The Development and Use of Indicators to Measure the Impact of ICT Use in Education in the United Kingdom and other European Countries
by Mr Mike Aston, Consultant, UNESCO IITE

Mr Aston’s report provided a historical summary of the conduct of impact studies of ICT on education in the United Kingdom and Western European countries. He touched on the measures and indicators that evolved, current practices being used, and were used in the recent years, as well as specific experiences faced by European nations in the conduct of these studies. He also presented “a more sophisticated model for describing the nature of ICT impact at a national level.”

The history of measuring ICT impact

The history of collecting meaningful data about the use of IT (ICT) in schools is relatively short. Microcomputers have been used in schools since 1979. The first survey carried out by the Department of Education and Science (DES) in the UK was in March 1990, the results being published as a Statistical Bulletin in June 1991.

There is no mention of communications other than a note to say that modems were in use in several secondary schools for access to the national viewdata system (Prestel) and mainframe computers. The number of CD-ROM drives was noted as being on average of one for every ten secondary schools.

In 1989, Tim Berners-Lee, a scientist at the European Laboratory for Particle Physics in Geneva, had proposed the World Wide Web project. In 1992, the World Wide Web became accessible to the public and in the spring of 1993, a group of graduate students at the University of Illinois computer laboratories, led by 21-year-old Marc Andreessen, created a “browser” program called Mosaic, and distributed it free. Netscape and then Microsoft followed with browsers that greatly simplified a computer user’s ability to search the Internet in search of information.

By 1999 there were 150 million users on the Internet with over 800 million web pages accessible to anyone in the world with the necessary equipment and communications facility. By August 2001, the number of Internet users worldwide had risen to 513 million.
From 1991 to 1999, ICT in schools expanded rapidly in the developed nations through curriculum change, networking, the professional development of teachers and software improvements. Some nations in development also began ‘ICT in schools’ programmes, notably Chile, Costa Rica, India, Mauritius and Pakistan. During this period, the UK Ministry continued to measure ICT resources in school and other nations started to follow suite with the Netherlands and Japan in the lead.

In 1996, a major provider of ICT resources to schools in the UK, Research Machines PLC, commissioned The Advisory Unit: Computers in Education based in Hatfield, UK, to carry out a comparative study of ICT in schools in the G7 nations (Canada, France, Germany, Italy, Japan, United Kingdom and the USA). The study concentrated on collecting quantitative data with methods used including interviews (face-to-face and over the telephone), questionnaires, local and national government statistical reports, ministerial documents and personal contacts. For example, in Japan, the following institutions were contacted for data:

- National Ministry of Education (MONBUSHO)
- Government National Computing Commission
- The National Teacher Training University
- Hardware manufacturers
- Educational Software publishers
- Teacher Training Institutions
- Universities

The first comparative results from the first G7 Report were of significant interest, for example:
Measuring the impact of ICT on school education systems was certainly not an exact science, as quantitative data often was ‘guesstimated’ or extrapolated from various sources with widely differing responses. Sometimes, official figures were clearly inflated in referring to figures obtained from end-users. Simple problems of defining a computer or the concept of ‘obsolescence’ in different mother tongues led to difficulties in obtaining accurate data. The biggest problem to overcome was that of timing: the study took more than three months to carry out, which was against the background of rapidly changing attitudes to ICT in education and technological advances - between them creating a moving set of targets. In many ways, the qualitative data collected on ICT in the curriculum and teachers’ take-up of the technology and software in teaching gave a more accurate picture of where a nation progressed. The RM G7 Report became known as the OrbIT Report and was repeated in 1998 and 2000, allowing year-on-year comparisons among nations.
From 1991, Tjeerd Plomp and Willem J Pelgrum at the Faculty of Educational Science & Technology, University of Twente in the Netherlands conducted studies on behalf of the International Association for the Evaluation of Educational Achievement (IEA) and the Organisation for Economic Co-operation and Development (OECD). The data was collected in various countries (the UK, Italy and most of Canada, for some reason did not contribute) by staff from National Project Centres, many of whom clearly did not have a background in ICT in education. Nevertheless, the studies tackled such issues as ‘Educating the Educators’ and ‘Structural Models of Implementation Indicators’. In the IEA publication of 1993, the following diagram below appears in a chapter on predicting computer use:
Further on, the study lists key indicators and notes on their measurement:

- School size
- External financial support
- External training support
- Previous innovation experience
- Availability and resource needs
- Perceived innovation relevance
- School policy for computer use
- Internal staff development
- Internal innovation assistance
- Teacher competence and readiness
- Monitoring and problem coping strategy
- Implementation outcome

These earlier studies failed to predict the growth of local and wide area networking in schools but were extremely rigorous in their statistical analysis.

The last study of note was carried out by the Directorate-General for Education and Culture in the European Commission 2000/2001 that resulted in two documents being published, namely ‘ICT@Europe.edu’ and ‘Basic Indicators on the Incorporation of ICT into European Education Systems – Facts and figures 2000/01 Annual Report’. The first booklet is entirely qualitative and covers the member states of the EU (15), EFTA/EEA (3) and the pre-accession countries (12). For each country, the report describes:

- Aims and strategies
- Public/private partnerships
- Sharing of responsibilities
- Major initiatives implemented

The second document is largely quantitative, using bar charts or shaded maps of Europe to illustrate comparisons between nations on the National Policy and Basic indicators as listed below.
1. Education levels covered by official documents on the use of ICT. Primary, secondary and higher education (in force during 2000/01).

2. National or official bodies with a remit for supervision and/or promotion of national policy for ICT in education, 2000/01.


6. Number of pupils per computer, and number of pupils per computer with an Internet connection. Primary education, 2001.

7. Number of pupils per computer, and number of pupils per computer with an Internet connection. Secondary education, 2001.


9. Distribution of the specific budget between the purchase of equipment and expenditure on human resources. Primary education. Projects under way in 2000/01.

10. Distribution of the specific budget between the purchase of equipment and expenditure on human resources. General lower secondary education. Projects under way in 2000/01.

11. Distribution of the specific budget between the purchase of equipment and expenditure on human resources. General upper secondary education. Projects under way in 2000/01.


13. Percentage of teachers who use computers and/or the Internet in the classroom. Primary education 2001.

14. Average periods during which primary schoolteachers use computers (with or without Internet connections) in the classroom, in hours per week, 2001.

15. Approaches to ICT defined in the curriculum. Primary education 2000/01.

16. Objectives defined in the curriculum for the teaching or the use of ICT. Primary education, 2000/01.


21. Annual number of hours recommended for teaching ICT as a subject in its own right. General lower secondary education 2000/01.

22. Objectives defined in the curriculum for the teaching or the use of ICT. General lower secondary 2000/01.


24. Objectives defined in the curriculum for the teaching or the use of ICT. General upper secondary education 2000/01.


26. Inclusion of ICT in the initial training of all teachers (except specialist ICT teachers). Primary education, 2000/01.

27. Inclusion of ICT in the initial training of all teachers (except specialist ICT teachers). Lower secondary education 2000/01.


29. Percentage share of compulsory teaching related to ICT and the number of hours devoted to such teaching, in the initial training of all teachers (except specialist ICT teachers). Lower secondary level 2000/01.

30. Desirable ICT skills according to official recommendations for the initial training of all teachers (except specialist ICT teachers). Lower secondary education 2000/01.

31. Percentages of primary schoolteachers and secondary schoolteachers who have received official training in the use of computers and/or the Internet in their teaching, 2001.

32. Percentages of primary schoolteachers and secondary schoolteachers in the EU who have received official training in the use of computers and/or the Internet in their teaching, 2001.
This range of indicators offers a comprehensive picture of the incorporation of ICT into European Education Systems but is not judgmental in any way. There are a number of blanks (presumably not known) in the data sets and problems of aggregating data for countries like Germany (with 17 distinctive education systems), Spain (with 17 autonomous regions) and the UK (with 4 countries) results in extensive footnotes to the tables and maps.

The three fundamental questions:
- Who is the information for?
- Why collect it?
- Who will be given access to the data?

Also to be considered:
- Accuracy of data?
- Interpretation of terminology? Estimates v Guesstimates
- Differences in educational systems
- Academic v Technical education
- Teacher competence – how do we measure?
- Skills v application
- Machine functionality, age
- Networking, access, software
- Comparisons over time

The UNESCO Institute of Information Technology in Education (IITE) situated in Moscow has initiated a major project to determine ways of measuring ICT impact on national education systems using a series of indicators. An Expert Meeting was held in Moscow during March 2001 with representatives from such widely dispersed countries as Namibia, Pakistan and the state of Brandenburg (Germany). It was agreed to test a set of indicators with a number of countries in the Commonwealth of Independent States (CIS), formerly part of the USSR.

The IITE also initiated a pilot seminar held in Moscow for High Level Decision-Makers in ICT Educational Policy during 2001. Nineteen states (mainly from the CIS) were represented and as part of the development of materials for the seminar two indicator matrices were created. The first, subsequently become known as Morel’s Matrix, after Professor Raymond Morel from Switzerland, one of the tutors on the seminar.
This, in essence, presents four levels of development, namely Emerging, Applying, Integrating and Transforming. The theory is that a nation’s ICT development in its education system can be mapped onto the matrix and can be described in general terms such as ‘the majority of the criteria have reached the Applying phase but with X still Emerging and Y already Integrating.

### Applied “Morel’s Matrix”

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<thead>
<tr>
<th>Criteria/Phase</th>
<th>Emerging</th>
<th>Applying</th>
<th>Integrating</th>
<th>Transforming</th>
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<td>Context</td>
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<td>Pedagogy</td>
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<td>Vision</td>
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<td>Staff development</td>
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<td>Quality assurance</td>
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The second matrix, attributed to Matti Sinko (Finland) and Mike Aston (UK), also tutors on the seminar in Moscow, focuses on National Priorities in the Short (2 years) and Long (3-5 years) terms. The two time periods are further divided into Producing and Updating/Revising phases. The matrix is completed by the National or Regional ICT in Education Strategy leaders or Policy makers and the following areas are covered in the matrix:
There is a clear need to collect both quantitative and qualitative data on ICT development in different nations and be able to present it in a reasonable concise manner. A combination of the EU data presentation, the IITE questionnaire, Morel's matrix and the Aston/Sinko matrix would provide a comprehensive set of indicators. The next stage is to synthesise the data collection methods and start the process.

Almost every country/region is embarked on a process of significant change in school education as a result of the all-pervasive nature of ICT. The advent of the Internet offers a mechanism for nations and regions to avoid re-invention, to learn from each other and to relate to different circumstances and economic resourcing. UNESCO is a strong contender to act as a clearing-house for this level of dynamic information.


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