MODULE: 3a) Cost-effectiveness in Distance Education
CONTRIBUTOR TO THIS SECTION: Tian Belawati, Universitas Terbuka, Indonesia
UPDATED ON: 31 May 2008
SPONSOR: Pan Asia Networking (PAN) Programme Initiative of the International Development Research Centre (IDRC: www.idrc.ca), under a 2005-08 grant to the Virtual University of Pakistan (VUP) for the project 'PANdora: Distance and Open Resource Access'

This section discusses the measurement of cost-effectiveness in ODL, and gives the particular example of practices at the Open University of Indonesia (Universitas Terbuka: UT). The section is based on a paper by the author to the Forum on Open & Distance Learning: *Revisiting Planning and Management* (Penang, February 2006).

Procedures for measuring educational effectiveness are not as well defined as those for calculating the general costs of running educational institutions. The measurement of effectiveness involves more subjective judgments of 'outcome' and 'output'. The measurement of educational outcomes requires a well-designed procedure and careful controls so that the effects measured are (as far as possible) due exclusively to the educational process. In ODL operations, as throughout the literature of modern educational technology, a major focus of effectiveness studies has been on the question of whether one medium is superior to another. While researchers including Salomon (1979) have shown that the matter cannot be defined so simply, cost-effectiveness studies have persisted in maintaining this approach.

Cost-effectiveness outcomes

Cost-effectiveness assessments typically involve an analysis of the institution as a whole, or of a particular teaching/learning outcome. An university has three main products (Wagner, 1982):

- men and women with degrees;
- research; and
- storage of knowledge and maintenance of cultural standards.

On this basis, the outcomes of an ODL institution in a given period can be defined as including:

- the number of students;
- the number of graduates;
- the number of course materials produced; and
- the amount of research conducted.

Over long periods, ODL products can be defined in terms of graduates' earnings, promotion, and social status. As indicated in *section 2b*, in developing countries such as Indonesia, the use of ODL methods is a political as well as educational issue, for they are expected to provide cost-effective solutions to social problems of equality and access to high-quality education. A subtle additional measure of effectiveness is thus the incalculable value of the ODL system itself. Owing to the non-measurable outcomes of ODL, the value of comparing its overall effectiveness with that of conventional f2f education is therefore debatable.

To measure the effectiveness of learning outcomes due to the use of particular media, empirical research methods are commonly used. These allow the researcher to control the learning condition(s) and to measure, as the learning outcome, the effects of specific treatments. The teaching/learning output can be measured by specific gains in cognitive ability and skill (entry level vs. exit level), the number of papers written, etc. (Wagner, 1982). The effectiveness of specific instructional media can be measured in terms of, for example, the number of students who have access to the media, and the degree of control the students have over the frequency and duration of media usage.

Experimental methods are not without weaknesses, however, for the control procedures they involve can make the learning conditions artificial and unnatural. Bates (1981) suspected two main reasons for the empirical method's lack of success in determining the effectiveness of educational media. Firstly, the researcher may fail to control all variables apart from the main treatment variable whose effect on the learning outcome is being measured. Secondly, experimental methods are often inappropriate in educational decision-making situation. An educational experiment may overlook the potential of a medium to present material in different ways, variables of presentation quality, differences in response by individual students, and the context in which the media were used. In addition, problems of effectiveness measurement over time are encountered, as in the measurement of learning gain. It may be impossible to isolate the specific effects of an experimental treatment from the numerous other effects that can occur after the student has been exposed to the treatment (Wells in Wagner, 1982). The measurement of cost-effectiveness of ODL has to begin, therefore, with a definition of the goals of the analysis, and by identifying the most appropriate outcome indicators for meeting them. The process ends with an estimate of cost-effectiveness in terms of these indicators.

The Open University of Indonesia (Universitas Terbuka: UT) has two main missions: to increase access to higher education for Indonesia's people; and to upgrade teachers' qualifications from high-school to diploma and bachelor's levels. When the minimum teaching qualification was increased to the two-year diploma level in 1990, approximately 1.2 million teachers needed to upgrade their qualifications. As an ODL institution, UT is regarded as the most suitable system for these professionals, because it allows them to complete their education without having to leave their teaching jobs. Since that time, the Diploma II Primary School Education (DII PGSD) has been UT's largest programme; and since UT began offering a full degree in Primary School Education (S1 PGSD) in 2001, some teachers have gone on to take that programme also. The S1 PGSD will also soon become a major programme, for the government has recently raised the minimum requirements for primary school teachers to bachelor's level.

Major effectiveness indicators at UT are therefore the number of students taught and the number of teachers taking the in-service teacher training programmes. Figure 1 shows that the number of active students at UT in the January - March 2006 semester was 287,252, and that almost 80% of this number was teachers taking in-service training programmes. These included 227,853 student teachers, of which 202,321 were primary school teachers in two-year diploma and full-degree (bachelor's) programmes.

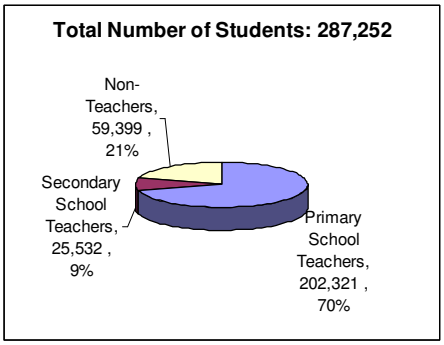

Figure 1. UT's student body (2006)

Figure 2 shows that the total number of UT graduates up to December 2005 was 585,107, of which the largest percentage was teachers (85%).

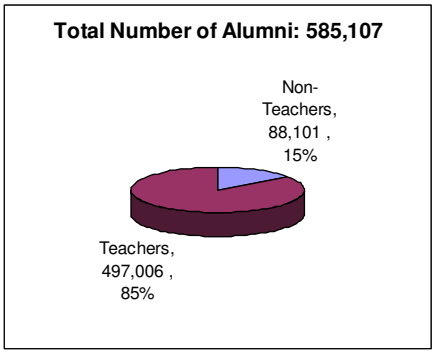

Figure 2. UT's alumni (to end 2005)

Cost-effectiveness and cost-benefit analyses

Cost-effectiveness analysis (CEA) and cost-benefit analysis (CBA) are the most common techniques for evaluating project outcomes (Peterson, 1986). Although both techniques compare the costs and the probable outcomes of an alternative, they differ in terms of objectives and approaches.

Cost-effectiveness analysis (CEA) is a tool for estimating the effects expected from different alternative methods of achieving an objective, especially when the outcomes cannot easily be measured in monetary terms. The usual concern of CEA is not to find out whether the objective being evaluated is economically feasible, but rather to explore how it might efficiently be achieved, and which costs are attached to reaching different levels of the desired outcomes. CEA is therefore commonly designed to include an assessment of several different plans for meeting a specified objective that is assumed to be worthwhile. The results of a CEA usually take the form of comparisons between the effects of a plan or course of action and the costs of specified alternatives. To conduct a CBA, the probable outcomes must be estimated and calculated in terms of their 'dollar' values. In a CBA, all tangible and intangible phenomena are based on estimating and comparing the total costs with the total benefits. The objective of CBA is usually to determine if the project being evaluated is economically feasible.

According to Peterson (1986), a CEA involves three approaches.

- Constant-cost analysis focuses on the optimal outcomes that can be achieved within a particular budget amount. The analyst determines the degree to which the objective can be attained within the limits of the cost involved.
- Least-cost analysis focuses on identifying the cheapest alternative method of attaining a pre-determined level of the objective. The analyst finds the alternative that achieves the stated level of objective in the least expensive way.
- Objective-level analysis estimates the costs of achieving performance levels via a specific alternative method. The analyst determines costs according to different levels of objective attainment (10%, 20%, 30%, etc.).

Regardless of which type of analysis is used, CEA is always about efficiency. Coombs & Jacques (1977) divided efficiency into 1) external efficiency or productivity; and 2) internal efficiency.

Wagner (1982) and Tsang (1988) divided efficiency into internal, external, technical and economic categories. Tsang stated that, in education, internal efficiency compares the costs of education with the outputs or effects of education such as the acquisition of cognitive and non-cognitive skills. External efficiency, on the other hand, compares the costs of education with its external benefits (e.g. productivity in post-schooling work). According to Wagner, technical efficiency measures the relationship between

physical inputs and outputs; and economic efficiency attaches monetary values to the inputs and outputs, and is therefore the same as the concept of CBA. Above all, education should be economically efficient:

> when, given prices, technology, and financial resources, the maximum amount of...outcome is produced by selecting the right combination of inputs...(and) is economically inefficient (when)...outcome can be raised without incurring additional cost, just by altering the combination of inputs. (Tsang, 1988)

There are eight detailed steps to conducting a CEA:

1) stating the general problem situation;
2) defining the objectives;
3) identifying alternatives to reach the objectives;
4) determining a common measure of effectiveness;
5) formulating a model for analysis;
6) estimating and recording the costs of each alternative;
7) calculating the effectiveness of each alternative; and
8) performing cost-effectiveness computations.

The way the CEA is reported depends on the analytical approach. If the constant-cost approach is used, the report might state that for a given budget (e.g. $200,000):

- 100,000 students can be reached via tutorial centers at a cost of $2 each (i.e. $200,000/ 100,000) per year; or
- 150,000 students can be supported at a cost of $1.5 ($200,000/ 150,000) by study groups; or
- 300,000 students can be reached at a cost of $0.6 ($200,000/ 300,000) by providing study guides.

If the least-cost approach used, the report might state:

- tutorial centers will cost $160,000 per year to run, and will reach approximately 100,000 students (i.e. $2.13 per student per year); or
- study groups will need $150,000 per year to run, and will serve approximately 150,000 students (i.e. $1 per student per year); or
- pre-produced study guides will cost 100,500 per year, and will reach 300,000 students (or $0.3 per student per year).

C/E ratios are useful tools for helping decision-makers to choose the best alternative for implementation, though not without certain considerations. For example, the production of study guides involves little costs and only increases the students' grade point average (GPA) by 0.25 point. The more costly process of providing tutorial centres is estimated to increase the GPA by 0.75; and study groups seem to be the most effective method of increasing students' GPA (1.5 points). In terms of actual ability to reach students, however, study guides seem to be the most effective method. Decision makers have to decide, therefore, whether they are willing to trade a loss of 150,000 students not reached by study groups for an increase of 1.25 points in the GPA. In other words, which is more important - equality of provision (number of students reached by the method), or quality of the learning outcomes (GPA)? In the UT example, it seems that tutorial centres are the least favorable alternative.

Using the constant-cost approach, the cost-effectiveness of UT's operations can be calculated as the cost per student. Based on the 2006 budget plan, the number of registered students (Semester 2006.1) and the estimated number of students (2006.2), the total institutional cost per student was approximately IDR 1.2 millions (US $ 102) for the year. This low cost was due to UT's reliance on print materials and asynchronous communication, which are therefore considered to remain the most suitable and accessible system for most UT students. If UT decides to use more synchronous teaching strategies, these costs will

certainly increase. For example, in the Primary School Teacher Training Programmes, requiring intensive f2f tutorials, the operational cost per student is approximately IDR 2 million (US $ 200) per year.

Conclusions

The section has discussed the problems of measuring educational effectiveness empirically. Principles of cost-effectiveness and cost-benefit analysis have been highlighted, and the methods of constant-cost, least-cost, and objective-level analysis. Using the example of the Universitas Terbuka (UT) budget and the number of UT students served in 2006, it can be argued that UT is a highly cost-effective system, notably in teacher training; for the average cost of studying in Indonesian state f2f universities is approximately four times higher, at IDR 8 million (US $ 800) per year. In fact, this is only the cost paid by the students, covering approximately 25% of the total institutional cost. Thus, the cost of ODL in Indonesia can be estimated at 30 - % of the cost of conventional f2f education. The difference is even greater between the low cost of ODL and the high cost of private f2f education.

References

Bates, A. (1981) Towards a better research framework for evaluating the effectiveness of educational media. *British Journal of Educational Technology 12*, 3, pp. 215-233.

Coombs, P. & Jacques, H. (1977) *Cost Analysis in Education: a tool for policy and planning*. Baltimore: John Hopkins University Press.

Peterson, R. (1986) The anatomy of cost-effectiveness analysis. *Evaluation Review 10*, 1, pp. 29-44.

Salomon, G. (1979) *Interaction of Media, Cognition, and Learning*. San Francisco: Jossey-Bass.

Tsang, M. (1988) Cost analysis of the cost-effectiveness of CAI and factors associated with its successful implementation in higher education. *AEDS Journal 15*, 1, pp. 10-22.

Wagner, L. (1982) *The Economics of Educational Media*. London: MacMillan.