SPECIAL THEME

INFORMATICS AND EDUCATION: IMPLICATIONS FOR HIGHER EDUCATION

Editorial

This issue of *Higher Education Policy* is based on the presentations to the Unesco 'International Congress on Education and Informatics: Strengthening International Cooperation,' held in Paris from 12 to 21 April at Unesco Headquarters. Almost 500 participants from 96 countries, 18 non-governmental organizations, five UN agencies, and eight intergovernmental organizations participated in the Congress, to exchange ideas and experiences on significant applications of computers and other new information technologies in education.

At the conclusion of the Congress, the delegates' judgements and envisagements resulted in a declaration of key principles which they believe are critical to the future development of informatics. These principles, summarized in the Final Report, are recommended for consideration in the development of any national or international plans for informatics. They are summarized here because they are an integral part of the articles presented in this journal.

The Congress agreed that information technology will remain an effective instrument in improving education. It realized that unless there are immediate cooperative steps among nations, leading to a real sharing of resources, educational disparities will grow and may never allow some countries to achieve a technological balance with projected technological development. Industrial countries develop technology with their own language and cultural formats in mind. Other countries, however, must respond to, and use it, within the context of its original format. The stress and conversion costs fall on the recipient countries. When there are no resources for conversion, these countries must adapt to culturally biased languages and formats. The Congress felt that the new information technologies should be part of the culture available to the entire populations of countries. The new technologies ought to play multiple roles: as tools for education, as effective transaction agents to improve teaching and learning, and as managers for information delivery, with the result that countries would see the improvement in societal development. Educators must be retrained to manage the new technologies. High-level professionals will have to combine their expertise in technology and cognitive science to provide leadership in the development of the technologies. Pedagogy can be improved through informatics. Research integrating the new technology with other technologies must continue to improve the pedagogical process.

The Congress noted the contributions of the hardware and software industries to promote the development of the new information technologies in education. The agreement to strengthen international cooperation for the promotion of educational innovation, experimentation and research was considered an important issue. This strengthening was to be based on a cooperative view of which new technologies would have the greatest potential for improving the entire informatics development.

Most of the articles in the journal are based on the speeches made during the Congress. Other articles were selected to provide additional background and case examples for five themes identified by the authors. These themes are:

1. Status of Development
2. Emergent Systems
3. Education and Teacher Training

4. Applications
5. Knowledge Access

THE PARIS CONGRESS: A FEW OBSERVATIONS

These observations, and recommendations which follow, are based on the following premise: that informatics must be developed and implemented in keeping with the needs, economic capacities, and social and cultural conditions of individual countries. The new information technologies, informatics, have become an integral part of the educational development and testing efforts of many countries over the last few years. In some degree, most countries have been involved in implementing informatics in education. Experiments and pilot projects abound and are present in the literature. Developing nations with limited resources wisely scale their efforts to pilot and demonstration projects as the starting point in national development of informatics. Industrial nations have spent millions on research, development, and implementation of widespread projects that have impact on every teacher and student. The continuum of projects and programmes ranges from small individual initiatives to entire country-wide efforts. A similar range in the financial support provided by countries is also evident.

The commonly accepted premise about informatics is that, over the last few years, it has proved itself in many settings and conditions. This acceptance has resulted in greater professional involvement and commitment from all sectors of societies — not just education. Some education systems are faced with the reality that informatics requires a flexibility beyond their current format. Integration of informatics into the education system of a country has impact on every facet of the curricula. Once started there is no return to prior methods of educational content and delivery. Planning for informatics has become as significant for countries as for any new curricular innovation in history. Societal needs, with the changing patterns of skills and competencies, are now thrust in the middle of informatics development. Training for new jobs has become a societally shared goal and requirement in many countries which can be greatly enhanced through informatics. Learning has begun to be accepted as a lifelong venture in which governments, business and industry, and education are partners sharing common worldwide needs and requirements. The financing of informatics education is emerging as a responsibility shared between all sectors of the economy, although implementation of the concept is only in its infancy.

The view of informatics, as an emerging science, with great potential to mould the culture, social and individual characteristics of countries was an important theme. A number of important roles for informatics were put forward as means to lessen the technology gap between developing and industrial countries and as ways of providing high technology training to an increasing number of countries at delivery costs lower than conventional educational methods. Transferability of information among countries with dissimilar systems will have to be overcome. Software for shared use among countries will have to be validated and freely distributed and hardware standardized. National and regional information centres would have to be set up to manage the exchange of information between countries.

A MISSING COMPONENT

A missing component in financing has been the demonstration that informatics can save resources and provide a real cost benefit in instruction, as well as greatly enhance teaching and learning. Account is now being taken of this component in the projection of financing for implementation of informatics education. The larger the scale of implementing informatics programs, the greater the opportunity for cost saving. Unfortunately, initial development costs remain high, and long-term projections and analysis of informatics education initiatives are difficult to forecast within many government budgets. Multi-national support of informatics through the leadership of worldwide organizations such as Unesco has not been a priority with many industrial nations. Without such support, the capacity necessary for developing countries to function in a high technology world is limited to experimental and pilot settings. In view of worldwide conditions and requirements for commerce, business and industrial health, this posture is neither reasonable nor realistic. A number of years ago James Hilton wrote a book, *Lost Horizon*, in which a mythical land, Shangri-la, was waiting for the time when the world would need the wisdom and knowledge to reconstruct itself into a completely coordinated universe of ideals and goals. Shangri-la would then be ready to serve all countries as keeper and disseminator of the total world's wisdom. Perhaps the time has arrived when some institution can fulfil that role.

Traditionally, education has taken a secondary and reactive position to societal development. The changing nature of informatics now places it in a position where it can permanently influence the development of countries, from elementary school through postgraduate education. No other institution has control of every citizen for as long a period as does education. With this growing responsibility and expanding potential, education now assumes the leadership role in training for all levels of society. The worldwide organizations which serve education must now expand their vision to improve conditions for all sectors of their countries.

RECOMMENDATIONS

A dominant theme which emerged from the recommendations of the Congress was the critical need for international cooperation because of the proven benefits of shared experience in informatics development and the limitations of scarce resources, a condition shared by many countries.

The Congress felt that international cooperation was needed specifically to:

1. foster the exchange of information in all areas of research, development, and implementation of informatics;
2. increase the exchange of validated software;
3. develop partnerships and joint projects for software development;
4. increase the training of teachers, trainers and specialists in the field;
5. conduct research to improve the field;
6. expand educational and industrial cooperation through alliances, partnerships and cooperative projects;
7. acquire financial and technical assistance for the broad range of needs and requirements common across and within countries;
8. expand the use of pilot projects as a cost-effective mechanism to test and assess programmes for countrywide distribution.

USIT: An Emergent Informatics Model

Numerous recommendations were made for procedures and prior conditions needed to operate successfully within the conditions, constraints and opportunities typically found within informatics development. Considered together, these elements constitute the basis for an operational model as follows:

To be effective, informatics requires a flexible and dynamic curriculum. Such a curriculum must take into consideration the

economic, social and cultural conditions of a country. There must be a high involvement of teachers and administrators during the development and revision of the curriculum. Where possible, international designs should enable countries to share resources and foster development and implementation with less cost. While pilot projects are an excellent starting point for countrywide or international projects, implementation can only be successful when proper infrastructures are in place with the continuing support and commitment of the government, organizations or funding agencies.

In some countries limited resources do not allow for minorities, including women, to be involved. Long-range plans ought to include minority access as a significant element. The use of wide area and local area networks can reduce dissemination costs and improve access. Start-up budgets are essential. Long-term commitments of resources are also required for project and program implementation. Investments by governments must be long-term, continuous and sequential in order to be most effective for most informatics projects. Technology continues to change at a variable rate. Under the current trends in industrial development, no project can assume that its initial plans to incorporate a current technology will be the same months or even several years later. Countries must keep up to date in the development of technology or they must band together in the development of a universal system for informatics that allows them to begin to achieve a critical technology mass. An essential part of such a development is a continuous scanning of industrial development that monitors the changing technology.

Commercial software has been very important in expanding the field. It plays a key role in the development and implementation of informatics everywhere. However, it must not be a substitute for country development that considers local needs, requirements and conditions. Industry has taken the lead in development in this field. Education is the user and knows best its needs and requirements. Education also controls the resources and the target groups. Education should lay down the needs and direct the future development of informatics. Every effort should be made to work with industry to so that the needs and requirements for informatics development will be met.

Clearly, from what has been identified in terms of needs and in terms of closing the technology gap between both industrialized countries on the one hand, and between industrializing and developing countries on the other, new initiatives to expand the utilization of informatics are called for. In this connection, the International Association of Universities, in cooperation with Unesco in Paris and with CEPES, its European Centre for Higher Education, based in Bucharest (Romania), is setting up a University-based Critical Mass System for Information Technology (USIT) designed to attain a critical mass in information technology usage at universities. It is intended to enable higher education establishments to obtain a better access to, and usage of, information technology. The project will provide a carefully tested design and work out strategies for implementation to meet both current and projected requirements for information technology over the next few years.

The International Association of Universities and Unesco will operate through their networks as well as through their institutional bases to develop the project. The initial phase will be launched in 1990. Universities, together with other interested organizations and agencies, will be invited to take part in the undertaking.

We have not yet become the global village. Dissemination of what we have learned in educational development, in financing, and use of technology are not yet effective. Dissemination strategies should analyse every delivery mechanism so that variations on the wheel are not invented over the entire world. Unesco, in cooperation with interests represented in non-governmental organizations such as IAU, can play a pivotal role in the development and dissemination of projects, programmes and initiatives, on a planetary basis.

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