

## Some Aspects of Integration of Information Technologies into Education

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Received: June 2002

**Abstract.** Information and communication technologies (ICT) are increasingly running into all kinds of activities in education. Modern technologies are applied in various fields and many institutions are involved in their development. The Institute of Mathematics and Informatics (IMI) is one of the research institutions that paid attention not only to pure theoretical investigations but also to various researches in the integration of ICT into education.

The paper deals with several trends in the field of ICT performed at the institute: Fostering the cultural heritage and e-democracy (1), Didactics and methodology of informatics (2), Localization of software (3), Information technologies in Lithuanian studies (4), Cooperation with business companies in the field of education (5).

Transfer know-how to less enabled institutions, development and active promotion of educational material on digital publishing are the most significant works done in the field of cultural heritage preservation and accessibility in digital space. Researches in the area of didactics and methodology of informatics provided at the institute are recognized all over the country. The investigations in software localization and Lithuanian philology have been the most important tendency for the last decade. The cooperation with business companies in the field of education as newly emerging trend is also discussed in the paper.

**Key words:** information and communication technologies, informatics, localization, Lithuanian language, multimedia, digitization.

### 1. Introduction

A rapid development of information and communication technologies (ICT) during the recent decades has had many contact points with education and research. The extreme development rate is indicated by numerous projects, investigations, strategies, programs related to this topic. Nowadays ICT play a role of increasing importance in almost all fields of education.

In order to apply information technologies in education more effectively, it is essential to perform diverse investigations, explore the situation and relate the current state with the experience of other countries.

The Institute of Mathematics and Informatics (IMI) is one of state scientific institutions in Lithuania the main task of which is to pursue research work in various fields

of mathematics and informatics. The studies in the field of probability theory conducted at the institute are well known all over the world. Important investigations are also performed in the field of differential equations, computational mathematics, and mathematical logic. Recognition processes, optimization methods, data analysis, infrastructure and management of computer network, and technologies of multimedia are the main trends of informatics in the institute.

Though the institute was established as an absolutely scientific theoretical institution, it is not dissociated from the activities in education and, particularly, from the various researches in applying new technologies in education. The activities have especially increased during the recent decade when informatics and information technologies took a very important place in the programs of both secondary schools and universities, thus causing a necessity to motivate different propositions related to application of modern technologies in teaching.

The importance of every scientific institute could be assessed according to two features: first, – what part its theoretical results play in the context of the world science, and second, – how useful it is for its country, region, and citizens. The theoretical studies of scientists of IMI are fairly well known all over the world.

In this paper, we will review experimental and more practical investigations that are necessary and important for Lithuania. The most important application trend of these scientific experiments is application of information technologies in education, which is understood, in a broad sense, including the humanities, culture, teaching and learning.

The most important experimental researches in the field of information technologies performed at the institute could be divided into several groups: 1) Fostering the cultural heritage and e-democracy (Informatics for the humanities); 2) Didactics and methodology of informatics; 3) Localization of software; 4) Information technologies applying to Lithuanian philology; 5) Cooperation with business companies in the field of education.

## 2. Theoretical Aspects of Applying Information Technologies in Education

The concept of integration of ICT into education is very broad and involves various purposes and means related with the use of computers in the process of education. There appeared several different trends of integration of information technologies into education after computers have been started to apply in education. The trends of computer implementation are different because of distinct educational purposes that are usually related to the use of information technologies.

These are the most often mentioned seven educational purposes presented by M. Eraut's promoting integration of information technologies: 1) more efficient realization of educational purposes; 2) realization of new educational purposes in the current educational system; 3) learning to use the information and communicative technologies and to acquire proper information and communicative abilities; 4) teaching of special knowledge and skills which will be needed for work in the future; 5) teaching about the society and information technologies; 6) formation of the critical attitude towards the new technologies and their cultural and economic aspects; 7) training of abilities to creatively apply new technologies in the realization of their projects (Eraut, 1991).

After the review on the integration of historical development of computers and, to be more precise, information technologies into education, several more general trends could be described. There are three most commonly indicated trends in the world that were first described by D.H. Jonassen (1996): Learning about a computer (1), Learning from a computer (2), Learning with a computer (3). Learning with a computer contains elements of learning about a computer and learning from a computer. This type of ICT usage covers a wide range of related knowledge and abilities to deal with information, and employ ICT in a rational way.

Even earlier F.R. Tarrago appointed three analogous trends, but his descriptions are more thorough and precise (Tarrago, 1993):

1. By applying common information technologies, to train knowledge and skills;
2. By using information technologies, to expand studying of various subjects;
3. By applying information technologies, to exercise common intellectual abilities.

Each trend is related with a different position of information and communication technologies in the process of education. In learning "about a computer", information technologies are the object of study; in learning "from a computer", they are the resource of study; in learning "with a computer", they become both the object and resource of study. The scientists almost one and all appoint two – academic and integrated – trends of computer installation that are commonly called as "teaching of informatics" and "computerized teaching". The third trend – learning with a computer, is called and interpreted differently in various classifications and sometimes is not appointed at all.

A thorough analysis of usage of the common elements of information and communication technologies in the process of education in comprehensive schools has been made (Markauskaitė, 2000). This paper is especially concentrated on the analysis of the methods of computerized teaching and the review of their taxonomies since detection of logic, lying in the classifications, reveals the entirety of approaches to applying information technologies in the educational process.

We will explore the activities of the Institute of Mathematics and Informatics in this area, considering theoretical preconditions, purposes, and tendencies of ICT applying in education. With reference to scientific literature, reviews of research results and educational documents, results of ICT integration into various aspects of education and culture, engineering activities performed, projects prepared and other stuff are analyzed in the paper.

## 3. Fostering the Cultural Heritage and E-democracy

New ideas that information technologies are important not only for computer scientists but for specialists working in the humanities as well emerged at the institute as early as 1980. The need of training in informatics for the humanities was realized and teaching-training activities in informatics started. In 1994 the UNESCO *Chair in Informatics for the Humanities* was established at the Institute, headed by professor L. Telksnys. It was rather innovative step: there were only thirteen UNESCO Chairs in information and communication technologies in the whole world that time (nowadays there are 37).

This article will focus on four aspects of applying advanced ICT: (i) preservation and safeguarding of cultural heritage; (ii) dissemination and accessibility of cultural heritage; (iii) education and training on ICT; (iv) ICT serving as a tool in developing e-democracy – the latest trend. The first three aspects were discussed and appreciated at the International Cultural Heritage Informatics Meeting (Kligienė and Telksnys, 2001).

#### *Preservation and Safeguarding of Cultural Values*

Preservation in IT context means digitization and safeguarding of cultural values as superior quality digital copies for long-term loss less data storage oriented to contemporary and future users. This involves storage and manipulating huge amounts of digital information representing images (digitized museum's treasures, medieval manuscripts), sound records (folklore or speech collections). Lithuanian language, still rich in dialects, are interesting for linguistic studies worldwide as one of the most ancient Indo-European languages, therefore must be safeguarded and made accessible for scientific research everywhere. The Multimedia Dictionary of Lithuanian Dialects [22] was created as the first attempt in this direction. This interactive CD-ROM demonstrates multimedia dictionary possibilities: a reader can see a picture of an object, to listen to pronunciation of a word in different dialects and to see how it is written in Lithuanian language. Therefore it can be used without any a priori knowledge of a language.

During a period of a few last years, some part of stored in Lithuania cultural heritage has been issued on CD-ROMs. Several of them have been already published or prepared to release on CD [19–27], more numerous are the websites representing cultural content [1–18]. The multimedia products into creation of which the Institute was involved, are included in the Annex of the list of References. This gives an insight into themes and content which was made accessible electronically upper-most.

#### *Dissemination of Cultural Heritage*

Nowadays cultural heritage cannot be represented by text only, multimedia elements emerge inevitably. This requires extended computer memory resources and broadband communication channels in order to share with others digitized cultural values. Computer networks are still not ready for transmission of heavy flow of cultural information. This is alike anywhere but a problem is especially hard in countries in transition experiencing all ups and downs conditioned by economical and social difficulties of post-communist period in its cultural revival and rediscovering its spiritual values. More precisely focusing on the specific economic conditions for ICT development in Lithuania, the following factors should be mentioned.

Firstly, the critical mass of users necessary to spark the market "explosions" can be expected, as declared in many sources, when Internet penetration reaches 10% (as percentage of total population). The latest data provided by the *InfoBalt 2002* on the Internet penetration in Lithuania shows that it has jumped from 11.2% at the winter 2001 to 21.3% at the summer 2002. At the same time the increase of ICT market, evaluated by 20% (1.23

billions \$) last year, will reach 30% this year (the data of *InfoBalt Association*). But there is no visible change for users: they face the high cost of network access (in average evaluated as 10% of a middle-level salary per month). Lithuanian Internet surfers can only dream about low-cost, high-band-width, and ubiquitous connections to the network so important for cultural heritage presentation online.

Secondly, the high quality equipment and an experience necessary for digitization and storage of cultural values is still rarity in Lithuanian museums or libraries and no funding foreseen for this. Among negative factors mentioned above, a positive one should be mentioned also. That is availability of highly skilled in informatics personnel at the universities and firms ready to take up actions and to help in representing a cultural heritage.

The important goal is a development of Internet-based services in order to extend cultural activities, to promote the use of advanced ICT for access to, understanding, preservation and economic promotion of country's cultural heritage in European or worldwide context. But that is rather hampered by economical factors, mentioned above. Even more important goal is to face a reality of country in transition and, using rather limited resources, to follow up worldwide process of so called digital revolution. The new era is the explosive development of the Internet and possibilities offered by the rapidly growing technical advances of the digitization, enabling easy access to various treasures of the cultural heritage sometimes is only an illusion. Say, a portal site *Museums of Lithuania* [7], rich in content is often hardly accessible from other countries because of the "bottleneck" effect and miss many opportunities to represent cultural heritage stored in Lithuanian museums.

New opportunities for self-expression of cultural communities of ethnic minorities in digital space and spread their wealth were used extensively in Lithuania. Several Lithuanian ethnic minorities, such as the Karaims or the Tatars celebrated the 600th anniversary of their settlement in Lithuania. In spite of a rather small number of those nationals (less than 0.2% of whole population). The smallest minority – Karaims have only 257 persons (data of 1998) living now in Lithuania they were not assimilated during ages and have safeguarded their customs, their religion and their identity. New media means such as WWW and CD-ROMs do open wide opportunities to those ethnic cultural minorities: their web sites were created in the framework of Lithuania State program *A Virtual Exhibition of a Millennium of Lithuanian Cultural Heritage* [6]: Jews in Lithuania [18], Lithuanian Karaims [6], Lithuanian Tatars [6], Russian Culture in Lithuania [6]. The past, history, customs, traditions, language, religion, social movements are considered here in details and are illustrated with pictures and records of music, language, hymns. This project has been developed adding new materials and issuing the CD-ROM on the Cultural Heritage of Ethnic Minorities in Lithuania [24]. It is interesting to notice that there is no analogous CD-ROM on the cultural heritage of the main population of Lithuania but instead there is a digital book-encyclopedia about Samogitia [27] – one of the ethnographic regions of Lithuania. It is a good proof that new media provides equal opportunities to small and big communities, fosters and stimulates their self-expression in a new media. This can be seen from the list of multimedia projects, given in the Annex of References at the end of this paper. These projects are implemented at the UNESCO

Chair in Informatics for the Humanities and the Multimedia Center for the Humanities at the Institute of Mathematics and Informatics, in collaboration with many other Lithuanian cultural institutions: Institute of Lithuanian Language, Lithuanian Art Museum, Vilnius Art Academy, Martynas Mažvydas National Library of Lithuania, Institute of History.

#### *Training Projects on Information Technologies*

In previous subsection was mentioned a great impact of ICT people into dissemination of cultural heritage, but not everything can be done by the efforts of information technology's specialists only. The progress in the fields of hardware and software is nothing if a human factor – the ability of the community to understand, accept and use the advanced technologies is forgotten. Teaching and training users and trainers in the fields of cultural education become one of the most important challenges in creating Information or Knowledge Society in many countries.

Training on ICT for purposes mentioned above is implemented as intensive course informatics for the humanities. The latest example of a specialized ICT training is the project supported by UNESCO entitled *Courseware for Training of Trainers and Users on the Special Applications of Internet-Based Services in the Fields of Cultural Education* [2], created at the UNESCO Chair in Informatics. The aim of this project is to develop educational material completed with explanatory texts, examples, demonstration material on the special ways in which computers and, in particular, Internet-based techniques can be used in the fields of culture, such as museums, teaching of music, management of cultural sites and tourism, artistic creation and education, preservation of and improved access to historical documents, publishing. The training material is accessible worldwide online and on CD-ROM if requested from UNESCO. Other projects in education area are: *Training of Trainers on Digital Publishing* [26] supported by UNESCO, 1999–2000, and *Development of Electronic Publishing Program in Lithuania* [10, 26], supported by the Open Society Fund-Lithuania (George Soros Foundation). *Training of Trainers on Digital Publishing* consists of:

- fundamentals of web page and site creation,
- processing of multimedia used on the internet,
- fundamentals of the copyright, right management,
- marketing multimedia products,
- fundamentals of being an instructor, evaluation, presentations.

The result of the project – the training course package consisting of the explanatory text and demonstration material – is included in the UNESCO Research Program Informatics Curriculum Framework 2000.

The latest project in ICT deals not only with cultural heritage but also with children. The EC funded project CHIMER (Children's Heritage Interactive Models for Evolving Repositories) aims to establish an open international network of children, teachers and museum's staff for developing an Open Evolving Multimedia Multilingual Digital Heritage Archive as a long-term storage medium for European cultural repositories. It sets

out to capitalize on the natural enthusiasm and interests of children in developing new approaches to the use of evolving technologies for documenting items of cultural interest in their local communities. It is one of projects funded by the European Commission's Information Society R&D program, 5th Framework. Partners are in Czech Republic, Germany, Lithuania, Spain, and The Netherlands, working together during 2002–2004. The partners in Lithuania are: the Institute of Informatics and Mathematics and the Vilnius "Minties" gymnasium.

The aim of the project is to teach children of 9–12 years the following abilities:

- to learn through game how to create an open digital archive;
- using GIS to create e-maps connected to the cultural heritage archive;
- to develop skills, using fully featured computers, digital cameras, web cameras, and scanners;
- to participate in building a live view of the cultural heritage of their villages, towns, and regions;
- to use the third generation technologies for creating an M-guide, E-Guide.

The results of the project CHIMER are presented on Internet [1].

Interesting educational material [20] is devoted to disabled people in order to teach them by pictures and video records to use sign language. In this digital book of conversations the readers will find over 1500 words and phrases in Lithuanian sign language: Lithuanian, Russian, Polish, English and German. The CD will be useful to the hearing for getting acquainted with the world of sign language and especially for the deaf who for the first time in Lithuania will have a conversation book for learning foreign languages.

The emerging trend in ICT use is a support and development of e-democracy. The Institute is actively involved into these activities as well (Kligenė, 2002). An information system is created at the Institute of Mathematics and Informatics for online consultation on *A Long-Term Strategy for Lithuanian Economic Development in 2001–2015*. It is the first Lithuanian effort in electronic community consultation put into practice on the special website [www.svarstome.lt](http://www.svarstome.lt) [3], enabling a topical public discussion with experts. Each visitor can read prepared documents of strategy and express his opinion online. Experts in 14 specific strategies (i.e., *Economic Integration, Finance, SME, Communications and Informatics, Agriculture*, and so on) have an opportunity to react to public opinion and to improve the strategy. The strategy was prepared in a very short time: November 2001 – April 2002 and this is a valuable impact of ICT too. Information system is applicable to effective online consultation in many other fields.

Several years of development cultural objects in digital space had proved that it is extremely important to teach the content owners to represent their heritage in new media and to maintain their web sites, when lack of funding is a common situation everywhere. Otherwise the number of forgotten or "dead" sites will increase dramatically and a culture of a small country will be diluted in a progressing process of globalization. An emerging e-democracy has a similar urgent need: highly qualified experts in various fields have to be trained how to use the modern ICT tools for effective work in their own field. Institute is facing this need and going ahead.

#### 4. The Didactics and Methodology of Informatics

In the process of experiments in the area of integration of information technologies into the teaching process, we have constantly referred to the analysis of general curricula and educational standards of Lithuanian comprehensive schools (Lietuvos ..., 1999; 2001), closely following how various computer application and information technology forms are integrated in foreign countries and how it is being done at schools in Lithuania.

The main document, prepared after conducting scientific research in the area, is the Strategy for Information and Communication Technology Implementation in the Lithuanian Education, approved by the Ministry of Education and Science of the Lithuanian Republic, dated 18 October, 2000 (Informacijos ..., 2000).

The key purpose of the Strategy is to provide the prospects and trends of integrating information and communication technology into the general Lithuanian education, to plan the stages of its implementation, to harmonise activities of various institutions, and to effectively use the funds allocated for the computerisation of education (Markauskaitė, 2001).

The Strategy includes primary, lower secondary, upper secondary, high, vocational, youth, and special schools, which provide general education. The Strategy is based upon the aims of the Information Society Development Programme in Lithuania, regulations and objectives of the National Curricula and Educational Standards of the Lithuanian general education. The document also includes the priorities of the second stage of the educational reform.

Five parts externalise the main purposes of the Strategy:

1. Analysis of the situation, where the qualitative and quantitative aspects of computerisation of the Lithuanian general education, the retrospective computerisation, and the existing level of school computerisation has been presented.
2. In the vision part, the following seven areas of education have been pointed out: 1) the relationship between education and society; 2) life at school; 3) the content and methods of education; 4) provision of computer equipment and learning aids; 5) teacher's role and qualifications; 6) the connection between science and education; 7) management and funding of ICT implementation.
3. Priorities: point out the most important tasks of ICT implementation, their order of importance and connections.
4. The principles of implementing the Strategy have been presented.
5. The programme of implementing the Strategy "Lithuanian School in the Information Society of the XXIst Century" has been developed.

The trend of integration of informatics and information technologies into secondary schools has prevailed for a couple of decades. It is possible to distinguish several most important areas:

1. Strategic and objective planning of teaching informatics.
2. Improvement of qualifications of informatics teachers.
3. Work of the Lithuanian Young Programmer's School.

4. Organisation of Lithuanian Informatics Olympiads and preparation of the tasks for them.
5. Localization of educational programs.

During that time a lot of results have been achieved. We list here the most important academic, experimental, and applied activities.

- Continual suggestions to the Ministry of Education and Science on the teaching of informatics and integration of information technologies.
- Accomplished analysis of teaching informatics and information technologies.
- Prepared curricula for teaching informatics in secondary schools.
- Prepared curricula for teaching informatics in the final level of secondary schools.
- Proposals on the educational standards of informatics and information technologies are being submitted.
- Course books on teaching informatics in basic schools are being prepared and annually updated.
- A prepared experimental course book on information technologies for 11–12 grades and the implementation of it is being carried out at 25 schools jointly with Ministry of Education and Science.
- Lectures on the teaching of informatics and integration of information technologies are being constantly delivered.
- Teaching material is constantly being prepared.
- Students from comprehensive schools all over Lithuania can study (by correspondence and e-mail) in the Young Programmer's School.
- With the help of the Ministry of Education and Science, Lithuanian Olympiads in Informatics are being organised (three rounds), the best students are trained for Baltic and International Olympiads in Informatics.
- Together with the Technical Committee of Standardization TK-4, the Lithuanian computer keyboard and coding standards have been prepared.
- The dictionary of terms of a dialogue with a computer and the phraseological English–Lithuanian explanatory dictionary have been prepared, published, and are being continually updated on the web.
- Several programs have been localised (*Comenius Logo*, *Windows Commander*, *Geometer's Sketchpad*, *Black Box*, *Mozilla*).
- The data management package *OpenOffice* has been started to localise.

#### 5. The Localisation of Software

In order to use computer tools widely and effectively in education, a dialogue with the user has to be conducted in the language the user can understand, in one case, in Lithuanian. Therefore, one of the most important goals is to supply users localised programming software. Since Lithuania is a small country, the localisation is being stressed.

There are many different projects in our institute being done, as well as software packages localisation, used for teaching, and preparation of the methodology for working

with such programs is prepared (Dagienė, 1999; Dagys, 2000; Dagys, 2001; Grigas, 1998; Grigas, 2000; Grigas, Zalatorius, 2000). The following final results should be mentioned:

1. The Lithuanian keyboard standard has been prepared (in 2000, together with Vilnius University and Technical Committee of Standardization TK-4).
2. The package *Comenius Logo* has been localised, a set of methodical learning material for working with this program (in CD and printed form) has been prepared.
3. The geometry teaching program *Geometry Sketchpad* has been localised.
4. The usage of Lithuanian names in various programming languages has been explored and translator *Free Pascal* was corrected to be used both in the Lithuanian and international environments (Dagienė, 2001).
5. The file management program *Windows Commander* has been localised. The course of working with data using this program has been prepared and published on the web.
6. The analysis of Lithuanian characters in the e-mail has been finished. Supplements for some e-mail programs as well as software compatibility methods have been prepared in order to adjust them to transmitting Lithuanian characters.
7. The dictionary of terms of a dialogue with a computer is prepared.
8. The system of component programming "Black Box" has been localised (Grigas, 2001).
9. The conferencing program "Majordomo" has been localised.

The work in this area is being done systematically. First, the corresponding research (analysis) is being completed and the most suitable software for localisation from several packages of the same purpose is being chosen, taking into account the specificity of localisation. The phraseological and term dictionaries are being compiled, the dialogue and the electronic vocabulary are translated. If the software has an educational purpose, then the teaching and methodological material is also prepared.

## 6. Information Technologies in the Lithuanian Studies

A great many of the unique Lithuanian language (lexicography, dialectology, onomastics, terminology, folklore) data are collected in Lithuania. This linguistic heritage is actually the main basis of theoretical and practical studies of the Lithuanian language. It also is of a worldwide significance – the Lithuanian language is the most archaic of the existing Indo-European languages, closest to the parent language from which it has originated. Thus the Lithuanian language is very important for exploring other Indo-European languages and antique cultural heritage of mankind.

The main problems of the Lithuanian language are storage, usage, and exploring of this material.

Application of information technologies in the Lithuanian language is very important both to our language and culture in general (Černiauskas, 1999).

Nowadays quite different problems arise. As it has been remarked in the report of The Strategy Planning Study Group of European Association Committee (DG XIII), a long-term exploration of languages pursued by the Association (Towards, 1992) referring to

the expansion of information technologies, both current written and spoken languages now undergo heavy changes, and in the future full-fledged languages will remain only those which will find a proper place in the information technologies.

More than ten years ago the Institute of Mathematics and Informatics started applying the information technologies in the Lithuanian language, – together with the Institute of the Lithuanian Language the first attempts to apply computers in processing Lithuanian language data were begun.

Specialists of informatics in cooperation with linguists have prepared a computerized version of "The Dictionary of the Modern Lithuanian Language", third edition. On the grounds of it "An Inverse Dictionary of the Modern Lithuanian Language" (Atgalinis ..., 1995) has been compiled, a system for a computerized derivational analysis of the standard Lithuanian language lexis was developed. The data base of the modern written Lithuanian language has been developed, on the grounds of which the "Dictionary of the Frequency of the Modern Written Lithuanian Language" has been compiled (Grumadienė, 1997; Grumadienė, 1998). Now the job of an extreme importance is performed – a bank of the Lithuanian language terms is created.

Due to the fast technology progress in the world, a lot of new terms come into being and get into usage, often alien barbarisms set up in the language. So it is very important, in time and properly, to admit and prepare new terms so that the correct terms would consolidate, and to inform the society as well. The bank of the Lithuanian language is indispensable for various needs of regulation and usage of terminology, namely:

- the research;
- the regulation of current terms: systemization, standardization;
- the specification of the terms used in special areas of science, engineering, art and others, as well as the creation of the new terms;
- compilation dictionaries of new terms;
- preparation of the technical-industrial documentation by manufacturers (not only in Lithuanian, but also in other languages, if needed);
- the source of information for translators, editors, and other users of the language;
- teaching;
- the Lithuanian language engineering;
- the search of information in the world network.

In 1995, it was decided to create a bank of terms (termbank), which would embrace proportionally all the areas of terminology and whose data base would consist of the best standardized groups of Lithuanian terms presented in the dictionaries of terms, standards, normative Lithuanian language dictionaries, and encyclopedias.

The termbank is being created gradually, first transferring to it absolutely unaltered data from dictionaries of terms. At the moment it is proceeding in this manner: the data from the best-prepared term dictionaries of various areas, which are recommended by the terminologists of the Institute of the Lithuanian Language, are being transferred into the termbank.

The data stored in the termbank have a thorough description (the title, abbreviation, synonyms and variants, equivalents in other languages, systematic data, grammatical in-

formation, bibliographic references, and so on). This allows performing a universal search in the termbank. At the moment, the search could be performed according to: 1) the entry (term word); 2) the first, middle, or last letters of the term; 3) abbreviation; 4) the reference to the usage area; 5) formula; 6) synonym; 7) variant; 8) equivalent in a foreign language; 9) deprecated term; 10) components of a compound term; 11) origin of the term; 12) other features.

In the termbank there are now about 200000 terms transferred from eighteen term dictionaries of various areas (physics, mathematics, botany, chemistry, geodesy, auto-roads, sociology, information, pedagogics, informatics, electrotechnics, radioelectronics, sport, psychology, geology, physical geography, textile, and others).

Later on, when the data from the main dictionaries of terms has been introduced, the corrections should be added, which were approved after publishing those dictionaries by the committees of terminology, Terminology Department of the Institute of the Lithuanian Language or the State Commission of the Lithuanian Language. Other sources of terms would be encyclopedias, new material – classifiers (the titles of goods, products, and other stuff).

The termbank is created under the auspices of the State Commission of the Lithuanian Language (State project for 1996–2005) and in cooperation with the Institute of the Lithuanian Language.

## 7. Cooperation with Business Companies in the Field of Education

Applying information technologies in education, the Institute of Mathematics and Informatics has been for many years in close cooperation with private institutions: the company of computer equipment supply “Baltic Amadeus” (BA) and two publishing companies – TEV and VTEX.

This is the way of coordinating the scientific research work with prospective projects and their concrete realisation in educational institutions.

For major trends could be distinguished in the cooperation with BA:

1. Software development and adaptation to the needs of education;
2. Creation and maintenance of data bases needed for education;
3. Equipment of computer labs in schools and sponsorship of individual schools;
4. Support in the organisation of Informatics Olympiads.

BA is successfully guiding the final stage of the project “Creation of the information system of education in Lithuania”, the executor of which is a consortium of Lithuanian information technology enterprises. Our institute is one of the members of the consortium.

Following this project, various teaching programs as well as data bases and registers, necessary for education, have been developed:

- Educational program for teaching geometry (IMI);
- Package “Teaching material of Logo” (IMI);
- Program of data management (IMI);

- Information system for work organisation and documentation (MES, BA);
- Data base for educators (BA)

Together with the Lithuanian bank of agriculture, BA equipped seven computer labs in different schools of Vilnius and Utena. Due to support of BA an Information centre has been set up in the Degučiai basic school (Zarasai district), the facilities of which are accessible not only for school students but also for residents of the town.

BA and IMI are sponsors of Lithuanian Young Mathematician’s Olympiads, organized by the Informatics faculty of Vilnius University. BA supports the team of informatics students of the Olympiad of Baltic countries. The annual competition of Logo is also supported.

In 2002, the Fund for Science, High Technologies and the Studies, IMI and its partners BA, TEV, and VTEX had an opportunity to exhibit in a joint stand the information society technologies associated with education, at the exhibition “MOKSLAS”.

The Institute of Mathematics and Informatics submitted its works in which information technologies are applied to the Lithuanian culture heritage, to the needs of the Lithuanians and to the building up the teachers’ infrastructure. Information systems developed in IMI meant for interactive public policy implementation in Lithuanian work with digital maps and geographic information have been demonstrated as well as investigation of Lithuanian teachers’ needs presented.

At the exhibition BA presented the system work organisation and documentation handling as well as an IntraLED version of a computer dictionary LED (Lithuanian–English Dictionary). The publishers of scientific literature VTEX submitted to the exhibition some modern scientific publishing technologies, while the publisher TEV displayed manuals of mathematics and informatics, proceedings of the international conferences on probability theory, and mathematical journals.

The application of information technologies in education is inseparable from the propagation of scientific research results in this field and preparation of the teaching matter. That is why the cooperation with the publishers TEV and VTEX is of utmost value. We could isolate here three major trends of work:

- Preparation for publication of manuals for comprehensive and higher schools;
- Compilation and publication of dictionaries;
- Elaboration of the systems for scientific information retrieval.

At the present time IMI, BA, TEV, and VTEX jointly with other founders take part in the project of establishing the scientific technology park (STP) in Visoriai.

The goal of the Visoriai centre is to concentrate the potential of scientific institutes, business and higher schools for the creation and implementation of information technologies, training specialists, and development of information technology business. The location of Visoriai centre is rather advantageous because side by side the Institute of Mathematics and Informatics and the company of information technologies “Baltic Amadeus” (which is cooperating with the most famous in the world IT producers and suppliers) are situated, as well as VTEX that is engaged in information data bases and cooperates with the largest scientific literature publishing houses in Europe. These institutions are interested in the cooperation with the scientists and students of Vilnius University, Vilnius

Gediminas Technical University, Vilnius College, and other higher schools. This suggests a hope that even at the initial stage of establishment of the centre the integration of science, studies, and business potentials will yield appreciable reciprocal use. It is planned that one of the work trends of this park will be application of information technologies in education.

## 8. Conclusions

1. In building an information society, one of the priorities in Lithuania is application of new information technologies in education. This work is successfully proceeded in Lithuania by coordinating the efforts of Ministry of Education and Science as well as of the science, studies, and business institutions. The role of the Institute of Mathematics and Informatics can be distinguished from science and studies institutions. The work of application of information technologies in education has been systematically performed at this institute for the three decades.
2. One of the important methodical jobs in the application of information technologies to education is scientific consideration of the aspects of information technology implementation in education. A close cooperation of scientists of the institute with the collaborators of education is one the successful work guaranties.
3. The work of the institute according to the projects of UNESCO in the field of culture heritage, pursued at the institute for nearly twenty years, has had a great positive influence on the application of information technologies in education. This work is closely connected with wider scientific methodical activities of the institute called in short as "Informatics for the humanities".
4. One of the scientific trends pursued at the institute is informatics didactics and methodology. Perhaps one of the most important advantages of this trend is that this work is performed by those scientists of the institute who coordinate their active research work with the most significant political problems on applying information technologies in a secondary school, namely, preparation of strategic documents, improvement of teachers' qualification, and organization of school activities for young programmers and Olympiads in Informatics.
5. Localization (adaptation) of software that securing a possibility of working by computer in Lithuanian at comprehensive schools is one more trend intensively performed at the institute when implementing information technologies in schools.
6. Considering the fact that Lithuanian is an ancient language studied in many universities of the world, for about two decades our institute has been pursuing work in creating a computer bank of the Lithuanian language terms and applying information technologies to study the Lithuanian language. This work is closely connected with the subject area of application of information technologies in education.
7. One of the guarantees for information technologies to be successfully integrated into education is cooperation of scientific institutions and business efforts. This

tendency is very typical of the Institute of Mathematics and Informatics that executes many important projects on education together with the enterprise "Baltic Amadeus" and other business partners.

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## Informacinių technologijų integravimo į švietimą aspektai

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Informacinės technologijos vis labiau skverbiasi į visas veiklos sritis. Šia tema rengiamų projektų, mokslinių tyrimų skaičius rodo jų nepaprastą augimo tempą. Ypač šiandien aktuali sritis informacinėms technologijoms diegti ir plėtoti – švietimas. Matematikos ir informatikos institutas, įkurtas kaip grynai mokslinė teorinė institucija, neatsiriboja nuo švietimo veiklos ir ypač – įvairių mokslinių tyrimų švietimo srityje įgyvendinant naujas technologijas. Šiame straipsnyje apžvelgiami eksperimentiniai, taikomieji darbai, kurie reikalingi ir svarūs Lietuvai. Svarbiausia šių mokslinių eksperimentų taikymo kryptis – informacinių technologijų taikymas švietime, kurių suprasime plačiąja prasme apimant humanitarinius mokslus, kultūrą, mokymą ir mokymąsi. Svarbiausi instituto atliekami taikomieji darbai informacinių technologijų srityje nagrinėjami suskirstant juos į keletą krypčių: (1) Kultūros paveldo ir elektroninės demokratijos puoselėjimas; (2) Informatikos didaktika ir metodologija; (3) Programinės įrangos lokalizavimas; (4) Informacinės technologijos liuanistikoje; (5) Bendradarbiavimas su verslo įmonėmis švietimo srityje. Institute atlikti nemaži darbai kultūros paveldo puoselėjimui, jo išsaugojimui skaitmeninėje erdvėje, užtikrinant prieigą platesniam vartotojų ratui. Sukurta skaitmeninės leidybos mokymo medžiaga publikuojama internete ir kompaktiniuose diskuose, vykdomi intensyvūs skaitmeninės leidybos mokymo kursai perteikiant savo patirtį ir žinias mažiau galimybių informacinių technologijų srityje turinčioms institucijoms. Informacijos didaktikos ir metodologijos tyrimai atliekami institute yra gerai žinomi šalyje, daug dėmesio skiriama programinės įrangos lokalizavimui, kas tapo ypač aktuolu paskutinįjį dešimtmetį. Aptariamos naujai atsiradusios galimybės ir perspektyvos bedradarbiauti su verslo įmonėmis švietimo srityje, kas sudaro realų pagrindą sėkmingam IT diegimui mokyme ir švietime.