and then to choose a sample only from among third-year secondary students (9th graders) in TS and ED. Math and Spanish were selected because they are core subjects through all the primary and secondary grades, and they are expected to provide skills highly valued by society. Science is a subject area that is stressed throughout the secondary curriculum, and for this reason chemistry was selected as the third course in which to measure student achievement. Third-year classes from both systems were chosen because if there was an effect of the type of instruction, either by television or by traditional methods, the cumulative impact of these methods would be more likely to show up at the end of the third year than at any other time.

The test in the three subjects were based on the official curriculum for the second semester of the third year. Fifty-item (sixty in the case of Spanish) multiple-choice tests were constructed by the evaluation group of DGEAD. Items were written, reviewed (by officials of the Secretariat of Public Education), and then pretested before the actual field testing was begun.

The same tests were given twice to both samples, in February and in June of 1972. When the second testing period was announced and carried out in the middle of June, teachers were not informed that the test would be identical to the one given before. Whatever the memory

factor from the experience in February that may have influenced the results of the second test, this factor was equal for students of both samples.

Ability testing. By its nature, TS serves a student group that is educationally disadvantaged. In large cities and especially in the capital, TS students are those who have not found a place in the regular schools; in the rural areas, they are generally from smaller towns where no ED school exists or is likely to be built. It was assumed that TS students would do less well on the achievement tests than the ED students would.

In order to control for these expected differences in favor of the ED sample, a general ability battery was proposed for the whole sample. These tests were ones used by the Centro Nacional de Orientacion Educacional and were to be administered by them in March and April of 1972 to all students in the sample. The tests that were used were the Otis Beta (Form A), a reasoning and verbal ability test, an analogies test, and a number skills test.

Two circumstances prevented full use of the general ability test as a control for achievement. First, students from ED schools did not take the tests when they were administered to TS schools. Secondly, the first administration of the achievement tests in February showed none of the large differences that were expected between the two groups. So the ability tests were deemed less urgent for control purposes.

Student aspiration. Information on student aspirations was gathered in a questionnaire administered to 9th grade students in the TS and ED samples at the end of the second semester. Coming so close to the finish of their secondary school careers, the questionnaire reached students

at a time when they were probably thinking seriously about their futures. Specific items of the survey asked about the amount of additional schooling desired, the expectation of achieving that goal, job preferences, salary aspirations, place and type of work preferred, etc.*

Attitudes about change and opinions about Telesecundaria. A small attitude scale on the theme of modernization and change in society was also applied to students in both samples in the survey questionnaire. Both the method and the scale had been tried before in El Salvador, and had shown good reliability there (Hornik, et al., 1973).

An additional attitude scale was applied to students in the TS sample only. This scale was designed to gauge student opinions about the television teaching system in their schools.

Results of Student Output Measures

In the following pages, the results of the output measures of students will be described. The general analysis will consist of a series of comparisons. A comparison between instructional groups (TS and ED) will be made first. Then the relationships between the particular output and input measures will be examined within each instructional group. This step will examine the pattern of relationships between output measures of achievement, general ability, aspiration, and attitudes with major input variables of state stratification, background, and demographic factors to see what best predicts student learning and whether such relationships differ for TS and ED.

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*A follow-up or tracer study of former TS graduates to see what they were doing in the year following graduation was attempted, but results were so fragmentary as not to warrant inclusion here. Cf. technical report (Mayo, McAnany and Klees, 1973, pp. 82-85).

Major findings will be summarized in a series of conclusions set off in the text.

Learning Results: Achievement and General Ability Tests

For the purposes of the cost-effectiveness part of this study, the basic comparison was made between two instructional groups: students taught by the TS system and those from the ED taught by regular secondary school teachers. Results of the three achievement tests are seen in Table 6. They may be summarized as follows.

Whereas both TS and ED groups started more or less equally, the TS groups gained slightly more over the semester in mathematics, Spanish, and chemistry. Once this learning result has been stated, one needs to examine more thoroughly what the process was and what factors help account for it. Both samples of TS and ED were stratified according to four administrative and geographic zones which include the Federal District of Mexico City (DF), Valley of Mexico (part of the state of Mexico surrounding the Federal District), Hidalgo (the state bordering the state of Mexico to the north), and Morelos (the state to the south of DF). Although data were coded by level of urbanization as well as by state, difficulties in coding made results from the urbanization analysis somewhat questionable.

When the achievement scores of the two groups are stratified according to state (as seen in Tables 7 and 8), the second major learning result emerges.

Change scores on achievement tests indicate a strong pattern of state differences, consistent across the three tests. This pattern shows more gain in learning in the more urban states of DF and Valley of

Table 6

Results of Before and After Achievement Testing for Telesecundaria and Ensenanza Directa

Telesecundaria (TS)

Subject Matter	Means	Std. Dev.	Gain Score	No. of Students*
Math 1 (Feb.)	20.24	4.84		1,151
Math 2 (June)	25.92	6.74	+5.68	
Spanish 1 (Feb.)	26.39	6.62		1,110
Spanish 2 (June)	31.50	8.44	+5.11	
Chemistry 1(Feb.)	18.06	4.25		1,132
Chemistry 2(June)	24.31	6.15	+6.25	

Ensenanza Directa (ED)

Subject Matter	Means	Std. Dev.	Gain Score	No. of Students*
Math 1 (Feb.)	20.15	5.02		836
Math 2 (June)	22.76	5.86	+2.61	
Spanish 1 (Feb.)	24.54	6.72		781
Spanish 2 (June)	27.19	6.84	+2.65	
Chemistry 1(Feb.)	18.49	5.02		713
Chemistry 2(June)	22.70	6.27	+4.21	

* Number of students are those who took both tests.

Table 7

Results of Before and After Achievement Testing for Telesecundaria by State

Area	No. Students	Mathematics Mean(Feb.)	Mean(June)	Gain
Federal District	353	20.28	28.84	+8.56
Valley of Mexico	300	21.46	26.85	+5.39
Hidalgo	226	18.89	23.94	+5.05
Morelos	272	19.96	22.73	+2.77

		Spanish Mean(Feb.)	Mean(June)	Gain
Federal District	336	26.06	33.22	+7.16
Valley of Mexico	293	29.03	35.03	+6.00
Hidalgo	210	25.04	29.09	+3.60
Morelos	271	24.73	27.41	+2.68

		Chemistry Mean(Feb.)	Mean(June)	Gain
Federal District	345	18.28	25.52	+7.24
Valley of Mexico	200	18.92	26.00	+7.08
Hidalgo	217	17.19	22.95	+5.76
Morelos	271	17.53	22.00	+4.47

Table 8

Results of Before and After Achievement Testing for Ensenanza Directa by State

Area	No. Students	Mathematics Mean(Feb.)	Mean(June)	Gain
Federal District	350	20.78	23.80	+3.02
Valley of Mexico	138	19.38	22.95	+3.12
Hidalgo	144	20.04	22.51	+2.47
Morelos	199	19.35	20.99	+1.64
		Spanish		
		Mean(Feb.)	Mean(June)	Gain
Federal District	340	25.37	28.14	+2.77
Valley of Mexico	115	27.10	28.84	+1.74
Hidalgo	134	21.10	24.28	+3.18
Morelos	192	23.94	26.57	+2.63
		Chemistry		
		Mean(Feb.)	Mean(June)	Gain
Federal District	248	18.41	22.77	+4.36
Valley of Mexico	159	17.08	21.44	+4.36
Hidalgo	107	21.35	27.96	+6.61
Morelos	199	18.16	20.79	+2.63

Mexico, less in the more rural states of Hidalgo and Morelos. This pattern is found without exception in TS results, and, although not perfectly replicated in ED results, it is generally found there as well. How does one explain this strong pattern in the achievement data? What is it about the different states that would cause such differences in learning? Would these differences also show up in other output variables in the same order? The answer to these questions will be examined in looking at the relationship of other variables to achievement.

Since the three general ability tests were administered only to TS students, there can be no direct comparisons between groups. However, some indirect evidence is available to make a tentative conclusion about the TS group results that are seen in Table 9 . Without a comparison group, it is difficult to judge how well the TS group did as a whole in these tests. When asked about the norms developed for these tests for the technical schools, the chief of the National Center for Educational Guidance, who has overseen the administration of these tests for a number of years, said that the TS results were well below the technical school norms. She thought that students from the ED schools would score higher in general ability than students from the technical or vocational schools, and that TS students would be considerably lower than ED students. She further added that the TS average on the Otis test was well below that for 16 and 17-year olds entering Normal Schools outside Mexico City in 1971 (18.41 and 17.71 compared with 8.20 and 8.47 for the equivalent TS sample in Mexico City). The tentative conclusion about the group comparisons follows.

TS students score below the general level expected of ED students and below the recorded levels of technical secondary students. Two other

Table 9

Pearson Correlations of General Ability and Achievement Tests for Mathematics, Spanish and Chemistry for TS.

General Ability Tests	Mathematics Achievement Scores		
	Before	After	Change
Otis	.27[3]	.28[3]	.09[3]
Analogies	.29[3]	.35[3]	.15[3]
Number skill	.34[3]	.41[3]	.17[3]

	Spanish Achievement Scores		
	Before	After	Change
Otis	.32[3]	.30[3]	--
Analogies	.26[3]	.26[3]	--
Number skill	.25[3]	.27[3]	.08[2]

	Chemistry Achievement Scores		
	Before	After	Change
Otis	.24[3]	.21[3]	--
Analogies	.22[3]	.21[3]	--
Number skill	.28[3]	.29[3]	.09[2]

Note: Numbers above the correlations indicate the levels of significance: 1=$p < .05$; 2=$p < .01$; 3=$p < .001$.

questions are important in understanding the general ability results for TS students: does the usual state pattern hold for general ability and, secondly, to what extent does general ability predict scores on the achievement tests? For the first question, an examination of results by states is found in the lower half of Table 10 , and strongly confirms patterns found in achievement results. Table 10 indicates that general ability is one of the largest factors accounting for the variance in achievement among TS students.

Such findings suggest several things: first, the general skills a student brings with him or her to secondary school strongly influences how well he or she achieves; second, students' abilities vary a great deal from one area to another. In thinking about the expansion of opportunity for secondary schooling to more rural students, decision-makers should realize that expanded opportunity cannot mitigate the varying effects of background. Achievement results of this study indicate that many disadvantaged students can learn, but it would be unrealistic to expect students with disadvantages to achieve at the same level as students from more urban areas. This does not mean that poorer students should get inferior instruction, but rather that, in order for them to have a more equal opportunity to learn, they need equal or better instruction.

It was pointed out in Table 2 that the ED students had better educated parents than did TS students. The same was true of fathers' occupations. If ownership of a television set is used as an indirect measure of income level, especially in the three rural states outside of DF, the advantage also lies with the ED students (comparisons of TV ownership for ED versus TS: Valley of Mexico, 84% vs. 61%; Hidalgo, 65% vs. 48%;

Table 10

Test Results from the Otis, Analogy and Number Tests for Telesecundaria Students, Total and by Geographical Areas

Total Scores for Entire Sample

No. Students	Test	Mean	St. Dev.
978	Otis	14.18	6.12
976	Analogy	6.02	3.12
976	Number	9.79	5.46

General Ability Scores by State

State	No. Students	Test	Mean	St. Deviation
D.F.	246	Otis	15.94	6.69
Valle de Mex.	286	Otis	14.23	5.60
Hidalgo	178	Otis	13.86	5.99
Morelos	268	Otis	12.71	5.77
D.F.	246	Analogy	7.12	2.98
Valle de Mex.	286	Analogy	6.61	3.03
Hidalgo	178	Analogy	5.33	2.94
Morelos	268	Analogy	4.86	2.97
D.F.	246	Number	11.42	6.02
Valle de Mex.	286	Number	9.96	5.09
Hidalgo	178	Number	10.36	5.49
Morelos	268	Number	7.75	4.63

Morelos, 55% vs. 50%). From analyzing achievement scores according to background factors, it was found that they all relate significantly and positively to achievement for the ED group. For TS, the pattern does not hold for achievement but only for general ability.

What is striking about this finding is not that students with certain family advantages do better on achievement, but that this pattern did not seem to hold to any degree among the TS sample, except for the general ability tests. Such a finding suggests a question to be answered in the analysis of these data: if background factors are positively related to achievement, why did the ED group, from more advantaged backgrounds, not do better than the TS group on their achievement tests? The apparent answer is that the instructional television of TS makes a difference in learning; a group from poorer homes, when given the chance to learn by instructional television and a classroom coordinator, can overcome the disadvantage and achieve equally with regular secondary students.

The study of classroom behavior of teachers reported elsewhere (Judith Mayo, 1973) gives a partial answer to the question: does the teacher's way of conducting his or her class make a difference in student learning? The partial answer, for mathematics at least, seems to be that it does. Observations were made of Spanish and mathematics classes only (no science) for a subsample of the classes tested in achievement. Since teaching behaviors did not differ significantly in the TS and ED, results were analyzed together. From this analysis, one may conclude the following.

Teacher behaviors that most prompted active student participation in mathematics showed a significant relationship with higher achievement for both TS and ED. In Spanish, there were few significant relationships

between teacher behavior and achievement. This may be due to several factors; the findings here are not as clear as they are in mathematics.

Discussion of Learning Results

The learning performance of TS and ED students, even though somewhat higher for TS students, really indicated more or less equal achievement on the part of both groups. What made this finding so important was that despite a generally poorer, more rural and disadvantaged background, TS students did as well as their counterparts in the ED schools.

On the basis of three achievement tests, it would be irresponsible to conclude that TS is a superior instructional system. In fact, many observers of the TS in and outside of Mexico have been highly critical of its quality. TS administrators admit that the telelessons are not as good as they might be, but they ask: are they any worse than the average classroom presentation of the regular secondary school teacher? No one can conclusively answer that question, but it might be quite revealing if one were to observe classroom teaching in both the TS and ED systems on a regular and unobtrusive basis. The limited teacher observation carried out as part of this study suggested that the teaching behaviors of the ED and TS teachers were actually quite similar (Judith Mayo, 1973).

Another factor which may help explain the encouraging learning performance of TS students is motivation. If rural primary graduates do not get secondary education from television, they will probably not get it at all. Thus, the motivation of individual students in TS schools may play an important part in their achievement. There is no direct

evidence for this other than impressionistic evidence gathered from a number of visits to rural schools in the four-state area. (One needs to remember that there were TS urban students who also achieved well and for whom the motivation explanation would be less appropriate.) If motivation is a factor, it is but one consideration for decision-makers to keep in mind as they seek to expand educational opportunities throughout Mexico. There is an accompanying caution to be made, however. Even if disadvantaged rural students can learn from a system of televised instruction, schooling itself may foster unrealistic aspirations. If school engenders the desire for more schooling and for jobs that are not available in the Mexican countryside, the high level of motivation may be replaced by a frustration and/or an accelerating exodus of ambitious young people from the rural areas.

Aspirations: More Schooling, Better Jobs, and Higher Salaries

Students in their final year of secondary school in Mexico are at a crossroad. They are 15 and 16-year olds and they must decide whether to look for a job or to continue their studies. This is an important decision for the student, but it is also crucial for the educational planner who must design programs that will not only serve the individual needs of students but the nation as a whole.

In the course of the evaluation, particular attention was paid to what the third-year students in the two systems wished to do in the future. A student survey administered in June 1972 contained a number of measures of future educational, career, and salary plans.

The analysis followed here will parallel that of the achievement section. Aspirations will be considered as outputs and the TS and ED

groups will be compared. Within each group, the relationship of aspiration to learning outcomes, state stratification, background, and demographic factors will be examined. A profile of high and low aspirers will summarize these findings. In conclusion, the implications of these results for educational decision-makers will be clarified.

Considering aspirations as outputs of the two instructional systems, Table 11 compares how much education and what kind of occupations the two groups aspire to. The results suggest the following.

Students of both TS and ED hold high aspirations for more schooling and better jobs, but the proportions of students desiring university-level training and professional careers are much higher in the ED group. Relatively few students from either group wished to terminate their education at the end of secondary (9th grade). Students from TS were particularly attracted to commercial and normal school courses which are terminal. While these opportunities were also attractive to ED students, the majority aspired to continue to university-level schooling. TS students opted mostly for middle-level careers such as teacher, secretary, or technician of one sort or another, while almost two-thirds of their counterparts in ED looked forward to careers in the traditional professions of medicine, engineering, law, or architecture.

The higher aspirations of ED students were also demonstrated in response to a question on the survey that asked students what monthly salary they considered necessary to live decently. Dividing responses into high and low categories (with U.S. $160 serving as a dividing line), 44 percent of ED students were in the high category versus only 28 percent of TS students.

Table 11

Educational and Occupational Aspirations of Students of TS and ED

Educational Aspiration

Level of Schooling Desired	(TS) Telesecundaria	(ED) Enseñanza Directa
Finish Secondary	13.8%	4.8%
Finish Normal or Short Vocational/Professional Course	50.5%	35.0%
Finish Preparatoria (Senior High School)	9.4%	6.0%
Finish University or Politechnic Institute	26.3%	53.8%

Occupational Aspirations

General Occupational Level*	(TS) Telesecundaria	(ED) Enseñanza Directa
Lower Level Occupations	9.2%	3.0%
Middle Level Occupations	51.6%	33.1%
Higher/Professional Level Occupations	39.2%	63.9%

*A list of occupations by level is found in the technical report (Mayo, McAnany, Klees, 1973).

Differences across states have strongly marked previous findings. As illustrated in Figure 1, similar findings also emerge on aspirations.

Students with high aspirations (for more school, better jobs, and higher salaries) were in the DF and Valley of Mexico, while those with lower aspirations were more evident in the poorer and more rural states of Hidalgo and Morelos. This was true of both TS and ED. A considerable number of TS students did not plan to go on in school (13.8 percent in Table 11), but the pattern within the total TS samples varied by state as Figure 1 shows. For example, while 8.4 percent of TS students in Mexico City planned no further education, 19.1 percent of Morelos students had come to the same decision. Other levels of educational aspiration followed a similar pattern. One concludes, then, that whether a student wishes to go on in school and how far he or she intends to go depends not only on the kind of school he or she attends (ED or TS), but also on where one is attending that school.

Background variables are a second area of examination. The four factors of father's and mother's education, father's occupation, and TV ownership were all found to be significantly related to aspiration. A glance at Table 12 confirms that as with learning, so with aspiration; the more advanced score higher.

Students with more educated parents who have better jobs and have a television set at home aspire to more education, better jobs, and higher salaries. This is true for both groups but the relationship is stronger for ED students.

Finally, one must consider whether boys and girls manifest different aspirations, and whether younger students aspire more than older

Figure 1

Aspiration for More Education by State for Telesecundaria and Enseñanza Directa

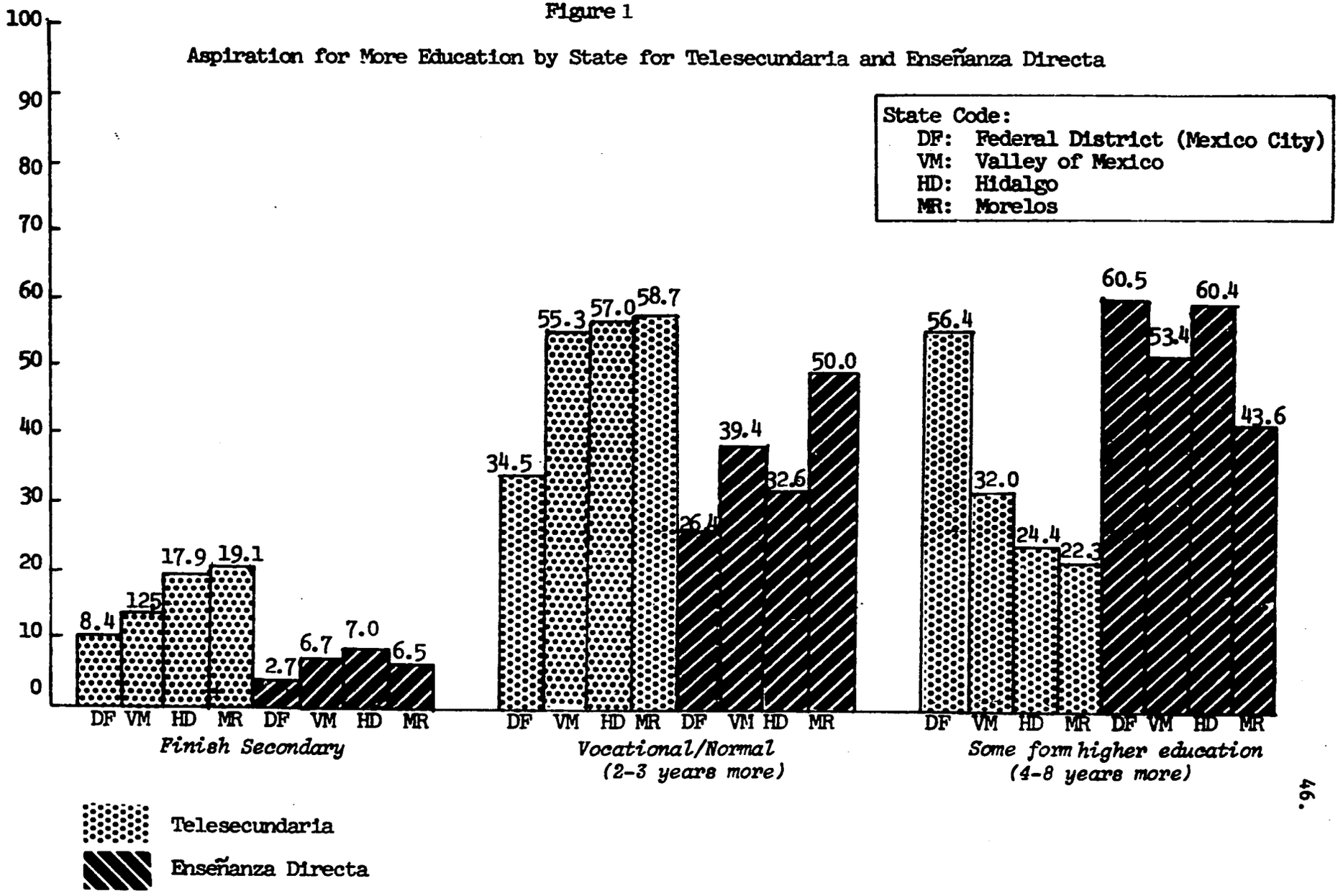


Table 12

Pearson Correlations for Student Aspirations and Background Factors for TS and ED

Telesecundaria (TS)

Background Factors	Educational Asp.	Occupational Asp.	Salary Asp.
Father's Education	.20[3]	.14[3]	.18[3]
Mother's Education	.16[3]	.08[2]	.12[3]
Father's Occupation	.07[2]	.05	.04
Television Ownership	.21[3]	.16[3]	.17[3]

Ensenanza Directa (ED)

Background Factors	Educational Asp.	Occupational Asp.	Salary Asp.
Father's Education	.30[3]	.21[3]	.39[3]
Mother's Education	.30[3]	.17[3]	.36[3]
Father's Occupation	.31[3]	.20[3]	.35[3]
Television Ownership	.29[3]	.18[3]	.31[3]

Note: Numbers above correlations indicate levels of significance: 1=$p < .05$; 2=$p < .01$; 3=$p < .001$.

ones. Taking the factor of age first, one finds that age does not seem to make much difference in occupational or salary aspirations, but that older students in both TS and ED had distinctly lower educational aspirations. This relationship seemed somewhat stronger in rural areas of the TS sample but not in ED. Such a finding might suggest that, although most students in rural areas want more education, older students in rural areas are more likely to need to find work immediately after secondary school. If there are more students who are older in rural areas, this may mean that graduates of TS schools especially need to look for employment sooner than their counterparts in ED.

The differences in boys' and girls' aspirations are a clear reflection of different career opportunities. Many more boys than girls in both TS and ED are drawn to advanced education and professional careers. Girls may be attracted to middle-level careers for predominantly cultural reasons (e.g., they are not expected to compete on a professional level with men) or they may simply envision careers as nurses, secretaries, and teachers as opposed to lawyers, doctors, or architects as inherently more rewarding. The data do not clarify reasons for the different aspiration levels for boys and girls. Although the pattern holds true for both TS and ED, an examination of comparisons of the two female groups shows that ED girls have much higher aspirations than do girls in TS. (13.5 percent of the latter want to go on to university, while over 40 percent of the ED girls desire advanced education.)

These findings about differing opportunities and aspirations are not new to research, but they emphasize again the need for educational planners to recognize the inequality of opportunity for jobs as well as

for education preparing for those jobs. Better instruction in itself will not solve this problem.

The data on aspirations suggests that 9th grade students have formed a fairly coherent picture of what they want in the future. Many wish to leave the countryside to find advanced educational opportunities in the cities, particularly Mexico City. They seem prepared to make the necessary sacrifices to achieve their objectives.

The pattern of aspirations has a great deal to do with background, state, and demographic factors. The more advantaged students of the ED system are repeating the aspirations that have existed in the past when the traditional school system served only an elite population. If one were to project these aspirations onto all secondary students in Mexico, and then look at the consequences for Mexican higher education, the problem would be made dramatically clear. There would be no chance of providing enough universities for all secondary students who eventually wish to enter professional careers.

Will the school system be able to stand mounting pressures at higher levels? What will be the consequences of an expansion of secondary opportunities through mechanisms such as the TS system? The increasing number of rural graduates of TS will need employment. Will rural graduates find employment in their own communities or will the television schools simply accelerate the rural exodus and create greater problems than it solves?

Attitudes: Affective Response to Change in Society

In the past, educational research and evaluation have stressed the cognitive side of schooling effects. Accordingly, a great deal of

emphasis has been placed on the development of objective measures of learning and cognitive abilities to the detriment or neglect of measures of the affective development of students. It is clear that school alone does not account for all affective development in children. The family and community remain a strong force in the student's formation. Yet school systems frequently outline general goals such as the training of well-rounded persons, good citizens, or socially responsible individuals. These are largely affective goals that concern values, attitudes, and character and go well beyond the cognitive growth or achievement so often stressed in student evaluation.

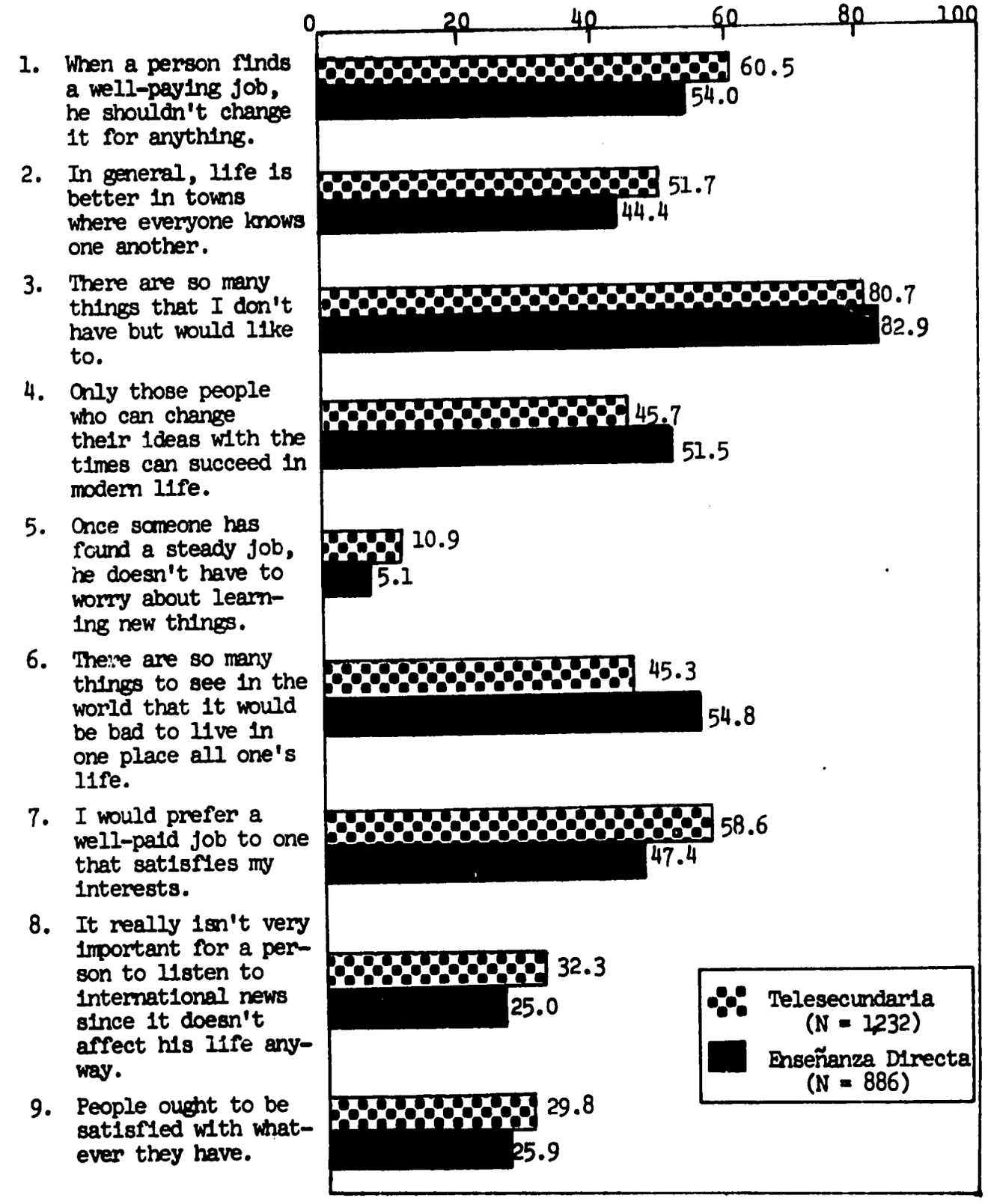
The present evaluation recognized the importance of this other aspect of students' development, but it was not able to do more than measure student attitudes toward their society and, in the case of TS students, toward the television instruction system in which they study. Both TS and ED students responded to questions seeking information about openness to change and attitudes toward a modern, changing society.

Attitudes may be considered both as outputs of the educational system and as inputs to learning. As outputs, one wants to compare attitudes of the two instructional groups to see if there are large differences between them. This comparison was made for the nine attitude items for TS and ED.

As Figure 2 illustrates, there is an almost identical pattern of attitudes for both groups indicating that on this measure the affective development of both groups is very similar. However, if one examines each item of the scale, it appears that the TS students are always slightly more conservative or less change-oriented in their responses. For example, the

Figure 2

Comparison of Attitudes of Telesecundaria and Direct Teaching Students. Percentage Agreement with Statements



first item asks how much a well-paying job is valued, if it has priority over everything else. The more mobile student might be willing to risk a well-paying job; a student with less mobility prospects might not. TS students were 60.5 percent in agreement with the notion that one should not risk such a job on any account, as against 54.0 percent of the ED students.

Though consistent, such differences between the two samples are slight (never more than 11 percent points apart). Desire for job security or willingness to stay in a small town may be more reflective of TS students who tend to be from smaller towns and from poorer families than their ED counterparts. These results might also mean that TS students realize they have little or no economic cushion to fall back on and they are thus less willing to take risks.

Learning or failure to learn is not just related to a particular method of instruction but also to the kinds of students that are recruited to go to school, the social structure in which they live, and the individual attitudes that are a product of their backgrounds. In the present case, a more change-oriented response pattern to the nine attitude items in the scale relates positively to achievement learning and, for TS students, to general ability levels. An examination of the data indicates that there was a consistent and strong relationship between attitudes and learning (cf. Mayo et al., 1973, Appendix C in technical report). The relationships may be summarized as follows.

Students who respond in more "modern" or change-oriented ways were more likely to score higher on achievement and (for TS only) general ability tests. The relationship between learning and attitudes was

stronger among ED students. For TS students, the relationship between "modern" attitudes and general ability was stronger than that between attitudes and achievement, although both were statistically significant.

In sum, a pattern of association, as opposed to a clear causal relationship, exists between student attitudes and learning. The matter needs further investigation to determine whether learning performance produces certain attitudes or vice versa, whether the variables could be influencing each other mutually, or whether some third factor like background or state residence could be causing both.

What factors are related to student attitudes? Do boys and girls tend to differ in their attitudes about change? Do attitudes vary according to state, family background, or age? An examination of the evidence currently available offers several tentative conclusions. First, the state of residence and the characteristics associated with it have a strong relationship with attitudes in both groups. Second, boys and girls did not by-and-large have different attitudes and age did not seem to make any difference at all in their responses. Third, father's and mother's educations did have a significant and positive relationship with student attitudes. Finally, with regard to aspirations, attitudes were strongly related to educational aspiration for both groups, but to occupational choice for ED alone.

One might summarize this attitude section with a profile of the more change-oriented student. He or she is a higher achiever and aspirer than average who comes from a better-educated family and a more urban state. His or her attitudes reflect a willingness to change even a good job to satisfy his or her interests. He or she prefers not to live in a

small town. He or she wants many things in life and does not think people should be satisfied with what they have. He or she believes one may have to be willing to change his or her ideas and his or her place of residence to succeed. One is struck by the fact that these attitudes may not be wholly appropriate to the rural student or to the development of Mexico's rural areas. It is this kind of evidence that the decision-maker must consider in spreading educational opportunity. Will more school form attitudes that will help develop rural Mexico, or will they simply draw off the most promising human resources to the urban areas?

Opinions About the Telesecundaria System

Although there have been some attempts to get systematic feedback on the TS in the past, the opportunity to find out on a broad scale what students think about their schools was seen as an important input to deciding how TS could be improved and/or expanded. The following section is a summary of what students, the chief clients of the system, think about TS. Students of ED did not answer this part of the survey questionnaire.

The inquiry was based on a set of seven general statements about television teaching. Responses to these items can be seen in Table 13 . An examination of results shows the following.

Student attitudes toward TS are generally favorable, but it remains up to decision-makers to determine what is an acceptable level of response before taking remedial action. The problem with this kind of feedback is illustrated in the first item. Seventy-five percent of the students say that they can see the television lessons clearly, 19

Table 13

Reactions of Telesecundaria Students to Statements about the Television System

Attitude/Statements	Response % Agree	Disagree	Not Sure
1. TV classes can be clearly seen.	75.2%	18.9%	5.9%
2. TV classes are difficult.	13.9	68.1	18.0
3. After the TV classes, there is not enough opportunity to ask questions or give opinions.	37.3	57.1	5.6
4. My parents are happy that I have my classes by TV.	79.9	3.7	16.5
5. It seems that classroom teachers like to teach by using TV classes.	74.6	6.3	19.1
6. If I do not understand something during the TV program, I can easily clarify my doubts about it.	81.4	7.8	10.9
7. I would prefer to stay in Telesecundaria even if I had a chance to go to a regular secondary school.	60.8	15.8	23.5

percent disagree, and 6 percent are uncertain. Those who agree constitute a majority to be sure, but when almost 25 percent cannot see the lessons clearly, then a decision-maker must ask whether this is not a major problem.

The remainder of the items on the scale show rather encouraging results. Only 14 percent of the students think that there may not be enough opportunity to ask questions after the TV lesson. This is a curious finding in the light of the teacher observation study (Judith Mayo, 1973) that found few questions being asked at all. The TS leaders may want to look further into this anomaly: are few questions asked because there is no time (observation refutes this); is it because the television teacher's approach does not encourage questions; or is it the passive atmosphere in the classroom that stifles curiosity? The decision-maker must provide some answers to these questions before he or she can try to correct the problem.

Three-fourths or more of the students agree that their parents and teachers are happy with the television system. Although more than one-third said that there was not enough opportunity to ask questions, over 80 percent agreed that they could clarify doubts that had come up in the TV lessons. Again, the teacher observation study indicates that students rarely try to clarify doubts in class. The problem with even the most carefully worded feedback questionnaire is illustrated here. Without other kinds of evidence from student learning and classroom observation, decision-makers have a difficult time translating the information into realistic action.

Finally, 60 percent of the students were loyal to their TS schools when asked whether they would leave if given an opportunity to

go to a regular secondary. In visits to classes throughout the four states, researchers found this loyalty corroborated by teacher and student testimony. Although many observers outside TS consider it a "second-class" system, students in the system defend the quality of their instruction and do not often transfer to ED. The difference in the response to this question across states was illuminating, however. Students in the Federal District were more inclined to change (21 percent) than the most rural students in Morelos (10 percent). It may be that where there is little opportunity to change, there is more loyalty. Still, TS does retain a high level of students who do not drop out or transfer, and one may interpret this as generally satisfying its present clientele.

This section has illustrated that an evaluation is not simply the gathering of a large amount of information on a given school system, or even comparative data from several systems. Once assembled and examined, the basic purpose of an evaluation is still unfulfilled. Decision-makers must see how the conclusions of the study point to realistic actions that can be taken to change and improve the system of instruction.

6. THE FUTURE OF TELESECUNDARIA

The TS system, using television in combination with more familiar educational resources such as classroom teachers and textbooks, has enabled Mexico to extend secondary schooling to rural communities whose size and isolation have heretofore prevented the construction of regular schools. At the same time, the TS has provided a second chance for many urban students who, for a variety of scholastic and economic reasons, have not been able to gain admission to regular secondary schools.

On the basis of available evidence, the TS appears to be accomplishing its basic pedagogical objectives. Test results in three subject areas indicate that students taught by television are learning with the same degree of success as their counterparts in the regular secondary schools. While students in the regular schools have a head start -- they come from more privileged backgrounds and are better prepared -- the achievement levels of students in the two systems are quite similar.

When one considers the lower cost of teachers and facilities in the TS (approximately 38 percent lower than regular secondary schooling on a per student basis), the appeal of the TS to cost-conscious educational planners is evident. Cost projections reveal that at higher enrollment levels, the TS system would offer even greater savings over the regular secondary school system; the differential in favor of the TS rises with each increase in enrollment. Indeed, on virtually all dimensions of cost that were measured as part of the current evaluation, the TS was found to be more economical than the regular secondary school system.

Two of the most important factors responsible for keeping TS's costs below those of the regular secondary schools are the local initiative and voluntary effort found in the rural communities themselves. To provide schooling for their children, rural parents have formed associations to furnish and maintain practically all of the necessary TS classrooms. The qualities of individual sacrifice and community self-reliance that are required by the present operation of the TS system may be, in themselves, the most lasting rewards of the system.

Evidence of the TS's growing popularity is found in the increasing number of communities which have expressed an interest in joining the

system. Most have been turned down because the Federal government did not provide enough primary teachers to serve as television coordinators.

TS's problems go beyond an inability to have more primary school teachers assigned as coordinators, however. Within the Secretariat of Public Education (SEP), there is an ambivalent attitude toward the system and its contribution to secondary education. On the one hand, TS is viewed as a useful mechanism for extending educational opportunity. Under current budget restrictions, planners realize that regular secondary schools cannot be constructed in the rural communities typically served by a TS school. On the other hand, there is a deep concern within the SEP and elsewhere about the quality of instruction currently offered by the TS. Critics cite TS's lower admission standards, its less specialized classroom teachers, its irregular and cumbersome administrative procedures, and particularly its televised lessons, as evidence that the system is a poor substitute for regular teaching and therefore not worthy of continued support.

The administrative problems of the TS system stem in part from an early independence that the system had from the regular secondary structure within the Mexican federal education structure (the SEP). Bureaucratic jealousies and problems of processing TS students through channels of the educational system have suggested to decision-makers that they think seriously of alternative growth patterns for TS if it is to play a significant role in the future. The present evaluation was only a first step to guide decisions. More research is needed on alternatives open to TS. To help determine the direction of future research, this study will conclude by outlining some of the more promising short and long range

alternatives open to educational leaders in Mexico. Other countries may be interested in the directions TS takes and what results from these directions.

The results of the study do not clearly demonstrate from the evidence that the input of television was responsible for learning gains of TS students. If the television component were withdrawn from the TS system, would there not be similar results? Some evidence of television's specific contribution may be found in a similar project in El Salvador (Hornik, et al., 1973) where a longer-term study and better controls were possible. To answer this question in Mexico, it would probably not be enough to simply create two experimental groups in rural areas, one using television and one not, to study relative effectiveness of TV versus face-to-face teaching. A great deal of evidence (cf. Chu and Schramm, 1968) indicates that experimental results looking only at learning do not clearly give the advantage to either method, other things being equal.

What does seem clear is that television teaching spreads one educational input evenly over a student population, unlike most other inputs, including teachers, which are most often biased toward the more urban and better-off communities. A second consideration is that a technology like television often has a catalytic effect, creating a willingness to change within the educational bureaucracy. Although ideally a ministry of education could create a secondary system of a type that might be close to the TS without television, there have been few examples of this because teachers cannot be persuaded to work in rural areas and ministries have not had the impetus for doing so. Finally, a technology can reach a larger and larger audience of potential users, including

students who do not enroll in organized classes. There are a number of such students of the TS system, although they were not included in the present investigation.

Given Mexico's present commitment to some form of the TS system, the following suggestions seem the most realistic to take advantage of what is in place and to increase its effectiveness.

Short-Range Alternatives for the Development of TS

Television production. Many of the SEP's misgivings about the TS stem from unfavorable reactions to the televised lessons. Observers from the SEP and TS, as well as many private viewers, have expressed displeasure at what they see as an unprofessional and unimaginative use of television. Much of the criticism has been fueled by periodic attacks in the Mexican press. Measures to review program quality and production procedures were taken and much needed technical assistance was obtained from within Mexico and abroad.

Better use needs to be made of DGEAD's large stock of videotape. The vast majority of telelessons are currently produced and transmitted live. This custom strains studio facilities and does not permit the television teachers sufficient time to rehearse their programs or to enrich them with appropriate visual aids. With videotape to pre-record lessons and to permit their re-broadcast in subsequent years, the teleteachers would be able to spend more time upgrading the quality of each individual lesson. Additional care in preparation would thus upgrade the quality of the programs and, ultimately, improve TS statureinthe eyes of the public.

Transmission. In the short run, it is reasonable for TS to continue using the donated transmission facilities of Channel 5. However, it appears that Channel 5 uses reduced transmission power for its TS broadcasts, resulting in a somewhat smaller broadcast area than is potentially possible and a lower quality signal at the fringes of the reception area. Although no precise information is available on the potential coverage area lost due to the reduced power operation, it would not be difficult to determine by comparing the reception of TS and commercial programs in outlying areas. If this problem warrants correction, it would not be very expensive to pay Channel 5 the extra money necessary to operate at full power.

Enrollment. If TS continues to operate only in the eight-state region, there are two strategies it might consider to increase enrollment and thereby reduce the unfulfilled demand for secondary schooling. The first strategy would be to increase enrollment within existing TS schools, while the second strategy would involve the formation of new TS schools.

Increased enrollments within existing TS schools could be accomplished by simply encouraging more students to enter the system. The marginal cost of adding a student to an existing class is very low -- approximately $26. Furthermore, with larger classes, TS's unit costs (average cost per student) would decrease substantially as teacher, facility, and television costs are spread among more students. For example, if TS's present enrollment of 30,000 were to double to 60,000, the average annual cost per student would drop from its present level of $151 to $84. Of course, the pedagogical effects of increasing class sizes would have to be carefully evaluated, but starting with the present average

class size of 23 students, it is likely that large increases could be made with little, if any, effect on learning.*

There would, however, be some difficulty in increasing class sizes within the TS system, partly because many of the communities are quite small and partly because of the expense involved in attending secondary school. The average annual family cost of $20 per student for TS is a deterrent to poor families, particularly those with many children. It has been noted earlier that the TS system costs families and localities more, both in absolute and relative terms, than does the ED. This situation, plus the fact that TS students come from poorer rural families, suggests that a strong case could be made for subsidizing TS students in the future. At a minimum, this might include having SEP pay for the students' books, supplies, and uniforms. Such a policy would spur higher enrollments and contribute to a more efficient utilization of TS resources. Remembering the Mexican government's commitment to rural education and the relatively low cost of the TS in comparison to the ED, a subsidy of TS students is an alternative worth serious consideration.

A second method for increasing TS enrollment in the short run would be to encourage the formation of new TS schools. Each year, requests by communities to begin a TS school are turned down because of a shortage of primary school teachers. The shortage does not seem to stem from lack of qualified teaching personnel, but rather from a shortage of funds allocated by SEP to hire additional TS coordinators. Again, considering the commitment

*In a multitude of studies carried out in many different countries over the past 50 years, differences in class size have had no significant effect on student learning (cf. Jamison, Suppes, and Wells, 1974).

of the Mexican government to rural education, this situation would appear to merit review.

Classroom teaching. The study of classroom teaching behavior in the TS and ED (Judith Mayo, 1973) revealed that instructors in both systems used quite similar techniques. The typical teacher in both systems dominated his or her classroom, leaving little time for student participation. At the same time, an analysis of learning results showed that when teachers lectured less and used more "modern" teaching techniques such as group work and supervised student projects, their students achieved more. Above all, the study showed that there was considerable room for improvement in the coordinators' teaching styles. How might this be achieved?

The fact that the teacher observation study discovered a positive relationship between student learning and the amount of general education obtained by the TS coordinator suggests that the scholastic attainments of prospective coordinators should be weighed heavily in their selection. Furthermore, coordinators now in service should be encouraged to continue their education. This process might be facilitated were DGEAD to offer scholarships for coordinators to continue their studies on a part-time basis, or by the use of TV for better in-service training.

Supervision. No position is more important to the day-to-day operation of the TS than that of state supervisor. State supervisors not only forge and maintain links with the local communities served by the TS, but they also oversee the work of the classroom coordinators and provide feedback to the teleteachers as well. Despite the talents of the present corps of state supervisors, much more supervisory effort, as well as change

in supervisory skills, will be needed if the TS is to implement the kinds of policies suggested above.

Feedback and evaluation. The reforms and short-range policy options suggested in the preceding sections would best be implemented with the help of continuing feedback and evaluation. Only with a steady flow of information on costs, learning, and opinion will decision-makers be able to determine whether or not their policies are successful. A competent evaluation unit now exists within DGEAD for this purpose, and it should be encouraged to develop research priorities and then to carry out the appropriate studies.

Long-Range Alternatives for the Development of TS

Transmission and coverage. There are a number of long-range cost alternatives for the transmission of TS programs, depending on whether or not the system continues to be confined to its present eight-state region. If the present broadcast area is maintained, there are three main possibilities: transmission facilities could continue to be donated, they could be leased, or they could be constructed by the government.

If transmission time continues to be donated by Channel 5, the cost would equal those calculated earlier. If transmission time were leased from Channel 5 at 75 percent of its minimum rate of $424 per hour,* the total cost (for 33 hours of programming per week, 40 weeks per year) would be approximately $424,000 annually. Although such a sum would add

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* Given that presently no commercial programming is done during these hours and the large block of time desired, a 25 percent discount does not seem unreasonable, especially considering that Channel 5 will still make a healthy profit and the purchaser is the Mexican government.

substantially to the fixed costs of the system, with more than 14,000 students in the system, TS's average cost per student would still be less than that for ED.

One method for estimating the costs of constructing government transmission facilities to cover this area is to use the cost estimate of $2,112,000 for the Channel 5 system (see Appendix). Converting this to an annualized amount* results in a cost per year of $248,000. Adding 10 percent of the cost of the system annually for operating expenses (actually if the system were just operated for Telesecundaria programming this cost would be less), we find the total annual cost of construction falls below the rental costs given above. Actually, since some government networks already exist in the Federal District area, the cost of adding to this system the ability to cover all of the eight-state region may be less than that described above.** Furthermore, the government would be getting more for its money by constructing facilities than by leasing since it could broadcast programs in addition to TS.

If the decision is made to extend TS coverage to the entire country, the same three alternatives exist - transmission facilities could either be donated, leased, or constructed. The only national network, Channel 2,*** has excess capacity during the daytime and thus might be amenable to donating the needed transmission time to TS.

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* This assumes a 10 percent social rate of discount and a 20 year equipment life.

** On the other hand, transmission facility costs may be greater than indicated here as Butman (1972) estimates that under the best circumstances, the cost will be about $35 per square mile. With about 100,000 square miles in the eight-state area, construction costs would amount to $3,500,000.

*** Channel 2 personnel estimate that 80 percent of the Mexican population lives within the geographical area covered by their signal.

If transmission time were leased from Channel 2 at 75 percent of its minimum rate of $2,592 per hour, the total annual cost for national coverage would be approximately $2,568,000. Assuming even higher than present costs for other components of an expanded TS system, operating in a national environment, and assuming the addition of such a large leasing fee, the average per student student cost of TS would still be below that of ED, provided that TS enrolled at least 50,000 students (see Klees (1975, Table B.2) for details).

Butman (1972) estimates the cost of constructing a transmission network to be approximately $25 per square mile under optimal conditions. Considering this estimate and the fact that Mexico's area is about 767,000 square miles, the total transmission facility cost for a system covering the whole country would be approximately $26,848,000.* In annual terms, this would amount to $3,152,000.** Without adding the annual cost of operating the system, this amount would still be greater than the rental charge for Channel 2 estimated above. Of course, given that some government transmission facilities already exist, the cost might be lowered somewhat and again, government ownership would also permit the broadcasting of other programming besides TS.

It is difficult to predict what TS's future will be. At issue is whether or not to continue TS and, if the system is continued, whether to conceive of it only as a means for extending secondary schooling to

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*The cost of satellite transmission was not considered in this analysis due to the present low feasibility of such a project in Mexico. Work is already underway to expand the coverage of the government's ground transmission network. However, in the not-too-distant future, a satellite system might become more desirable as total coverage and/or multi-channel capability are required.

**This assumes a 10 percent social rate of discount and a 20 year equipment life.

areas not served by the regular school system or to let it serve urban areas as well. The latter policy would put TS into more direct competition with ED.

If TS were ever to be seriously considered as a complete replacement for ED, a large cost savings could ensue. Given an enrollment of a million students and nationwide coverage, TS's highest probable cost per student would be $143, a 30 percent saving over ED (see Klees (1975, Appendix B) for details). Of course, in addition to cost, there are many other considerations that would enter into such a decision. One crucial consideration is that if the TS system is to remain less expensive than ED, instructors at the secondary level would have to receive the lower salaries currently paid to primary school teachers. Some adjustment could probably be made over time, but such a policy would be strongly resisted by the teachers' union and would inevitably engender harsh political opposition.

Nonformal education. An alternative way to use television to extend secondary education in Mexico might be to reduce TS's ties to the formal school system and to adopt a less restrictive policy with regard to admission and accreditation. With a modified secondary curriculum emphasizing basic subjects such as mathematics and Spanish and with an effective means for supplying students with the necessary textbooks, televised lessons could be broadcast directly to students in their homes or community centers. Students' progress in such a system could be monitored by means of regional consulting centers manned by qualified teachers or by having students periodically mail in samples of their work for correction and evaluation. Such an open instructional system could

be tied to a much less formal promotion procedure wherein students would simply present themselves at the appropriate time for examinations that would be the basis for awarding secondary diplomas.

The problems, however, of creating such systems in Mexico and elsewhere are formidable. The kind of structure needed to insure outcomes that will justify costs are not clear from other systems like the British Open University, since circumstances in each country vary so much. There are a series of basic political decisions about the kind of secondary education Mexico wants and needs for development that must precede any creation of a large-scale open school system. Many of these decisions will be unacceptable to one segment or other of the society. Although it is possible to do an evaluation on an existing instructional system and estimate cost and effectiveness, and even make some reasonable suggestions about growth patterns, the actual path of growth will be taken by the decision-maker who considers both the research results and the political realities open to him or her at the time.

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APPENDIX

BASIS FOR COMPONENT COST CALCULATIONS FOR ED AND TS[1]

A. Basis for Cost Calculations for Ensenanza Directa--1972

Cost Component	Basis
Administration	The administrative costs per student of the system are assumed to be 54 percent of teacher costs. This has been the case for the last five year period on which such data is available, 1961-1965. The source is the report by the Mexican Comision Nacional de Planeamiento Integral de la Educacio (CNPIE (1968)).
Classroom Teachers	A full-time teacher equivalent (there are few full-time teachers) is assumed to work 30 hours per week at $10 per week-hour per month. With an average class size of 50, we can compute an annual teacher cost per student of $24.
Facilities	An untitled Federal District report that estimates public expenditures for September 1968 to August 1969 showed a cost per equipped secondary school classroom of $18,800. This

[1] When specific references are not given, cost estimates were based on untitled documents of the DGEAD and/or conversations with appropriate DGEAD personnel.

Cost Component	Basis
	was annualized over a 20 year period and spread over an average class size and average classroom utilization rate of 1.5 (i.e., half the schools were on double session).
Student Costs	The costs of books and notebooks were estimated at $24 per year, and the cost per uniform at $4 per year.

B. Basis for Cost Calculations for Telesecundaria—1972

Traditional Component	Basis
Administration	The total administrative cost for 1972 was $168,000 and this is assumed to vary with the number of students in the system. Given about 29,000 students in the system in 1972, we can compute the annual administrative cost per student at $5.60
Classroom Teachers	Assuming a full-time teacher [illegible] and an average class size of 33, we can compute an annual teacher cost per student of $88.
Facilities	Survey data showed an average construction cost of $4,160 per classroom and annual rental of $192

Traditional Component	Basis
	per classroom per year. We assume a twenty year life and that half the classrooms are constructed and half are rented (actually this overstates the cost because less than half are constructed and many are donated). Average class size is again 23 students from which an annualized cost of $11.92 per student per year can be computed. Because of the aforementioned overstatement, it is assumed that this figure includes maintenance.
Student Costs	The average cost of books is less for the TS system ($16 per year) than for ED. Adding a $4 cost per uniform per year yields an estimate of $20 per student per year for this category.

ITV Component	Basis
Production	
Personnel and Administration	The cost for 1972 as estimated by DGEAD personnel was $220,000.
Teleteachers	Teachers are paid on an hourly basis at $10.40 per week-hour per month and receive 7 hours teaching credit for each program they teach. Given that about 100 programs are produced each week over a 38 week school year and that DGEAD adds about $16,000 annually in bonus pay, we can compute a yearly cost of $104,000.

ITV Component	Basis
Studios	There are four studios built at a cost of about $32,000 per studio, and their cost is annualized over a twenty year life to arrive at an estimate of $15,200 per year.
Studio Equipment	The total cost of existing studio equipment was computed at $204,000 and was annualized over a 10 year life to arrive at a yearly cost of $49,600.
Video Tapes	The present stock of about 1,500 hour length tapes, costing $240 per tape, was allocated over a 12 1/2 year period, which assumes a utilization rate of about 120 tapes per year (i.e., 10 percent of programming is taped).
Maintenance	This cost was estimated in 1973 by DCEAD personnel at $120,000.
Transmission	
Operations	This is based on an allocation of the operations cost of a system of the same size and power as Channel 5. The cost of transmission equipment is estimated at $2,112,000. Forty percent of operations costs are allocated to TS, with operations cost-estimated as follows: 5 percent of facility cost per year for maintenance + $105,600 for power and utilities. To this 40 percent allocation is added the cost of two full-time

ITV Component	Basis
	personnel at $4,000, yielding a total annual cost of $52,000.
Reception	
Receiver	The price of the television set is assumed to be $280 (somewhat high so that it includes the cost of the antenna) annualized over a five year life. Ten percent of purchase price is added to include costs of maintenance and power. With an average class size of 23, we get an annual receiver cost per student of $4.80.