Developing Performance Indicators for ICT in Education

The creation of knowledge societies depends on the joint process of knowledge usage and the way the educational systems and institutions master the known and upgraded methods of generating, analyzing and spreading of knowledge and information. This poses the challenges related to adaptation and renewal of the system of education to be continuously monitored and to be reported about in the view of the state of education in the world.

Reaching these objectives implies:

- Use of information and communication technologies, national, sub-regional and regional potential in the fields of policy, planning and simulation, budget formation, education programme cost evaluation;
- Acquisition, analysis and dissemination of upgraded data and statistical information on educational status-quo in the states participating in the project attracting various data sources and specialized investigations, which add to the systems of regular data collection;
- Circulation of scientific and research results, information on the effective policy, innovations and experiences, and securing access to such data.

General description

The project sought to acquire and process data on ICT usage in education in the sub-regional level. The project also evaluated main trends and knots, and presented recommendations.

Dr Kotsik’s report presented the highlights of the researches conducted by the UNESCO Institute for Information Technologies in Education (IITE) in the Baltic countries and Commonwealth of Independent States from 1999 to 2002. His presentation outlined the process of conceptualisation, design, implementation, monitoring and evaluation of these projects.

Indicators of ICT usage in secondary education: UNESCO IITE project for Baltic and CIS states

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**Objective**

The project was conducted for the purpose of strengthening ICT application potential for national education capacity-building.

**Result**

The research findings were submitted to UNESCO Member States to assist them in the elaboration of national action plans for ICT application in education development.

**Data gathering**

The statistical data was studied and collected in two stages. At the first stage of the IITE preliminary developments, the questionnaire was compiled and expertise was made by foreign specialists with the subsequent changes, which considered the experts’ recommendations.

On the basis of the official letters, the ministers of education of the Baltic and CIS states appointed specialists responsible for submission of data on indicators for the project.


The research work on ICT in Education in the Baltic and CIS states started in September 2000. The timeline of related activities was:

<table>
<thead>
<tr>
<th>Year</th>
<th>Activity</th>
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<tbody>
<tr>
<td>1999</td>
<td>Provision of data on Russian Federation for OrbIT - 2000 Report</td>
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<tr>
<td>March 2001</td>
<td>International Expert Meeting ICT in Education: State-of-the-Art, Needs and Perspectives - Indicators and Information System</td>
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<tr>
<td>June 2001</td>
<td>Publication of the proceedings of the Experts’ Meeting in IITE Newsletter #2’2001</td>
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1. Components
   - Questionnaire development
   - Questionnaire expertise and amendment
   - Establishment contacts with ministers of education
   - Appointment of data provision experts
   - Conducting a workshop on data provision
   - Data collection and assessment
   - Data precision and primary processing
   - Data secondary precision and processing
   - Statistical report composition and dissemination

2. Data structure
The questionnaire was based, as in similar studies and as recommended by IITE-held international expert meeting on the most relevant indicators reflecting the main factors which determine the efficiency of ICT usage in education. The six indicator groups are:
<table>
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<tr>
<th></th>
<th><strong>1. Official Documents on ICT usage in education</strong></th>
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<tbody>
<tr>
<td></td>
<td>• Official documents in ICT in secondary education valid till 2002</td>
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<tr>
<td></td>
<td>• Official documents in ICT in secondary education currently in force</td>
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<td></td>
<td><strong>2. ICT in Educational Institutions’ (EI) Curricula</strong></td>
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<tr>
<td></td>
<td>• Available state curriculum on Informatics and/or ICT</td>
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<td></td>
<td>• Informatics and/or ICT as a separate subject</td>
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<td></td>
<td>• ICT usage to support other subjects implied in curricula on these subjects</td>
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<td><strong>3. Hardware and Equipment</strong></td>
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<tr>
<td></td>
<td>• Computer classrooms availability in EI</td>
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<tr>
<td></td>
<td>• The average number of students per one computer in EI equipped with computer classrooms</td>
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<tr>
<td></td>
<td>• Percentage of IBM- and Apple-compatible computers in total number of EI computers</td>
<td></td>
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<tr>
<td></td>
<td>• Percentage of EI equipped with one or more multimedia system in total EI equipped with computer classrooms number</td>
<td></td>
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<tr>
<td></td>
<td>• Percentage of EI equipped with local network to total EI equipped with computer classrooms number</td>
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<td><strong>4. Software</strong></td>
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<td></td>
<td>• Percentage of computers with installed OS DOS™ to total number of computers in computer classes</td>
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<td></td>
<td>• Percentage of computers with OS Windows™ or Apple Macintosh to total computer number in computer classes</td>
<td></td>
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<tr>
<td></td>
<td>• Percent of computers with other OS to total computer number in computer classes</td>
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</table>
|   | • Percentage of EI with any educational software for teaching the corresponding subjects to total EI number with computer classes:  
  ▪ Elementary school subjects  
  ▪ Science subjects  
  ▪ Humanities  
  ▪ Informatics or ICT |   |
|   | • Percentage of educational software designed by the specialists within the country to total number of educational software used in EI for teaching of the corresponding subject curriculum (elementary school, science subjects, humanities, informatics/information technologies) |   |
|   | • Percentage of educational software designed by foreign specialists to total number of educational software used in EI for teaching of the corresponding curriculum (elementary school, science subjects, humanities, informatics/information technologies) |   |
|   | **5. Global communication means** |   |
|   | • Percentage of EI without Internet access |   |
|   | • Percentage of EI with limited Internet access – only e-mail |   |
|   | • Percentage of EI with access via dial-up channel |   |
|   | • Percentage of EI with access via dedicated line |   |
|   | • Percentage of EI with own web-pages |   |
|   | **6. Personnel** |   |
|   | • Percentage of elementary school teachers, subject teachers (except teachers of Informatics and/or Information Technologies), teachers of Informatics and EI administration who have undertaken the computer literacy course from 1 September 1999 until present time  
  ▪ Less than 50 hours (index 1)  
  ▪ 50-100 hours (index 2)  
  ▪ Over 100 hours (index 3) |   |
|   | • Computer skills of elementary school teachers, subject teachers and teachers of Informatics and administration  
  ▪ Elementary computer literacy  
  ▪ Proficiency in ICT field |   |
3. Data processing and presentation
The data was collected by questionnaire in MSWord format, transformed to the MS Excel table, processed according to appropriate formulas and presented in diagrams (the process is described in the Statistical Report).

4. Dissemination of the results
The survey results were published as a Statistical Report and disseminated through:

- The net of Focal Points for the cooperation with IITE
- National Commissions for UNESCO
- UNESCO Field Offices
- Educational institutions and organizations
- Series of workshops and consultative meetings in the framework of sub-regional projects, i.e.:
  a) Consultative workshop for Developing Performance Indicators for ICT in Education, Quezon City, the Philippines, 28-30 August 2002.

The paper presents a unique practice of the specialized comparative research of the state-of-the-art of education in the Baltic and CIS region as well as the comprehensive study of the ICT usage in education. The following can be mentioned as the results of the accomplished work and the collected data analysis:

- Activity of all the project participants and their interest in the data collection;
- Lack of elaborated organizational tools of such data acquisition, difficulty in obtaining the homogenous and reliable data, absence of data validation;
- Considerable scattering of national, geographical, historical, social and economic features of the processes under study, high diversity in different data categories, the complexity of comparative data analysis;
Chapter 4: Summaries of Experiences from other Regions

Necessity of thorough elaboration of the indicator model, relative data set and appropriate means of data obtaining, processing, presenting, keeping and disseminating as well as timely development of automated tools for these procedures;

Need to organize a systematic continuous research to gain the information on the dynamics of the studied processes.

Based on the results of the work the following can be recommended to education policy- and decision-makers in the states participating in the project:

To use the materials of the statistic report in shaping national programmes of ICT development in education;

To conduct the similar research at the local level to formulate national and local programmes of education development;

To consider the recommendations on each indicator when identifying the priorities and choosing the most efficient trends in education development;

To disseminate the best practices of the most effective development of certain factors of the ICT usage in education based on the research results.

Major consideration must be directed to the following experiences confronted during the course of the research:

The project was under the Council of Ministers of Education of CIS States, and covered the post-Soviet Union territory where about three generations of communist rule had institutionalised a rather strict and centralized system of educational governance; similar structures of education systems, goals, knowledge standards, and teacher training programmes; and prevailing of Russian language prevailing as the main means of communication. Thus many tasks for this project were simplified, though levels of education development of the countries still varied significantly.

The project was positioned as a regular activity of National Ministries of Education so data acquisition required no additional budgeting but only a managerial support of National Ministries of Education. Data was gathered by staff members of National Ministries for Education (i.e. heads of departments, senior specialists, staff of national Centres of Informational Technologies in Education or Centres of Teacher Training, Retraining and Educational Support). Data gathering was facilitated by official letters from the Ministries, thus, the obtained data acquired the status of official information.
The questionnaires of the Indicators of ICT Usage in Secondary Education of the Baltic and CIS States survey were faxed and e-mailed to the addresses given by the Ministries.

A meeting was held on 23 November 2001 in Moscow to discuss the features and details of the information collected, and the unification and simplification methods of data collection. The meeting was attended by representatives of participating ministries of education, international experts (who analyzed the questionnaire), data gathering experts, IITE hosts and managers. The methods of data collection, extrapolation and analysis for the project were debated during the meeting.

In discussion of the most appropriate methods of gathering different kinds of data, distinction was made between direct information (national policy documents, curricula), statistical data collected from different sources (amount of hardware), expert estimates (computers age and types, educational software availability, levels of teachers computer confidence), indirect data gathered from various sources (Internet access, number of teachers retrained in computer literacy). Special attention was paid to the necessity of defining exact and inexact data, what are mean and middle values, the difference between statistical data and expert estimates. In the last case an averaged result should be used of values obtained from several experts.

Recommendations were made for the project to include data on ICT application in education in regular national statistics collected by Ministries, to correlate the data with the results of direct sociological surveys and information obtained by independent sources. Concerns were expressed that since data collection was facilitated by high-ranking government officials, some of these data may be incorrect as data results may have been adjusted by the data gatherers to impress these authorities.

Since this research used data obtained from independent sources, the Institute had to work with figures that are contradictory to official statistics. This raised the concern that the financial and managerial support of the project should be independent from national governance.

In this case the overall status of the project and utilization of its results are different and this approach does not well accord with the main principles of IITE project development based on the needs of the UNESCO Member States.
At the second stage of the project, during the collation of collected data, latent uncertainties were revealed as data from different areas were in forms that are not compatible with other areas. To reconcile these differences, the project specialists had to restructure the initial data three or four times. As a result, recommendations were prepared to modify the content of the questionnaire and the method of its filling-out.

The above mentioned ‘latent uncertainties’ were due partly to the data gatherers’ not following the instructions, and partly to ambiguities in the definition of indicators, data gathering methods, and the processing of data.

Some uncertainties were evident at the start of the research and were discussed in the November 2001 meeting in Moscow, but these were not addressed by the experts. Among the ambiguities encountered:

- In their calculations, some of the experts mistakenly considered total number as a simple average of numbers for urban and rural schools, while the result depends on the ratio of rural/urban schools,

- The experts’ calculation of the student-computer ratio was taken as the ratio of total number of students in the country to total number of computers in schools (500 to 1000 students per computer unit), and this was used as basis for concluding that, on average, a school of 500 pupils in the country has one-half to one computer unit. The experts did not consider that the student-computer ratio was intended as a measure of didactic usability of computers in schools, relative not to total number of students in the country but only those schools with computer classrooms.

It remained unclear in the frame of this Survey how to separate data for elementary and secondary schools in case these schools comprise a single educational institution, so the Survey referred to secondary education consisting of elementary, basic and secondary stages.

It should be more clearly defined in the questionnaire and indicator description how to deal with the cases when one and the same school has both dial-up and dedicated channel access to Internet, or when the same teacher has attended 100-hours computer courses consisting of four 25-hour modules.

During the data precision and processing, some indicators were excluded from the survey data analysis and/or from visual
presentation because of their very small values and large amount of missing data. The excluded indicators numbered 13 out of the total 27.

In further attempts to combine an aggregated index and to compose an integral model on the base of indicator data, most difficult task was to deal with cases of missing data. A special mechanism should be created to avoid these problems in future.

Recommendations of this research included guidelines for future studies:

» An **updated indicator system** for the next step sub-regional project Indicators of ICT usage in secondary education in Baltic and CIS States;

» An **indicator system for the national pilot projects** for Belarus and Russian Federation;

» An **aggregated indicator model** for overall evaluation of ICT usage in education;

» A **model for integration** of indicator model with overall socio-economic data and education evaluation information;

» **Indicator models for different education levels, forms and domains** - pre-primary, primary, higher, vocational, supplementary, education for people with special needs;

» Requirements, structure and implementation of **information system** for automated indicator model data collection, processing, storage, presentation and dissemination;

» **Position paper** on ICT Integration in Education for policy- and decision makers of the UNESCO Member States;

» **Instruction materials and training courses on** ICT Integration in Education for policy- and decision makers of the UNESCO Member States;

» An updated indicator system for the next step sub-regional project Indicators of ICT usage in secondary education in Baltic and CIS States.

**Issues to be reflected on for IS composition**

» Target audience (countries, languages, professional groups, level of computer competence)

» IS purpose (information, inventory, monitoring, research, decision-making, complex)

» Scale (global, regional, national, local)
Chapter 4: Summaries of Experiences from other Regions

- GIS data type if any (vector, raster, combined, 3D)
- Data storage, updating and administering (periods, type of access)
  - Data processing, modeling and analysis
  - Data control, visualization and output
  - Database features (type, volume, functions, number of users)
  - Distributed access features
  - Data acquisition (web-forms, spreadsheets, text-forms, blanks, DBMS applications)