
THE ECONOMICS OF
EDUCATIONAL MEDIA

LESLIE WAGNER

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THE ECONOMICS OF EDUCATIONAL MEDIA

The book provides a concise conceptual and practical guide to the economic analysis of media use in education. While the book reviews the evidence on the costs and benefits of educational media its main orientation is to provide a methodology to guide future decision-making. Thus it includes chapters on establishing a framework for media choice, on evaluating the effectiveness of media use, and on analysing costs. The empirical evidence from past projects is chosen to illustrate both different types of media projects and different methodological approaches.

Amongst the projects which come under close scrutiny are the Open University in the UK, the Telesecundaria project in Mexico, the Nicaraguan Radio Mathematics Project and the PLATO computer-assisted learning project in the USA. The final chapter draws on the evidence of past projects to discuss why many media innovations seem to fail and what is required to make such innovations more effective, thus turning their potential cost and educational benefits into reality.

Leslie Wagner is Professor and Head of Social Sciences at the Polytechnic of Central London. He studied economics at the University of Manchester, and then worked as an economic assistant and economic adviser at the Department of Economic Affairs and Ministry of Technology from 1966 to 1970 before joining the newly-established Open University as a Lecturer in Economics.

At the Open University he played a prominent part in the production of the economics courses and also began research into the economics of the university and education systems more generally.

He published the first economic study of the Open University in 1972, and his other publications include an economic study of the SURGE system in the USA. He is the editor of *Readings in Applied Microeconomics*.

He has acted as a consultant to the International Council for Educational Media and to the UK Council for Educational Technology.

By the same author

READINGS IN APPLIED MICROECONOMICS (*editor*)

To Jennifer, Mark and Sharon

Preface

My interest in the economic implications of using new media in education began some ten years ago when I was appointed to an economics lectureship at the Open University. The University challenged many of the assumptions of traditional higher education and because of that it attracted a great deal of (sometimes sceptical) attention. One of the areas it challenged was the cost implications of providing higher education. In economists' language the Open University's media-based distance learning system changed the production function of higher education. The clear and almost linear relationship between staff and student numbers which was the primary determinant of cost no longer applied. In cost terms the Open University system of producing courses is to higher education what Henry Ford was to motor car production. It offers a mass production alternative to the traditional craft approach.

One of the things I became aware of as a result of my early work on the comparative costs of the Open University and traditional higher education was that there was a limited insight to be gained from studying the costs of *the* Open University. The results obtained, which were very favourable in cost terms to the University, were the result of its particular media mix. The Open University itself could be made cheap or expensive within very broad limits by making small adjustments to its media mix or changing its student numbers. The wider study of the cost implications of using media in education seemed to be a much more interesting approach.

And so it has turned out to be. Almost every project I have studied round the world either at first hand or through the work of others has added to my understanding. During the seventies, interest in these cost implications increased through the work of international organisations such as UNESCO and the World Bank which are heavily involved in sponsoring projects in the developing areas of the world. I have been privileged to participate in some of this work and have learnt a great deal from it.

This book then is a distillation of what I have learnt from my own work and that of others over the past decade. As I explain in the text I believe there will be a growing interest in the use of media in education during the eighties despite (or indeed because of) the problems facing the economies of many

countries. The crucial question for the future is how can we make such media use more effective? I believe an understanding of the economic approach is an important contribution to part of the answer. It is my hope that policy-makers and managers of media systems will gain insights that enable them to make more effective decisions and that my fellow economists will appreciate the application of economic analysis to an unusual area.

Virtually everyone I have spoken to on this subject over the past decade will have had some influence on what appears here, and it is difficult to single out individuals for special mention. Many I'm sure in any case would not wish to be found guilty by association. I must however give special thanks to the following: Richard Layard was very helpful in the early days in introducing me to the literature and making available the facilities of the Higher Education Research Unit at the London School of Economics. Keith Lumsden also encouraged my early work and guided me to the work being done in the USA. The Social Science Research Council provided me with a small grant to pursue this work.

As to the book itself, David Hawkrige read through early drafts and provided constructive criticisms, particularly on Chapter 2. I suspect however that he is still unhappy with parts of it. More than anything I have benefited from discussions over a long period with colleagues in the USA. To Dean Jamison, Stuart Wells and Steven Klees my grateful thanks. Although they have had no direct involvement in the book they will recognise their influence. However they will be the first, I'm sure, to join with the others in echoing the usual disclaimer that all responsibility for what appears here is mine. A final thanks to Jenny, Mark and Sharon for tolerating my obsession with a rather esoteric subject that must have seemed an almost permanent lodger in our home. By now I think they are reconciled to the tenancy continuing.

Leslie Wagner

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1 Introduction

ECONOMICS AND EDUCATIONAL MEDIA

During the past two decades there has been what can only be described as an explosion in the use of media in education. The range is enormous. There is hardly an educational institution, certainly in the advanced economies, which does not have some form of audio-visual equipment. The use of media ranges from *ad hoc* materials, to enrich normal teacher-mediated instruction, to a comprehensive and systematic use of different media approaches as an integral part of an instructional system as is found, for example, in the UK Open University. Media use in education is, of course, not new. The media themselves (principally radio, television and film) were all developed commercially during the first half of the century and soon found their way into schools. In the UK, for example, the BBC began its Schools Broadcasts in 1924 and educational television was introduced in 1957.

Two features, however, have come to prominence in the 1960s and 1970s. The first is the growing international nature of media use. Side by side with its more intensive use in advanced economies has been the growing use of media in developing countries. International aid agencies such as UNESCO, the World Bank and the United States Agency for International Development have recognised the potential of media for raising educational levels, particularly in the developing country context of geographical difficulties and specialist staff shortage.

A second feature of the recent past is the increasing cost of instructional media systems. Whilst improved technology and larger-scale production has reduced the price of individual pieces of media equipment the systems which incorporate this equipment have grown larger. In many cases projects involve many millions of dollars to establish and run. The Open University for example after 7 years was involved in an annual expenditure close to 50 million dollars.

So the size and the scope of media use in education are reasons enough for an economic study. Recognition of the need for an economic dimension to the evaluation of media systems was, however, slow to develop. Studies began in the sixties but it is still the case that most of these are of a *post hoc*

nature. They evaluate the economic implications of a system (usually its costs) after it has been established, usually when it has been in operation for a number of years and sometimes when it has finished.

These studies were undertaken for a variety of reasons. In some instances the agency funding a particular system required an analysis of its costs and a report of what had occurred. In other cases the studies have been more of an academic exercise with economists interested in exploring the cost implications of new methods of instruction. (Recent publications have attempted to summarise and synthesise the information available from a number of studies (see for example UNESCO, 1977 and Spain *et al.*, 1977).)

This interest in media systems is likely to continue in the future, not only because technological developments will provide new scope for media use in education but also because media will become increasingly attractive to educational administrators and fund-providers on cost grounds.

The argument is simply expressed, but it is at the core of the economists' interest in this area, and its implications and ramifications will be explored throughout this book. Education is traditionally a labour-intensive process with teachers' salaries often taking up to seventy-five per cent of total cost. Where media are used to supplement the teachers' role they do not affect this basic situation. Where, however, television or radio is used to replace the teacher there is a substitution of capital for labour. The problem with any labour cost is that it is always rising. In contrast improved technology leads to the reduction of unit capital costs. So even from a starting position in which labour is cheap and capital expensive the unit costs move in opposite directions – labour upwards and capital downwards. The point at which they intersect depends on many factors but in the long run the use of more capital (which largely means media) as a substitute for labour in education becomes increasingly attractive. Media use in education is, therefore, likely to become of greater rather than lesser interest in the future.

Focus of an economic study

The interest of economists in education developed in the fifties and sixties through its possible effect on economic growth. Kendrick (1961) and Denison (1962) attempted to isolate the element of economic growth which was not due to increases in physical capital and labour inputs. This was called the residual and was taken to measure technical progress or the increase in the quality of labour and capital. Whilst Abramovitz might have been nearer the mark in calling the residual 'the coefficient of ignorance', attempts were made to isolate the proportion of this residual due to

improvements in education. These showed that the residual was responsible for about half the economic growth and that education might be responsible for about half of the residual. So improvements in educational provision might be responsible for 25 per cent of growth.

At a more down-to-earth level Harbison and Myers (1964) showed a positive correlation between school and higher education enrolment rates and Gross National Product (GNP) in 75 countries. Bowman and Anderson (1963) studied the link between literacy rates and GNP in 83 countries. They found 32 countries with very low literacy rates and very low GNP, 24 countries with very high literacy rates and a high GNP, with a number of others approaching a high literacy rate but still with a low GNP.

All these studies face a general problem of attributing causation. For example it may be the wealthier countries that can afford to put more resources into education and so the conclusion might be that GNP growth causes high literacy rates and not vice versa. Bowman and Anderson generally concluded that high literacy was a necessary but not a sufficient condition for growth.

One result of these studies on policy was that more resources were devoted to education. In advanced economies which had near-universal primary and secondary education the school-leaving age was raised but the main emphasis was on higher education. In the UK for example education as a percentage of gross national product rose from about three per cent in 1950 to over seven per cent by the end of the 1970s, and the number of students in higher education rose from 180 000 at the beginning of the 1960s, to over 500 000 some 15 years later. In developing economies, in contrast, the emphasis was much more on establishing universal primary and secondary education and enabling basic literacy and numeracy skills to be achieved. Here too, however, higher education was also substantially expanded.

One result of this large expansion of resources to education was an increasing focus on the internal efficiency of the education system. As the desire for expansion increasingly came up against either physical or financial constraints greater attention began to be paid to use of media. Not only might they enrich the quality of educational provision but they might also allow expansion to be achieved through greater efficiency.

In school education in advanced economies media are used mainly as an extra help to teachers rather than as a means of doing without them at all. Hence the term audio-visual *aids*. The reasons for this are partly practical and partly political. On the practical level, school pupils usually require supervision. So, whether the television screen is showing a programme, or the radio transmitting some information, or the computer allowing some individualised instruction, a teacher usually needs to be on hand to

supervise, assist, or even just to make sure the students are paying attention to what is being said or shown.

In the school system the main role of educational media is to improve the *quality* of educational provision. It increases costs and whilst it might increase the quantity of output (say in terms of the number of pupils achieving a certain grade) its main function is to improve the quality through an enrichment of the educational process.

The political reason for media being used as a supplement to existing educational provision, rather than as a substitute in the school system, is the attitude of teachers. One of the major problems surrounding the successful introduction of media into an educational institution is the suspicion, if not downright hostility, of the instructors. There are all sorts of reasons why teachers view educational media suspiciously, but one of the most important is the fear that it may be doing them out of a job. This fear has a very real foundation.

With compulsory schooling from around 5 to 16 in most developed countries, the education market is to all intents and purposes saturated. Demand is virtually at its maximum possible level. There are two ways in which the school population might be increased: either through a natural growth in the child population or through government policy to extend compulsory schooling downwards to three years of age or upwards to (say) eighteen years of age. Both these changes, however, are unlikely to occur quickly and in the short term the pupil population is more or less fixed. The number of teachers is linked to the number of pupils through the pupil/teacher ratio. So in the short term the way to increase the demand for teachers is to reduce the pupil/teacher ratios, one of the reasons for the continuing pressure from teacher unions for smaller classes.

Now in a situation of virtually no growth in the pupil population, the use of educational media as a substitute for labour implies a worsening of the pupil/teacher ratio and teacher redundancies. It is no wonder that teachers view media suspiciously if their use could lead to the loss of jobs. So whenever media are presented to teachers, their role in supplementing and improving the quality of the teacher's own personal contribution is stressed. Even where media do take over the teaching role, as in some computer-assisted instruction in primary schools, other roles in the instructional programme are found for the teacher. The situation is different, however, in many developing countries where economic, geographical or teacher shortage problems often prevent children from obtaining access to secondary education. Here educational media have an important role to play particularly in overcoming teacher shortages and enabling children in remote areas to receive education. Where labour is the scarce resource, as is the case in

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these situations with skilled teachers, the substitution of capital for labour makes a great deal of sense. Thus a great deal of attention has been paid by international organisations such as the World Bank and UNESCO to the potentiality of educational media in developing countries and relevant studies will be referred to in later chapters.

Higher education provides in both developed and developing countries greater scope for labour substitution. On the practical level the students involved need far less supervision than their school counterparts. Indeed, conventional instruction in higher education occurs largely without supervision. On the political level also, problems are fewer. Higher education is a growth market. In the UK about fifteen per cent of the appropriate age group were in higher education in the mid-1970s. The demand for higher education, particularly at the subsidised price at which it is offered, is likely to continue to grow.

For this reason, higher education teachers have less cause to worry about the effects of teacher-substituting technology on the security of their employment. (This fact, however, has not made them any less suspicious of this technology than their school counterparts.) Indeed, it is when educational policy-makers have studied the pressure of demand in relation to the limitation of resources that they have turned to educational media. One of its major purposes in the expanding environment of higher education is to produce labour substitutions to allow for a larger student population for any given amount of resources, e.g. the use of closed-circuit television to extend the audience for a lecture.

Finally this study is concerned with systems of educational media rather than individual items. In Chapter 2 various types of media are discussed. Although the list given there is by no means comprehensive, it ranges from overhead projectors to television and computers. To try and report on the economic costs and benefits of each of these items would be a mammoth task. Moreover, in most cases, the question would not be a meaningful one. For example, the cost of an overhead projector could be readily obtained but how is one to evaluate its benefits in any quantitative sense? These items are usually used as aids to teachers rather than having a function of their own. The more sophisticated media produce the same problem. Even where television or computers are used to substitute for the teacher's role, they are rarely used on their own. Usually they form part of a system of media which might include audio-visual and written elements as well as some personal tuition elements. It is often preferable, therefore, to view educational media as applied through a system of instruction rather than a collection of individual components. Much of this study will be looking at the subject as a system. However, the general analytical approach, particularly in costs

analysis, can also be applied to individual items such as television, radio and computers. (Whether and how they can be reflected in an economic study will be discussed in Chapter 4 on the benefits of educational media.)

So whilst there may be a variety of reasons for introducing media into an education system any media use will have economic implications. How far these economic implications should affect media decisions is a matter of judgment. It is possible, however, to establish a framework within which economic factors can be related to the achievement of objectives and it is the major task of this book to show how this might be done.

Scope and plan of the book

This book is primarily concerned with the role of economic analysis as an input to decisions on the use of educational media. It therefore surveys economic studies and past reports of media projects not so much to provide generalised conclusions on the use of media (although some are possible) but to illustrate how economic analysis of both costs and benefits can be useful to decision-makers. Its orientation is, therefore, to helping guide future decisions, and inquests of past decisions are included only in so far as they indicate lessons to be learned. This concern with decisions implies an emphasis on models and frameworks. Chapter 2 begins by discussing the range of media now available and their particular characteristics in an educational setting. It then seeks to establish a framework for choosing the appropriate media for a given educational task by establishing a relationship between educational objectives, learning tasks, learning stimuli and media. The point that is emphasised is that the choice of media comes at the end of the chain rather than at the beginning. It is not a question of looking at the machinery available and thinking what you can do with it, but of starting with the education objective to be achieved and establishing through the use of task and stimuli analysis the appropriate media for the job.

The heart of an economic analysis of educational media is the concern with efficiency, and Chapter 3 deals with the central questions of what 'efficiency' means when applied to education and how it might be measured. The application of efficiency concepts to education is defended and it is stressed that efficiency studies require a concern with both costs (inputs) and benefits (outputs) and their interrelationship. The chapter concentrates particularly on the objectives of educational systems, institutions and courses and how these might be translated into measures of output, and finishes with a discussion of how the efficiency of educational media might be evaluated.

Having established the theoretical framework in the opening chapters, the

analysis now moves to a more detailed investigation of the specific components of an economic study: benefits and costs. Chapter 4 is concerned with benefits but does not attempt to provide a general survey of empirical studies. Instead it concentrates on the methods and problems involved in measuring the educational achievement of media systems, using empirical studies to illustrate the points being made. The subjects discussed include the need to specify objectives, including overcoming the problems of multiple objectives, the difficulties of measuring cognitive and non-cognitive achievements, and the wider implications of educational media systems, such as their effect on the distribution of income, status and power in a society.

Chapters 5 and 6 deal with the costs of media systems. In the first of the two chapters some simple cost concepts are introduced and brought together to show how costs analysis can provide insights into the costs structure of media systems. The costs differences between media and traditional systems of education are particularly emphasised. The second chapter deals with some of the problems inherent in costs analysis and show how these might be overcome. These problems include the identification and measurement of costs, the treatment of capital costs, and the calculation of an appropriate interest rate.

The analysis of benefits and costs in Chapters 4, 5 and 6, draws on examples of particular systems and projects to illustrate a point or argument. In Chapter 7 a more detailed study of a number of these projects is provided. The projects chosen represent different types of media and illustrate different forms of costs and effectiveness analysis. They are designed not just to provide information on the particular projects as representative of a particular use of media, but to highlight the different analytical and methodological approaches to the economic analysis of media. Amongst the projects which come under close scrutiny are the Open University in the UK, the Telesecundaria project in Mexico, the Nicaraguan Radio Mathematics Project, and the PLATO computer-assisted learning project in the USA.

Finally Chapter 8 draws together some of the main themes explored in the book. As a recurrent theme is the role of economic analysis in guiding decisions about media use in education, this final chapter discusses why many media innovations seem to fail and what is required to make such innovations more effective at the course, institutional and national level.

2 Media Choice

2.1 DIFFERENT FORMS OF MEDIA

A vast array of equipment of increasing sophistication is now available for educational use. This can be divided into four main areas of print, sound, vision and teaching machines, and Table 2.1 provides a list of some of the different forms of educational media under each heading. This is not a comprehensive list; indeed given the rapid changes in technology that are occurring, it cannot pretend to be. Its main purpose is to serve as an illustration of the range of media now available to educationists.

This classification concentrates on the means by which instruction is conveyed rather than the method of instruction itself. In McLuhan language it stresses the medium rather than the message. For example, the same intellectual approach is likely to be adopted in a piece of instruction that becomes embodied in a programmed text and a teaching machine. The first,

TABLE 2.1 Range of educational media

<i>Print</i>	<i>Sound</i>	<i>Vision</i>	<i>Teaching machines</i>
Books	Radio	Board and chalk	Teaching machines
Textbooks	One-way	Television	Computers
Programmed			
Texts	Two-way	Open-circuit	
Readers		Closed-circuit	
		Cable	
Journals	Radiovision	One-way	
		Two-way	
Pamphlets	Audiotape/cassette	Videotape	
Booklets	Gramophone records	Film	
		16 mm	
Offprints	Telephone	8 mm (\pm sound)	
		Filmstrip	
		Overhead	
		transparencies	
		Slides (\pm sound)	