PN-ABD-168
62602

GUIDELINES FOR PRELIMINARY APPRAISALS OF CAPITAL PROJECTS

PART II - EDUCATION PROJECTS

Prepared for

AGENCY FOR INTERNATIONAL DEVELOPMENT
Under Contract AID/csd-2583

by

ROBERT R. NATHAN ASSOCIATES, INC.
Washington, D.C.

April 1971

GUIDELINES FOR PRELIMINARY APPRAISALS OF CAPITAL PROJECTS

Part II - Education Projects

Prepared for

AGENCY FOR INTERNATIONAL DEVELOPMENT
Under Contract AID/csd-2583

by

ROBERT R. NATHAN ASSOCIATES, INC.
Washington, D.C.

April 1971

CONTENTS

FOREWORD..... 1

I. INTRODUCTION..... 2

II. PERSPECTIVE FOR THE PROJECT: ITS RELATION TO MACROECONOMIC, POLITICAL, AND CULTURAL FACTORS AND TO SECTOR AND MANPOWER SURVEYS..... 6

Macroeconomic Factors..... 6
Political and Social Goals..... 7
The Importance of the Sector Study.....8
Other Important Background Considerations..12
Use of Manpower Surveys and Their Relation to the Educational System and the Incentive and Demand-Supply Structure for Graduates.....13
Lack of Sector or Manpower Survey.....14

III. IMPORTANT FACTORS AFFECTING THE FEASIBILITY (PRELIMINARY VIEW) OF THE PROJECT.....16

Social and Institutional Factors: National Education Policy.....16
The Parent and Student.....17
Other Key Factors.....18

IV. STEPS IN PRELIMINARY APPRAISAL.....20

Projection of Need.....20
Formulation of Alternative Physical Resource Flow Plans.....21
Pricing the Project.....23
Measuring the Cost of Education.....27
Selection of the Most Promising Alternatives.....31
Computation of Net National Rate of Return.....31
Sensitivity Analysis.....38
Evaluation Summary.....39

FORWORD

The project analyst using these guidelines should first read Part I, General Guidelines. It provides insights into key considerations for preliminary project appraisals (PPA's) in all sectors, with a detailed discussion of the methodology for calculating the internal rates of return and other relevant measures of the worth of a project.

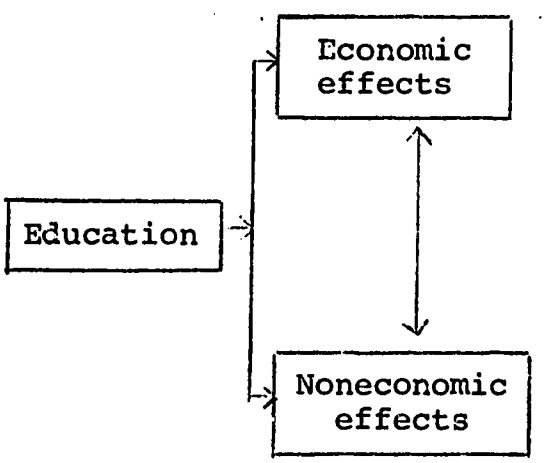
These guidelines deal expressly with those matters relevant to education. They tell the analyst how to think about a project in education; what to look for; and how to assure consideration of all elements essential to a project. They suggest institutional, cultural, political, and other factors which can weigh heavily on a project. They encourage concentration on big issues in broad orders of magnitude, leaving details and matters of lesser importance to be explored later, possibly in a feasibility study.

I. INTRODUCTION

The objective of these guidelines is to provide a basis for preliminary appraisals of projects in education.

The main consideration is that education fit the future nature and purposes of society. Educational projects can be valuable simply because they produce educated persons. They can also help to create more economic wealth. The PPA seeks to measure whether they will do so.

Economic and noneconomic matters interact with each other. The goal of adult literacy may be desired because it is seen as desirable in itself, because it is a way of achieving greater national unity, or because it will have economic effects. This relationship is sketched below:



If the PPA succeeds in calculating the rates of return on investments in education, returns can then be compared with returns from investments in other sectors or returns in other forms of human capital.

The analyst might well feel that there is something artificial in the division between economic and noneconomic benefits in education; indeed, he would be right. However, some choices

must be made between one project and another; they cannot all be financed. Consequently, insofar as one can put even a tentative measure of worth on the value of an educational project, it is important to do so. One can still allow faith in noneconomic, nonmeasurable benefits to push a project with a lesser or uncertain return ahead of a project with a higher one.

It is not too difficult to measure the costs of providing educational services. Costs are incurred by parents, by students, and (typically) by governments. For parents, costs include such elements as additional expenditures for clothing, food eaten outside the home, transportation, and books and supplies necessitated by school attendance. For the student, the principal cost is the earnings he might receive if he were not attending school. The government supplies teachers, administrators, supplies, physical plant and equipment, heat, electricity, etc. In private schools, a much larger portion of the costs will be borne by parents, students and sponsors. As noted in a later section, insofar as the private rate of return from educational projects is concerned, parents and students can assess these costs against the value they place on the private benefits.

All of these costs must be included in the appraisal of a particular project -- regardless of who pays the costs -- if the project is to be evaluated from a net national rate of return viewpoint. Fortunately, most of the costs (inputs) can be valued in a straightforward manner, as they involve market transactions at prices that can be determined. When necessary, prices can be adjusted to obtain more accurate measures of real costs. The one cost that cannot easily be figured by quoting the market price is that for the income lost while the student is attending school. This requires an estimate which should be based on the actual reduction in output attributable to the student's absence from the labor force.

The valuation of outputs of educational projects is not so simple; when education is publicly provided on a free basis, the task is especially difficult because the analyst will not have the amount of fee paid (plus other costs borne by parents and students) as a measure of the minimum value to the parent and/or student.

Insofar as education contributes to increased productivity, and insofar as higher earnings measure this additional contribution to output, a basis exists for estimating the economic value of educational output. That there are other, perhaps more significant, values arising from education is not questioned.

A better-educated populace may facilitate the achievement of national unity, produce greater works of art and literature, and contribute in other ways to the enrichment of human life. However, in the appraisal of educational projects these guidelines offer no technique for the quantification and valuation of such benefits.

Nevertheless, the analyst can exercise a useful role even if the total benefits of educational projects elude measurement in terms common to other projects: he should prepare least-cost alternatives to meet the needs of specified educational projects, however it has been determined that such projects are to be undertaken.

Project proposals in education attract support for two basic reasons. The first is the human desire for learning and the political imperative to respond to it. The second is the recognition that economic growth requires an increasingly educated and informed population. The PPA should determine whether the resources to carry on a project in education will be available and whether they can effectively be gathered and administered. It should also determine the relative gains to the national economy from the use of scarce resources in the educational project rather than in alternative investments. And, insofar as quantification and valuation of benefits permit, the potential contributions of alternative educational projects should be assessed.

Project possibilities in education have few limits. Obviously it is not possible in these guidelines to chart the way through a PPA for every possible project. Effort is therefore concentrated on developing a way of thinking about a PPA and on impressing the analyst with the need to identify and test vital matters regardless of whether the project involves bricks and mortar, institutional reforms, or the training of skilled minds and hands. An inquisitive approach is necessary for an effective PPA.

Since reservations bordering on skepticism may surround a rate-of-return calculation for a project, the PPA should emphasize the least-cost way to achieve a stated objective. Then, if a project moves ahead because decision-makers want it to, regardless of rate of return calculations, at least the project will be done efficiently. The PPA should, therefore, give much attention to the least-cost concept (see General Guidelines, chapter IV).

II. PERSPECTIVE FOR THE PROJECT: ITS RELATION TO MACROECONOMIC, POLITICAL, AND CULTURAL FACTORS AND TO SECTOR AND MANPOWER SURVEYS

Macroeconomic Factors

No project, however small or however difficult the measurement of its benefits, can escape the impact of macroeconomic factors, and this is true even for projects in education. It is a fact that opportunities for educated persons greatly depend on economic growth, for it will substantially determine the demands for educated persons. Moreover, the resources consumed elsewhere determine the resources available for education and for the project. The project should, therefore, try to identify the demographic and macroeconomic factors most likely to affect the project. Among these are:

- Population changes by age, sex, and location
- The growth in gross national product and in per capita income
- Regional development plans within the country requiring basic new facilities in education
- The development strategy of the country
- The development needs in other sectors which will shape the funds available for education
- Demands generated by other sectors for persons of both general and specialized education
- The foreign exchange and exchange rate policies that will affect import costs of items required for alternative educational projects
- Tax and price policies that can affect the availability of total funds and the cost of items required for educational projects
- Credit costs and availabilities

- Imbedded programs in education and in other sectors needing educational aids that require current and future budgetary and resource allocations

- Sectoral emphasis that will emphasize the need for vocational training in certain fields.

The PPA should determine whether the project has adequately considered these and other macroeconomic factors.

Political and Social Goals

Projects in education are uniquely sensitive to cultural mores and values and to the political and social goals of the country. Does the project proposal deal with such matters as:

- Religious customs and goals

- Goals for furthering national unification

- Goals for achieving greater equality of opportunity among various segments of the population

- Identification and development of the full potential of children with outstanding ability and talents

- Role of the tribal leaders, of the matriarch or patriarch

- Regional and tribal differences

- Evidence of the society's adaptability to forces of change and methods for reducing clashes between the old and the new.

Here, again, are factors that will affect the project. Have they been adequately probed? Are there still others to be considered? Were these other factors examined by experts?

The Importance of the Sector Study

Ideally, any project in education should have emerged from a sector analysis because each layer of education makes sense only insofar as it is linked to other layers; e.g., a secondary school project must be related to the primary schools that precede it and to the activities of the students that graduate (college or otherwise). Moreover, a sector analysis should relate the projected outputs of the educational system to the other activities of the society. The sectoral analysis will also have set forth overall objectives and the strategy for meeting them; resources, needed and available; and considered systems, including management and information systems, for controlling costs, improving efficiency, and monitoring progress. If all this has been done, then the PPA will surely have available from the sectoral analysis such useful data as the following:

Past Data

- Data on literacy by age and sex group
- A time series of the number of students in schools of various kinds, capital expenditures, and operating costs (see table 1 for illustrative format for operating cost; a comparable table can be drawn for capital expenditures)
- A description of curricula of the various schools
- Statistics on enrollment attrition in various schools and localities, and the reasons for such (see table 2 for illustrative format)
- Data on repeats in grade
- Data on teacher-student ratios, numbers of teachers, existing training schools
- Expenditures on inputs and outputs (school leavers and graduates) of educational projects
- Data on employment gained by students
- Analysis of major problem areas.

Table 1. Enrollment and Operating Cost of Education

	1966		1967		1968		1969		1970	
	Number	Total cost	Number	Total cost	Number	Total cost	Number	Total cost	Number	Total cost
Primary school										
Basic cycle, secondary										
Other secondary										
Military										
Commercial										
Elem. teacher										
Secretarial										
College prep.										
Higher educ.										
General studies										
Teacher train.										
Social service										
Nursing										
Agriculture										
Economics										
Law										
Denistry										
Pharmacy										
Sciences										
Other										
On the job (by specialty)										
Total										

Table 2. Enrollment in the Educational System, Private and Public, and Attrition from Year to Year, 1966-1969[a]

Classes finishing sixth grade in various years	Year of school							
	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Total
1969:								
Number of entering students.	95,372	50,994	34,876	23,384	17,791	14,677	7,698[b]	
Rate of attrition.....		.47	.32	.33	.24	.18	.48	
1968:								
Number of entering students.	95,350	48,108	32,458	21,357	16,710	13,923	7,392	
Rate of attrition.....		.50	.33	.34	.22	.17	.47	
1967:								
Number of entering students.	93,287	44,948	28,612	18,655	14,390	12,065	5,635	
Rate of attrition.....		.52	.36	.35	.23	.16	.53	
1966:								
Number of entering students.	68,376[c]	34,869	23,099	15,358	11,880	9,988	4,962	
Rate of attrition.....		.49[c]	.34	.34	.23	.16	.50	
Total.....	352,385	178,919	119,045	78,754	60,771	50,653	25,687	
Cumulative total.....	352,380	531,304	650,349	729,103	789,874	840,527	866,214	
Average rate of attrition....		.49	.33	.34	.23	.17	.49	
Attrition of those starting..		.49	.17	.11	.05	.03	.07	
Cumulative attrition of those starting.....		.49	.66	.77	.82	.85	.92	

a/ Basic figures were taken from a report on the schools in a Central American country.
b/ Based on 1968 rate.
c/ Estimated on basis of average for available years.

Projected Data

A thorough analysis can provide guidance in converting relevant past trends and projections of manpower needs into a statement of educational needs and costs for the future 15 or 20 years:

- Estimates of the number of "graduates" by type and grade required to meet the projected goals of the society
- The time gap that exists between the total required graduates and the estimated numbers of such graduates available from the existing and scheduled supply. This gap would be expressed as a phased requirement for a flow of students and graduates
- Projected structure of the educational system (see table 2 for format)
- Adaptability of various types of graduates for different positions
- Projected policies on tuition, stipends and other measures that affect student selection and retention (student merit, parents' means, etc.)
- Degree of fragmentation of skills that is projected for various activities, with the type of training and numbers that correspond to such fragmentation (e.g., paramedical personnel, engineering associates)
- Regional physical emphasis (rural versus urban)
- Orientation of general curriculum (agricultural, commercial, industrial, general)
- Policies on education for ethnic, linguistic, tribal, religious, or racial groups
- Decisions concerning reliance on national or international training resources

- Deficiencies in the present educational system which are to be corrected

- An inventory of existing teaching facilities.

A sector analysis will have tentatively identified candidates for project assistance -- capital projects, changes in policies, training programs, etc. Indeed, the PPA may be concerned precisely with a project identified in the sector study. Since each project in education is closely linked with the next, it is important that the project proposal clearly establishes what these links are. One of the important values of the sector analysis is that it shows what these linkages are.

Other Important Background Considerations

Before proceeding with a project, the project analyst has an obligation to ask whether the correction of deficiencies in the existing system merits priority over the establishment of a new project. In proceeding with the new project, he should be especially alert to designing the proposed project to remedy inadequacies that are characteristic of existing activities. Too often new schools are built, more textbooks are made available, and more teachers are trained, while the existing plant is underutilized or undermaintained or teachers are unemployed or utilized far below their skill level.

An important factor that will govern projects in education is what might be called "style." Perhaps the chief element in style is the extent to which the student is expected -- and is given opportunities -- to exercise initiative. This in turn affects the need for materials, the adaptability of students as workers, and teacher-student ratios, particularly at higher levels. Aside from the potential savings in cost, a style of teaching which relies on student initiative can improve the potential of the labor force very substantially.

It will be a rare project, indeed, that can be justified solely on the basis of the bricks and mortar or equipment required. What activities elsewhere gave rise to the need for the improved facility? How will the better minds and skills created be utilized? What consumption and capital values depend

on better minds and trained hands? For a PPA in education, it is essential that the project's backward and forward ties to other projects in education and to other sectors be described. Particular attention must be given to the relevance of education to the known needs of society. Will the students emerging from schools be trained to handle jobs that are unfilled? Or will the education to be provided alienate students from the types of employment opportunities most likely to be available?

In carrying out a sector manpower study and projecting need in education, there are two extremes to be avoided. The first extreme is to underestimate the educational requirements of occupations, counting on greater learning and adaptation taking place on the job than can reasonably be expected. The other extreme is to overestimate the educational requirement for various projected occupations by counting on schools to provide personnel with ready skills. The latter extreme requires greater expenditure on education than is necessary and may fail to turn out graduates that are adaptable.

In discussing the linkage of schools and training with required skills of occupations, one authority warns against an existing bias toward overestimating the required schooling for specific occupations, such bias being particularly characteristic of experts from developed countries. "Few planners, one suspects, have any realization of how adept employers are in utilizing half-trained men. Gearing plans for schools precisely into estimates of needed skills fosters the very rigidity that would prevent flexible adjustment by workers to changing economic circumstances."1/

Use of Manpower Surveys and Their Relation to the Educational System and the Incentive and Demand-Supply Structure for Graduates

Because sector analyses often do not exist or are incomplete, special manpower studies may have been undertaken that

1/ United Nations, Educational, Scientific, and Cultural Organization, International Institute for Educational Planning, The Social Context of Educational Planning, prepared by C.A. Anderson, 1967, p. 17.

will reveal information vital to a PPA. They seek to relate the output of the educational system -- "graduates" -- to various occupations in the following ways:

- Schooling and training that has been required for various occupations
- Incentives and costs that exist for various occupations, including the cost of education and training and the increase in earnings that may be derived from education
- Shortages and overages of past "graduates" of various kinds in terms of potential occupations and their relation to incentives
- Degree of adaptability of past "graduates," and indications of needed changes in curriculum that will make future "graduates" more adaptable and capable of greater earning power.

These censuses represent limited attempts -- less comprehensive than those in sector surveys -- to relate outside factors to factors that are the responsibility of educational authorities. If a sector survey does not exist, the special manpower survey is a much-needed second best.

The PPA should examine whether the project proposal or the sector or manpower survey unheedingly projects the future from past data. In developing countries many emerging activities, particularly in education, will have to differ substantially in scale and nature from past activities. Changes in economic growth rates, kinds of economic activity, and social systems create new, untested demands for educated and trained persons. Historical relationships may thus be no heralds of the future. However, the past may reveal systematic weaknesses that are relevant for an appraisal of the project.

Lack of Sector or Manpower Survey

If neither a sectoral study nor an educational manpower survey is available to serve as background for assessing an educational project, or if what is available is inadequate,

there are a number of ways a preliminary appraisal can be carried out. First, the scope of work that has been given to the analyst may provide specific guidance. Such guidance may assert that a strong and urgently felt need exists. The analyst is therefore called upon for a PPA that concentrates on the least-cost approach to the project, with some leeway granted as to quality. The analyst would formulate and evaluate the various least-cost solutions to meet the stated needs, using the procedures for determining the least-cost alternative described in the General Guidelines.

When the scope of work does not give such specific guidance, the need for a project may still be urgent and manifest in the light of stated government policy. In this case the analyst could proceed on a similar basis, in effect creating his own scope of work with confidence. But in other cases of a priori demand favoring the project, the project analyst will have to determine such key matters as occupational needs to be filled, foreseeable changes in required skills, factors affecting parent or student motivation, and other factors -- particularly those pertinent to the locality where the project is to occur -- that will influence its success.

III. IMPORTANT FACTORS AFFECTING THE FEASIBILITY (PRELIMINARY VIEW) OF THE PROJECT

Projects in the educational sector cannot be judged feasible or infeasible on the basis of any single simple test, either economic or physical. A number of tests are needed. For the PPA, the tests can be more limited than those for the detailed feasibility study. However, it is vital to assure that key elements affecting the project are taken into account.

Social and Institutional Factors: National Education Policy

Nothing is more important to education than the government's attitude and actions toward the essential elements of the project. Is the prospective project compatible with the government's expressed or implied educational policies and objectives? The essential elements will vary among projects, but the following elements (and others) are indicative of principal matters that should be considered in appraising the project.

- Institutional arrangements for control of the type of facility and the sources for continued financial support of the activity
- Scale of educational activities that government authorities contemplate and provide for
- Student-selection criteria for domestic institutions and for study abroad
- Goals on language use, particularly where multilingualism is a problem
- Orientation toward continuing research and evaluation of the existing educational system
- Means for involving political, tribal, religious, and other power influences in the shaping and execution of educational programs
- Degree of openness to innovation in teaching techniques, teaching arrangements, and curriculum

- Prestige and influence of senior officials assigned to the educational field

- Assurance of funds to maintain and operate the facility for the life of the project, including necessary supplies; assurance of funds and administrative policies to train and retrain teachers necessary for the project

- Availability of funds to support policies on student selection (tuition grants, stipends, etc.)

- Willingness and ability of government to bring the required infrastructure to the countryside

- Grant of flexibility to educational leaders to modify the curriculum in accordance with changing requirements in the society

- Requirements that projects in all sectors specifically identify training and educational requirements

- Legislation and regulations to assure that those agencies which control funds and have jurisdiction over personnel appointments will work with and not against the project

- A voice in the principal planning councils of government for a representative of the educational sector.

The Parent and Student

Education begins almost completely under the control of the parents and relatives of the child, and remains so for a long time. Have sociologists and anthropologists looked into the attitudes of parents in the community toward the project?

- The content and orientation of the curriculum may have to be modified to make the project more acceptable to the parents and students.

Adjustments may be needed to account for local, religious, or ethnic customs on food, clothes, language, or on other aspects of the culture. Do the modifications seem apt and acceptable to the country?

- Does the project recognize and respond to parental attitudes towards the apparent economic opportunities that are available as a result of schooling? Does the project seek to prove to parents that their investment in education will pay off? If so, how? Does the project go so far as to seek assured job opportunities for graduates?

Other Key Factors

Many of the factors already described that will shape the project and condition its success are external to it. There are other important matters having a direct bearing on the feasibility of educational projects. These include the factors discussed below.

Student and Teacher Availability

The PPA must assess the degree of assurance that can be attached to the estimated number of suitably qualified students available for attendance. Population density, family and religious considerations that may hold children on the farm, and transportation problems are only a few of the matters that should be considered in assessing likely attendance. Furthermore, there should be some assurance that conditions for learning (nutrition, time availability, health, financial support) will be sufficiently favorable to attract students.

The availability of suitable teachers is sometimes mistakenly assumed. Candidates may not appear because such conditions as pay, location of jobs, hours and working conditions, and competing seasonal demands (particularly in rural areas) are such that potential teachers turn to other employment.

Size and Location of Project

Accessibility to students and teachers may have an important bearing on both the size and location of the project. Economy of a larger sized unit must be weighed against the cost and convenience of transportation and possibly the cost of residence dormitories.

Weather and Other Seasonal Factors

The physical characteristics of the plant should be influenced by climate and other environmental factors. In some climates relatively inexpensive construction can be quite adequate. Weather will influence the need for transportation and may also affect the school calendar. The latter will also be influenced by peak labor requirements in agriculture as well as by holidays.

Health and Nutrition

Does the project give adequate attention to these aspects of student welfare? Are measures necessary to prevent undue absenteeism and the spread of disease through the student body? Is the provision of food a necessary condition for attendance?

IV. STEPS IN THE PRELIMINARY APPRAISAL

Project preparation and appraisal consist of the following:

1. Identification of need for project and category of project
2. Formulation of alternative physical resource flow plans
3. Pricing the project
4. Selection of the most promising alternatives
5. Computation of rates of return
6. Sensitivity analysis of rates of return
7. Evaluation summary.

While the above can be discussed as discrete steps that will occur in the stated order, it should be recognized that in the course of carrying out these steps there will be considerable interaction. For example, in carrying out step 4, the analyst may find that other alternatives suggest themselves, so that he may find it necessary to return to step 2.

Projection of Need

The scope of work for an educational project will generally specify the population to be served and the nature of the education to be provided. A scope of work for a project may be derived from a sector study, a manpower survey or a total educational plan, or it may be an ad hoc solution to a "felt need." If a scope of work is not provided, the project analyst will have to develop one appropriate to the objective. To the extent that data ordinarily available from a sector study or a manpower survey are not available, the project analyst must collect such data on his own. As an absolute minimum, he must determine the extent of the need to be met by the proposed project. In addition, he must also determine the approximate budgetary limit on capital and current expenditures that the project must adhere to.

It is important to specify as precisely as possible the output that is needed, i.e., that capabilities that are desirable for students to acquire. The latter will be very dependent on the employment opportunities expected to be available.

Formulation of Alternative Physical Resource Flow Plans

Based on the needs identified, the project analyst will formulate promising physical resource flow plans. These flow plans must reflect some of the key considerations previously discussed, such as social and institutional factors, desires of parents and students, weather and other seasonal factors, and health and nutritional considerations.

Instructional Methods and Curriculum

Are institutional methods and the curriculum relevant to needs? What is the basis for the judgment? Has adequate scope been given to the use of mixes of teachers, audiovisual aids and other equipment, programmed instruction material, and correspondence course procedures? For example, for secondary schools in sparsely settled areas, expensive busing services and teacher costs might be reduced very substantially by greater reliance on self-study at home or in the resident village. The scope for self-study is probably greater in developing countries than in others because the possible and necessary selectivity of the student body is far greater.

Television is a new but fairly expensive medium for instruction. Experience has shown that the use of TV requires a highly trained, well-paid staff in addition to regular teachers and staff. There is also a cost for equipment, maintenance, and operation. However, with the use of TV cartridges and the availability of prepared courses, the economics of educational TV may change radically.

Intensity of Use of Physical Plant

To reduce the capital costs of education, the multiple use of the educational plant should be examined. Does the

project examine the possibilities of double shifts or of a facility so designed that it can accommodate youngsters during the day and adults at other times, with equipment suitable for each?

Search for Alternatives

Does the project specifically address the issue of ways in which the project can be made less costly and can be modified to increase the value of its output? Comparisons among alternative forms of the project are needed, with the rate of return on the difference flow as a criterion for choice. Some alternatives that should be explored are

- Orientation of curriculum

  -- Rural versus urban
  -- General versus specific

- Large versus small school

- Schooling versus on-the-job training

- Adult education in addition to child education

- Indigenous college versus college abroad

- Teacher qualification for various levels

- Types of buildings

- Reliance on volunteers or peers

- Methods of selecting students

- Teacher-student ratios.

In the shaping of promising project alternatives, action coordinated with the needs of other sectors is called for (e.g., a change in curriculum consistent with local on-the-job training, the creation of curriculum coverage consistent with skill required in specific fields).

A factor that should be given close attention is that of enrollment attrition and its causes. Such attrition deserves close attention not only because it increases the cost

per graduate, but because it can also provide important indications regarding the adequacy of curriculum and the effectiveness of teachers. The attrition rate may also reflect significant external obstacles, e.g., difficulties in access to school attributable to location or inadequate transport, family income constraints, etc.

The possibilities for projects are limitless, and the factors internal to the project will vary greatly. It is simply not possible to list here the many factors internal to a project that will influence its success. The essence of the PPA must be an examination of what is represented as the case for the project; the depth and quality of supporting evidence; the range of factors considered; the extent to which experience in the country and elsewhere has been drawn upon; whether generalized facts and opinions have been used in place of specialized expertise; and whether alternatives to achieve a given purpose have been examined.

Pricing the Project

Conversion to Value Flows

At this point in the PPA it is important for the analyst to be familiar with the pricing procedures described in the General Guidelines. In educational projects the parent-student interest would focus on out-of-pocket costs (at market prices) and foregone opportunities (at market prices). The ministry of education would be interested in market prices for budgetary purposes, but for national evaluation pruposes (NNRR) it would make use of shadow or accounting prices for inputs and outputs.

Delineating the Scope of the Project

It is necessary to determine what is embraced within a project. For a privately owned project (e.g., a shoe factory), the project embraces whatever must be paid for and whatever is received in payment. Looked at from a national point of view, the project coverage may be quite different. The project embraces whatever resources are consumed to make the project possible and whatever benefits are realized, no matter who pays the costs or receives the benefits. Also, because projects in education are almost totally publicly financed, these

guidelines require that account be taken of all costs, both those privately and publicly borne, and all benefits as well.

Guidance follows on how to delineate a project in education so that its coverage corresponds to the national viewpoint just described. (See chapter III of the General Guidelines.)

Parents and students pay for some of the costs of education. There will be current costs for tuition, etc., and another cost in the form of earnings foregone by the student while he is attending school. The rate of return on the individual's investment in education can be calculated in the same manner as later described in this document for the nation's investment -- the notable difference being that the individual would calculate his costs and earnings at market prices instead of at the factor prices relevant for the net national rate of return.

Costs

- The project must be charged with all costs internal to it. They should be divided between capital and current costs -- the bricks, mortar, laboratory equipment, salaries, current supplies, etc.

- The earnings foregone by students are a cost of the project. However, these earnings should be shadow priced. (See later discussion and General Guidelines, appendix B and chapter III.)

- It must also carry the costs of infrastructure -- roads, power, etc. -- expressly created for the project (perhaps a power plant or a road to some school or laboratory). If the infrastructure was to be created anyway, the capital costs can be ignored, but the charge for purchased services must be included.

- Similar decisions must be made on matters such as school lunches or health activities which may be part of the school program. In general, if these activities provide a kind,

quality, or quantity of good or service which would not otherwise be provided, the cost should be included as part of the educational package. For example, if the society would not feed the child except for his promise of greater productivity when he is provided with education, these ancillary costs would be part of the cost of education.

- There may be investments that serve more than one project or purpose; for instance, a printing press that publishes school texts and other material not related to the educational project. If the cost of the press can be justified only insofar as both tasks are served, then all costs associated with the second task must be allocated to the other project.

Establishing the Cost for Project With Noneconomic Benefits

A country may propose an educational project because of noneconomic considerations. For example, society may prize persons with cultural skills or talents (religion, music, dance, poetry). Students can be oriented toward healthier personal hygiene and better nutrition; they can be given a sense of national unity; and they can obtain greater personal confidence and a disciplined attitude toward work (punctuality, responsibility, etc.).

For projects totally or substantially justified by noneconomic benefits, the project should find the least-cost (in net national terms) form of the project and should make clear what the cost is. It will generally be advantageous to determine the cost of such projects at various scales or levels of service and meaningful qualities. The means of so doing are described in the General Guidelines (chapter V).

For this purpose the opportunity shadow cost of capital must be assumed. What is the basis used in the project for the selection of that rate? Common errors are to assume that it is the price at which the government borrows money or to consider it costless if it is received as a grant. Concessionary interest rates are not the proper basis for setting the opportunity

cost. If the same resources required for the project could be employed at a higher rate of return in some other activity, it is that higher rate of return which should be used in the least-cost calculation for the educational project.

Benefits

In a consideration of benefits, natural counterparts to costs appear.

- In measurable economic terms, the increased earnings accruing to educated persons will be considered as benefits. The method of measuring these increased earnings is discussed later.

- Another benefit is the value of the services rendered to other activities benefiting from the infrastructure specifically created for the project, e.g., farmers' use of a rural road leading to and built expressly for a school. The increased output or higher price estimated for the farm product is the relevant benefit.

- Identifiable benefits from improved health and nutritional services and supplies are another benefit.

- The output of a separate but intertwined activity (e.g., printing) should also be considered.

The increase in earnings of educated persons compared to those of persons without education is a reliable indicator of the value of benefits when it is determined by market forces. To the extent that present and prospective educated persons receive payments that result from nonmarket forces, earnings may overstate the benefits of education. This qualification is particularly relevant where earnings are determined by family, racial or political connections or by class status, and where the level of earnings is set by administrative government action.

A subjective description of the noneconomic benefits of a project is properly included in the PPA.

Measuring the Cost of Education

As previously discussed, there are essentially two types of costs that are incurred by a nation in providing education. One obvious set includes expenditures for facilities, materials, and teachers' salaries, among other things. The other and less obvious cost is that of the national production that is foregone while students are in school. Does the project proposal recognize these twin costs? How does it go about measuring the latter in particular?

Production Foregone

While people attend school they may have to forego jobs. If there is not a surplus of labor, some sacrifice of production will result from the withdrawal of workers from the labor force, or their delayed entry into it, because of school attendance. This loss in production is a cost to the nation of providing education, a cost that should be weighed against the increased future productivity of an educated, trained (or more easily and quickly trainable) worker.

However, if students would be unemployed if they were not attending school, or would be replaced by otherwise unemployed workers of equal productivity, there would be no loss of production. If the students would be replaced by workers of somewhat lower productivity, the cost of education would equal the productivity of the students less the productivity of the workers that take their place. Again, this assumes that there is a job available for everyone, but this is very often not the case.

Practically speaking, labor is abundantly available in developing countries, except for specialized skills. Therefore, considering the rough orders of magnitude valid for a PPA, it is generally not necessary for the project to take into account the marginal productivity of labor in the student's age-educational group in order to calculate the production foregone. However, when the educational project deals with persons of special skills, it would be relevant to do this. The value of production foregone in this case has a special element to it. The shadow price for skilled labor may be <u>above</u> the market price for labor, while the wage of the replacement labor may correspond more nearly to its marginal productivity.

If these conditions are encountered, it may be that some portion of the skilled wages foregone during the educational period should be considered as a real cost in appraising the project. The value of this input can be estimated only in the light of the particular circumstances.

The question of determining exactly what earnings have been foregone now arises. What measurements are used for the project? Hopefully, a sector study will have prepared a schedule somewhat like that shown in table 3. This shows the difference in income associated with age and years of schooling for a person with general education. Ideally, there should be a like table relevant to each project; a generalized table is not suitable to reflect lost wages for a bricklayer, a farmer, and a computer operator.

Direct Costs

In addition to the production foregone, the economy has to commit additional resources to provide the desired quantity and quality of education. There must be direct investment in such long-term assets as buildings and equipment. Recurring expenditures for teachers' salaries, materials and operating expenses are also necessary. Does the project comprehensively and accurately cover and measure such data?

The costs that should be covered in the project were previously discussed under the heading Delineating the Scope of the Project. As noted there, the additional resources required by the project are costs to be covered; costs that the economy would have incurred in any event should not be charged to a project. It is irrelevant whether these additional costs are financed by the individual or public authorities.

How precise are the estimates? The PPA can use rough estimates of costs not based on detailed engineering designs, but what are the apparent margins of error?

The PPA must bring out the basis for cost estimation. Is it based on costs per student in existing and similar educational facilities? Have such current costs per student been adjusted to account for the differences between the project

Table 3. Earnings[a] Per Year by Age and Years of Schooling

Age	Years of schooling				
	0	6	10	12	14
6-7.....	30	--	--	--	--
8-9.....	50	--	--	--	--
10-11.....	75	--	--	--	--
12-13.....	90	125	--	--	--
14-15.....	110	200	225	--	--
16-19.....	120	300	400	600	800
20-24.....	130	400	500	700	1,000
25-29.....	180	500	600	800	1,200
30-34.....	180	500	700	900	1,400
35-39.....	200	500	900	1,000	1,600
40-44.....	200	400	900	1,200	1,800
45-49.....	200	350	900	1,400	2,000
50-54.....	150	300	800	1,300	2,200
55-59.....	100	300	700	1,200	2,400
60-65.....	50	275	600	1,100	2,200

a/ Figures are in units of currency and are illustrative.

under consideration and the existing facilities? It would be meaningless to base cost estimates for a technical school on the actual costs of a primary school.

Estimates of costs per student are best made in terms of:

- Capital outlays for buildings, equipment and site preparation
- Recurring expenditures for teachers' salaries and other operating expenses.

The cost per student derived from such general costs should be calculated for the general class of education that includes the project being investigated. Has each cost component been adjusted to take into account differences between the project and the type of educational activities from which the cost components have been computed? Thus, construction cost per student may have to be adjusted to account for the size and location of the project. Equipment cost adjustments would have to reflect differences in teaching methods. Teaching cost per student may be changed to reflect deviations of the project's student-teacher ratio from the average.

Has allowance been made for the cost of teachers' services that are not included in salaries? Generally the training of teachers is subsidized by free or low tuition, and stipends and salaries are set low to recapture some of this public expense. Thus a teacher might have received a subsidy of $2,000 during a 4-year teacher training course, and his salary during his first 5 years of service therefore would be $400 less per year than it would otherwise be. This $400 would be added to the annual salary of the teacher in deriving the cost from the national point of view.

Benefits of Educational Projects

As stated previously, measurable economic benefits from educational projects are the additions to the nation's output -- measured by the increase in earnings of individuals -- attributable to education and training. This difference could appear as shown in table 3. If possible, the project should present an earnings table relevant to the particular profession or

skill to be supplied by the project. If, for example, satistical clerks are being trained to become computer operators, by how much can their earnings be expected to rise? The PPA should discuss the adequacy of the data used to establish the prospective earnings schedule. Is it based on different trends in demand for workers among industries?

Selection of the Most Promising Alternatives

Within the scope of work provided or derived by the project analyst, there will generally be alternative projects to meet the specified needs. For alternatives that meet the needs equally well, the procedures for determining least-cost alternatives described in the General Guidelines (chapter IV) apply. There is substantial scope for increasing net benefits by trading lower attrition rates for higher out-of-pocket costs per student in attendance.

In addition, alternatives which do not provide levels of service that are as satisfactory may have to be given serious consideration because of budgetary limitations. The project analyst should be alert to these possibilities and should provide the cost of such alternatives to the decision-maker.

Computation of the Net National Rate of Return

In seeking to measure the justification for a project, the analyst should judge the project's worth in terms of the net national rate of return. (See General Guidelines, chapters III and VII). Relevant worksheets for amassing data on costs and benefits and for deriving the rate of return are shown in tables 4 and 5. The proper setting down of costs and benefits is of great importance.

Direct Costs

Table 4 illustrates how the direct costs of education for primary school students could be shown. Cost data could be drawn from the experience of similar projects (with suitable adjustments). These costs would be expressed in terms of their relevant shadow prices (foreign exchange, unskilled labor,

Table 4. Illustration of Cost Estimates for Direct Educational Costs Based on Prototype Information (Annual Cost Per Student Based on Shadow Prices as Applicable)

Direct educational costs	Age of student					
	6	7	8	9	10	11
Building and equipment investment[a/]	30					-24
Supplies and books at public expense	2	2	2	2	2	2
Supplies and books at student's expense	1	1	2	2	2	2
Teachers' salaries[b/]	20	25	30	30	30	30
Miscellaneous	2	2	2	2	2	2
Total current cost	25	30	36	36	36	36

a/ Based on prototype project. Investment is assumed to start the year before entrance to school and the "salvage value" to accrue a year after completion of the sixth year of school. Plant is assumed to have an 80-percent salvage value at the end of the sixth year, reflecting the 18-year life of facility less use (60 percent) per first grades due to the dropout rate (use = 1/3 x .60 = .20).

b/ All payments plus allowance for subsidized training costs.

Table 5. Net National Return on Primary School Graduates for 1,000 Students Entering First Grade

Age	Student retention rate[a/] (1)	Number of students[b/] (2)	Life survival factor[c/] (3)	Total number of graduates[d/] (4)	Labor participation rate (5)	Number of employed graduate workers (6)	Current cost per student[e/] (7)	Total current cost (8)	Foregone earnings per student[f/] (9)	Total foregone earnings (10)	Building and equipment investment[g/] (11)	Difference in earnings per worker[h/] (12)	Total difference in earnings (13)	Total net return flow (14)	Discount factors 12 pct. (15)
Preschool..											-30,000			-30,000	1.000
6.....	.80	1,000			.05		-25	-25,000	-30	-1,500				-26,500	.9454
7.....	.80	800			.10		-30	-24,000	-30	-2,400				-26,400	.8441
8.....	.80	640			.10		-36	-23,040	-50	-3,200				-26,240	.7537
9.....	.85	512			.12		-36	-18,432	-50	-3,072				-21,504	.6729
10.....	.90	435			.15		-36	-15,660	-75	-4,894				-20,554	.6008
11.....		392	.9975		.20		-36	-14,112	-75	-5,880				-19,992	.5365
12.....			.9975	391	.27	106					+24,000	+ 35	3,710	27,710	.4790
13.....			.9975	390	.33	129						+ 35	4,515	4,515	.4277
14.....			.9975	389	.37	144						+ 90	12,960	12,960	.3818
15.....			.9965	388	.40	155						+ 90	13,950	13,950	.3409
16.....			.9965	387	.42	163						+180	29,340	29,340	.3044
17.....			.9965	386	.44	170						+180	30,600	30,600	.2718
18.....			.9965	385	.47	181						+180	32,580	32,580	.2427
19.....			.9965	384	.50	192						+180	34,560	34,560	.2167
20.....			.9944	383	.53	203						+270	54,810	54,810	.1935
21.....			.9944	381	.57	217						+270	58,590	58,590	.1727
22.....			.9944	379	.61	231						+270	62,370	62,370	.1542
23.....			.9944	377	.66	249						+270	67,230	67,230	.1377
24.....			.9944	375	.68	255						+270	68,850	68,850	.1229
25.....			.9935	373	.70	261						+320	83,520	83,520	.1098
26.....			.9935	371	.70	260						+320	83,200	83,200	.0980
27.....			.9935	369	.70	258						+320	82,600	82,600	.0875
28.....			.9935	367	.70	257						+320	82,240	82,240	.0781
29.....			.9935	365	.70	256						+320	81,920	81,920	.0698
30.....			.9935	363	.70	254						+320	81,280	81,280	.0623
31.....			.9935	361	.70	253						+320	80,960	80,960	.0556
32.....			.9935	359	.70	251						+320	80,320	80,320	.0497
33.....			.9935	357	.70	250						+320	80,000	80,000	.0443
34.....			.9935	355	.70	249						+320	79,680	79,680	.0396
35.....			.9924	353	.70	247						+300	74,100	74,100	.0353
36.....			.9924	350	.70	245						+300	73,500	73,500	.0316
37.....			.9924	347	.70	243						+300	72,900	72,900	.0282
38.....			.9924	344	.70	241						+300	72,300	72,300	.0252
39.....			.9924	341	.70	239						+300	71,700	71,700	.0225
40.....			.9909	338	.70	237						+200	47,400	47,400	.0201
													Present value:	+39,286	

a/ Obtained from school records of planning factors.
b/ Column 1 X column 2 of previous year.
c/ Obtained from death rates of country or similar country. Illustrative rates obtained from 1966 UN Demographic Yearbook, table 19, "Death Rates Specific for Age and Sex." Particular survival rates used are derived from male death rates, Colombia, 1951.
d/ For age 12, column 2 X column 3 at age 11.
e/ From table 4.
f/ Earnings for 0 years of schooling from table 3.
g/ From table 4; factor multiplied by 1,000.
h/ Obtained from table 3; difference between 0 and 6 years of schooling.

and capital). See the General Guidelines for suggested ways of estimating and applying coefficients to convert market prices into shadow prices.

Actual Computation of Net National Return

Table 5 illustrates how to calculate the net national rate of return for a project providing children with 6 years of primary school.

For convenience, the computation was carried out for 1,000 students entering first grade. The age of the student is listed on the extreme left so that all variables can be related to it.

Column 1, "Student Retention Rate," is the rate at which students from one class pass on to the next. Thus, in the example, 80 percent of those entering the first grade pass on to the second grade. Such rates and even lower ones are not unusual in developing countries. The main causes of student attrition are socioeconomic reasons, rather than death. Attrition rates of students depend on local conditions.

Column 2, "Number of Students," is the number of students of the previous year multiplied by the student retention rate of the same year. As can be seen from the example, which is not an extreme one, the impact on the number of primary school graduates can be quite substantial.

Column 3, "Life Survival Factor," is determined by the formula: 1 - death rate. The annual death rate, by age group, is given per 1,000 persons for most countries in the United Nations Demographic Yearbook. The death rates used for the example were those for males in Colombia in 1951. For instance, in the 10-14 age group the rate is given as 2.5 (per thousand). The comparable life survival factor for that age group is 1 - .0025, or .9975. Where death rates are high and measures are being taken to reduce them, one might project lower death rates based on the experience of countries that had similar situations some years previously. The United Nations Demographic Yearbook can be very useful in this regard.

Column 4, "Total Number of Graduates," is the estimated number of workers who have graduated from the 6th year of school and have survived to the age given. For age 12 it is the number of 6th-year students multiplied by the life survival factor. For later ages it is the number of workers of the previous year multiplied by the life survival factor.

Column 5, "Labor Participation Rate," is the proportion of persons in the labor force who are employed. In the example it is implicitly assumed that the participation rate for graduates is the same as for nongraduates. If this is not so in a substantial degree, a more complicated calculation is required in which the differential participation rates are taken into account.

Column 6, "Number of Employed Graduate Workers," is the estimated number of workers who have graduated from the 6th year of school, who have survived to the age given, and who are employed.

Column 7, "Current Cost Per Student," is taken from table 4.

Column 8, "Total Current Cost," is column 2 multiplied by column 7.

Column 9, "Foregone Earnings Per Student," is the estimated earnings which students would receive if they were not attending school.

Column 10, "Total Foregone Earnings," is column 2 multiplied by column 5 multiplied by column 9.

Column 11, "Building and Equipment Investment," is based on table 4. It is assumed that a "seat" is supplied to each 1st-year entrant. However, because of attrition as well as an assumed 18-year life of the facility, after 6 years the average investment has been used up by 1/3 x .60, or .20. The .60 is a rough estimate of the average use of seats per entrant over the 6-year period. The figures entered represent the investment for 1,000 entrants.

Column 12, "Difference In Earnings Per Worker," is obtained from table 3 and is the difference between earnings of people with no years and 6 years of schooling.

Column 13, "Total Difference in Earnings," is column 6 multiplied by column 12.

Column 14, "Total Net Return Flow," is the algebraic sum of column 8, column 10, column 11, and column 13.

Column 15, "Discount Factors, 12%," is a list of the continuous flow discount factors which are applied to column 12 to obtain the present value of the total net return flow. If the present value exceeds zero, the return is greater than 12 percent. The discounting procedure should be repeated using a higher rate, perhaps 15 percent; if at the higher rate the present value of the surplus flow is negative, we know the internal rate of return is greater than 12 percent but less than 15 percent. The approximate internal rate can be obtained by interpolation.

A number of approximations in the calculation of table 5 would be satisfactory for most preliminary appraisals (or sector appraisals). However, depending on the country's conditions (death rates, different living conditions of students and educated workers) and the type of calculation (high school or professional school), somewhat different procedures and refinements may be required.

The implied assumption in table 5 is that the same life survival factor applies to students and nonstudents. Because of different living conditions (family, government support, effect of knowledge), in some circumstances the survival factors for graduates could be markedly higher than for nongraduates. In this case a more refined calculation may be necessary (separate life survival rates) or table 5 would underestimate the net national return. In most circumstances this would not be the case, largely because the high death rates lie outside the most relevant ages (6-50).

In principle, column 3 of table 5 should reflect disability as well as deaths. In most instances this would not make much of a difference.

Building and equipment investment (column 9) is clearly an approximation which is satisfactory where, as in primary schools, it is not a large item. For large one-time projects where buildings and equipment bulk large, a more elaborate allowance for building investments (like that shown in the example in the General Guidelines) would be more appropriate, along with more detailed student programming costs and benefits; that is, the calculations would be done in terms of actual students programmed rather than in terms of 1,000 students entering first grade.

Table 5 carries out the calculation for 35 years from the first year (age 6) to age 40. This underestimates the benefits somewhat. Although in principle the calculation should be carried out for the lifetime of the worker, in the illustration the difference will be small, reflecting the fact that beyond 35 years the discount factor at 12 or 15 percent becomes quite small and life survival factors also start decreasing more substantially. Factors that would make longer periods of calculation necessary would be lower discount factors, longer periods of schooling, and longer working lives with peak earnings reached rather late in life. All factors but the first would characterize professionals, so that in general we can say that the more professional the training, the greater need for longer periods of calculation.

For the project illustrated in table 5, at 12 percent, the present value of the net national flow is positive, indicating that the internal rate of return is in excess of 12 percent. If the opportunity cost of capital in the economy is 12 percent or less, the illustrative project represents an <u>economical</u> use of resources in that particular economy. Any benefits other than those reflected in the increased productivity of graduates, as measured by higher earnings, would be in addition to those reflected in the NNRR. Such benefits would include not only the unquantified benefits accruing to graduates and to society at large but also partial benefits accruing to those who left school before the 6th year.

Sensitivity Analysis

Sensitivity analysis should be used in appraising many development projects (General Guidelines, chapter VI). The values placed on the outputs of the project and the cost of inputs may be sensitive to many factors. By judging the sensitivity and the probability of the event occurring, the analyst can present conditional judgments on a project's worth; he can identify key factors requiring more detailed study and in general can seek to guarantee or safeguard the project against some types of risks. For example, if a project's worth would be upset by a failure to have a sufficient number of teachers available, greater emphasis would be placed on assessing the availability of teachers.

Rates of return to educational projects are extremely sensitive to the society's future supply and demand for educated persons and the opportunities for productive employment of such persons. These are reflected in the values provided in table 3.

A project may be sensitive to other developments in the sector or in other sectors. For example, how will the demand for liberal arts graduates be altered by the rate of overall economic growth or by changes in the make-up of the national budget that are favorable or otherwise to the social sectors?

If the demands for the graduates are closely linked to a specific event, such analysis is relevant. Also, if the availability or cost of inputs is highly speculative, further analysis is again called for.

For certain types of educational projects which recur (such as primary schools), the cost limits (such as building and current operating costs) are likely to lie within a narrow range. For such types of projects, one need not be concerned with potential variations and there is no need for sensitivity analysis. For one-of-a-kind projects that are novel for the country, costs are likely to be more uncertain and are therefore more likely to require sensitivity analysis.

Since there is replication over time for many types of educational projects, there is economy in having prototype projects analyzed for sensitivity in a sector study. The project analyst can make use of results from such sensitivity analysis, perhaps modified by special local factors. This can free the project analyst to concentrate on manners in which the orientation and content of the project can give greater assurance of the productivity of graduates.

It may be valid for the project to be subjected to continuing sensitivity analysis, providing for periodic evaluation of previous estimates in the light of current developments.

Once sensitivity has been analyzed, the rate of return on the project should be recalculated, taking into account the likelihood of occurrence of the event that would significantly alter costs or benefits. What begins as a rate of return of 12 percent might then appear as 10 or 16 percent, given certain assumptions on the events occurring.

Evaluation Summary

In accordance with the General Guidelines (chapter VII) an evaluation summary should be prepared in which the major findings are presented for consideration. In the presentation of findings of PPA's in the field of education, it is especially important that the full range of extra or noneconomic benefits be placed before those persons who will make the decision on the project.