Issues in Online Learning

With
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Dr. Gerald Knezek

and Visiting Scholars

Nola Campbell, University of Waikato, New Zealand
Dr. Iliana Nikolova, University of Sofia, Bulgaria
Dr. Roumen Nikolov, University of Sofia, Bulgaria
Dr. Lynne Schrum, University of Georgia

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Issues in Online Learning Reader

Table of Contents

Our Visiting Scholars

Nola Campbell

Kia ora, my name is Nola Campbell and I am a Senior Lecturer in Information and Communication Technology at the School of Education, University of Waikato in Hamilton, New Zealand. After an experience in the early 1990's as an online student, I began to learn what it was like to teach online. At first many colleagues suggested this was not "real teaching" but I am pleased to report that the climate is now very supportive. As the coordinator for online teaching and learning in the School of Education, I currently support staff to make the move to a virtual classroom. My research is now focused on what is happening for us as lecturers when we describe our online teaching as successful and satisfying.

Dr. Iliana Nikolova

Iliana Nikolova's research, development and teaching activities are related to flexible and distance learning, online learning, teacher development and support in ICT, multimedia authoring for children, applications of ICT in teaching and learning and integration of powerful Logo-style learning environments in schools.

Iliana is a member of IFIP WG 3.6 (Distance education). Iliana Nikolova is a chief assistant professor at the Department of Information Technologies, Faculty of Mathematics and Informatics, University of Sofia, Bulgaria. Currently also a Country Director for the USAID sponsored "Public Computer and Communications Center" (PC3) Project, also called Bulgaria Telecenters Project, which is being implemented in Bulgaria by AED-Washington.

Iliana has a Ph.D. in Computer Science (University of Sofia, 2000). The topic of her doctoral dissertation is "Design and Delivery of Web Based Instruction: Methodology and Tools". She also has a M.Sc. in Educational and Training Systems Design (University of Twente, The Netherlands, 1996).

Dr. Roumen Nikolov

Dr. Roumen Nikolov is an Associate Professor at Sofia University, Bulgaria, Head of Department of Information Technologies. He has specialized in Artificial Intelligence at the Department of Artificial Intelligence, University of Edinburgh, UK, and in Educational Technology at University of Twente, the Netherlands. Dr. Nikolov is a member of: the Faculty Council, Faculty of Economics and Business Administration, Sofia University; the Management Board, Center for European Studies, Sofia University; the International Federation of Information Processing (IFIP) Working Group 3.6 - Distance Education (WG 3.6), the Central European Chapter of the Association for the Advancement of Computing in Education (AACE). He has participated in several European projects

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Dr. Lynne Schrum

Lynne received the M.A. in Elementary Education and Learning Disabilities from the University of Evansville and, in 1991, a Ph.D. in Curriculum and Instruction with an emphasis on Distance Learning and Educational Telecommunications from the University of Oregon.

Prior to coming to Georgia in 1994, she was on the faculty of SUNY Plattsburgh. She recently completed a two year term as President of the International Society for Technology in Education (ISTE) and continues to serve on its executive board. Recently she was named as one of the 25 leaders in the field of educational technology by Converge Magazine.

Her current research focuses on computer communications, on-line course delivery, curriculum integration of telecommunications, technological innovations in education and ethical electronic research.

Her teaching areas include Distance Learning and Educational Telecommunications, research, and an Introduction to Instructional Technology.

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2001 Gwen Gawith: Garbage detection is a key component of information literacy

2000 Ron Johnston: Knowledge is abundant, but the ability to use it is scarce

2000 Stuart Hale: The last communication revolution.

1999 Pete Sommerville: Virtual field trips.

1999 Gwen Gawith: An open letter to Bill Gates.

1999 Gwen Gawith: Hype, hope or information literacy.

1998 Mark Treadwell: The emperor's new computer.

A conversation about being online

This article was published in Good Teacher, Term 2 1998

Nola Campbell

The phone rings. Nola: Good morning. Jane: Hi Nola, it's Jane here. My class is going online and I wonder what we might do. I need some ideas. Nola: What do you want to do Jane? Jane: I want to use the Net. Nola: Why? Jane: Because we have it in the school and we are going to get it in our classroom soon.

This conversation has happened many times. Jane, and all the others like her, are brilliant teachers. They are creative, resourceful and willing to try new things. I wonder why being online is so important but remember that we hold conferences and courses on the topic. We read journals, magazines and newspapers about the Internet. Clearly Jane is being seduced by this medium. Is it any wonder she wants to be involved?

We continue our conversation: Nola: Jane, do you use all the other information technology resources in the school? Jane: No, I don't need to. Nola: Do you have 10 minutes to spare while I tell you a story? Jane: Sure. I began by telling Jane a story about a group of children I met last year.

We have 'done' New Zealand:

While living overseas last year, I received a phone call from a teacher in a local city school. The teacher phoned to tell me all about how they had 'done' New Zealand and now that the project was finished they would love me to come along and hear what they had found out. She told me how she had worked for a period each day with this class of gifted and talented students, and I was led to believe that this would be a most exciting occasion. As a visitor in the country one is keen to see the local school landscape so I accepted the kind invitation.

Having got through the various security measures in place in the school I spent some time chatting to staff, visiting the Media Centre and finding out about the information activities that were in action in the school. Half an hour later I entered the classroom for the presentation by the students. This consisted of readings from the booklets they had each produced followed by a reading of their individual charts. Each was beautifully published and appeared to be quite comprehensive. I heard about the length of sealed and unsealed roads we have, the number of sheep and kiwis that roam wild, temperatures, rainfall, industries and a little about

1998 Nola Campbell: A conversation about being online.

1998 Gwen Gawith: Intelligent technologies: Teaching for information literacy.

1997 Gwen Gawith: Technology and ODL: Rent an information literate luddite!

1997 Gwen Gawith: Technology and learning.

1996 Gwen Gawith: IT: charms or challenges.

1994 Gwen Gawith: new technologies: new skills for information literacy.

and kiwis that roam wild, temperatures, rainfall, industries and a little about tourism. Once the reading activity was over I was treated to our national anthem.

Alas, there was no 'God Defend New Zealand'. The song would have been stunning if I was an Australian!

By this stage I was bursting with questions but I continued, as the guest, to maintain my polite silence until finally I was asked by the teacher to respond to the presentations. I could not resist and asked them, 'where did you get your information about New Zealand?' The response was instant, 'we got it all off the net!' I took a deep breath and then enquired what it was they had searched for and what keywords they had used. I was told that they just typed in 'New Zealand' and used whatever came up that looked interesting or good' for the project. I was unsure about what 'good' meant but it was clear that they viewed the project product as being something that presented a range of important looking facts. This was a brilliant copy and paste activity that had not apparently required too much thought or consideration as to the value and validity of the information. There was no question that the results looked impressive but how deep was their new understanding about New Zealand?

I knew I would have a captive audience as I continued to speak because they really wanted to continue to hear how funny I sounded! Here they were face-to-face with a real New Zealander. I encouraged them to ask me questions and after some coaxing they started to ask:

- What do kiwi kids watch on TV?

- What do kiwi kids like to eat?

- What music do they listen to?

- What sports do we play?

- What chores do kids have to do?

- How much allowance do kids get?

- How much do Nike and Reeboks cost in New Zealand?

- What would school be like over a whole day?

The fact that our schools generally have a swimming pool and some classes go on school camps drew gasps from the children as they pointed out the window at a relatively bare and barren landscape. Having met classes of students internationally before I also knew they would be interested in such things as seasonal variations and time difference. This was quite an exciting thing to pursue as the notion that New Zealand was almost a day ahead was quite something to grasp, almost as difficult as them discovering they were in fact behind as far as time was concerned.

The interaction between the children and myself was like a storm. Here were all these questions that they had about life in New Zealand, questions that were

relative to their own view of the world and allowed them to compare and imagine just what it might be like living in this country. Once we had dealt with what they clearly saw as essential information we moved on to discuss aspects of our economy, industry, government, landscape, etc. These more traditional facts were understood when the children had some feeling of ownership over what they wanted to find out about and it was meaningful for them.

Having answered the numerous questions, I now let the teacher in me emerge even further. I asked the question, "If you wanted to find out more about New Zealand where else could you look if the Net was not available?" There was a deathly silence. I tried again, "If you wanted to know more about the food we eat how could you find out?" One brave soul suggested the library and there followed a discussion about how they might go about this process. I interrupted once more, repeated the question and finally one of the students announced, "You could ask a New Zealander or someone who has been there." I now let them into a secret. In the first thirty minutes I had been in the school I had discovered that one of their teachers had been born in New Zealand and another had visited there recently in her summer vacation. You could have heard a pin drop!

If you want to know about life in New Zealand who better to ask than a real live person who has first hand experience? This could be face-to-face or via email we concluded. First hand sources of information will always be better and it was a lesson this group of children had learned that morning.

The Net is the answer to what?

There are many myths surrounding the World Wide Web and the Internet. It is a seductive medium that masquerades at times as the "fount of all knowledge." As teachers we are well aware that quantity does not equate to quality and more is not necessarily better.

The Net is not the answer to our students information needs, particularly when they do not even know what it is they want to know. They may be looking for information about the marine world but do they know what they want to know about that world? More importantly how much ownership will they have over deciding what they might want to find out about the marine world? I find out things when they are really interesting to me, when I need to know. However I do need to know exactly what I want to know about. What is critical is how I will refine my information search.

What motivates us to find out about something? I need to know for myself. I got sick last year and was told the facts of the situation by a series of doctors. This was not sufficient for me, I wanted to know more so that I had control over the kinds of decisions I was being asked to make. While I was being given options, they were always couched in such a way that I felt pressured to choose the option that the specialist recommended. I wanted to decide for myself. I went home and wrote a list of the things I felt uninformed about. Obviously my best source of information were people who had experienced the same difficulty. If you have ever shared conversations with other people in hospital you will know exactly what I am talking about. We can be experts about ourselves so I began my search for others in the same situation. I checked out the phone book to see if there was an

in the same situation. I checked out the phone book to see if there was an appropriate organisation. I phoned the local Public Relations Office and perused the community newspaper. These actions proved to be of little assistance in my urgent quest for information.

Going back to my list of questions I clarified some keywords and began my search online. Not only did I get some information from reputable medical centres but I was also able to locate some support networks. Late into the night I 'talked' online with new friends who could help me become more informed. I was feeling really good about the information I was assembling because it was meaningful and answering the questions I had been able to establish for myself. I had ownership of the information process. I knew what I wanted to know about. I knew how I might find it. Finally I was able to question and then do something with the information I had found. When I went on my next visit to the doctor I was armed with a sheaf of papers that astounded him. Fortunately he did not allow himself to feel threatened by my actions and soon we were both delving through them. We were beginning to work together and I could make the kinds of decisions that I needed to make. First hand information from reliable sources gave me the power and confidence to feel in control of what was happening for me.

The information I got was pertinent, meaningful and reliable. It had come from members of a community called the Internet. I had been able to discern what was useful and discard the bits that I could not authenticate or did not directly relate to what I was looking for, however interesting they may have been.

The BIG question:

How useful are online sources of information? The simple answer is that online sources of information are as useful as we want to make them.

If I want a quick cut and paste job then, sure, the WWW will do that but I cannot claim any ownership of this information.

If I want an in depth study of a particular topic I should be able to find something or someone online who has shared my own interest. I can join the online community and borrow from it the bits I want while considering what they mean for me. I can share with others this new perception that I have about anything that interests me from large grey mammals in marine worlds to eight years old children who have low vision.

Online resources are more useful when I take responsibility for my own interaction with the material.

To return to Jane:

Now my conversation with Jane about being online has taken a number of turns as I guided her through the path I had taken in my own quests for information. She had many questions both about the process and the outcomes. I asked her again, "Jane, why might you want to be online?" There was a moment of silence and then I heard the gem. "Well, Nola, I might not need to be online but there are times when it could really allow us to find out things that we cannot find out in any other

way."

We continued to talk about the aspects of being online that were relevant to her situation:

- How can this happen most effectively and efficiently?

- How much time should be spent online?

- How can she help the children to sort out what represents reliable and less valid sources of information?

- When should she discourage use of the online resources so other primary sources of information were seen as more relevant?

If being online is about good information literacy then I am a strong advocate. If the medium is the message then I will strongly oppose such actions. We have all heard about being in an information society and we cannot escape the media attention that drives us toward such notions of excellence. Online sources of information are great when we know how to use them, we are in charge of what is happening. We need to consider why we might want to go on any online journey, remembering where we have been, where we are now and where we might want to go.

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Reshaping Academic Practices through Multi and Hypermedia

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Abstract: This paper focuses on the influences of multimedia and hypermedia technologies on the academic practices of a higher education unit. It traces the ways in which these technologies penetrate its research, development and teaching. Multifaceted uses of Web are illustrated: as environment for course design and delivery, as research project support environment, as product integrator, as facilitator of dissemination of research outcomes and support for their implementation. Examples of on-line courses, methodology and tools for Web-based course development, and specialized educational Web sites are presented. Pros and cons of this Web-orientated approach are discussed and current problems are identified. Multimedia developments for children – an authoring tool and applications, developed by a European consortium - are also reported. Finally, reflections on the overall dimension of change are made.

Introduction

We are witnesses and active participants in a vast process of globalization of education, educational communications and professional collaboration due to the remarkable developments in the area of distributed hypermedia systems and their applications. This tendency calls for adequate changes in the traditional activities of higher education institutions to effectively integrate these innovations. Challenged by the technology rich reality, many higher education units innovate their practices – either revolutionary restructure or evolutionary enrich and re-engineer (Collis 1997) a broad range of activities. This paper focuses on the impact of multimedia and hypermedia technologies on the academic practices of the Department of Information Technologies at the Faculty of Mathematics and Informatics, University of Sofia. First the ways in which these technologies penetrate research, development and teaching are traced. Then examples of on-line courses and methodology and tools for Web-based course design and delivery are presented. Next the utilization of Web as facilitator of dissemination of research outcomes and support for their implementation is discussed. Current multimedia developments – an authoring tool for children and applications, developed by a European consortium – are also reported. Finally, pros and cons of this hypermedia-orientated approach are discussed, problems are identified, and the dimension of the overall change is estimated.

"Webbing" Research, Development and Teaching: An Overview of Adopted Web Uses

I would define "academic practices" for our Department as including *teaching, research and development* and naturally embedding *communication and collaboration* – within the staff, with students, with other professionals. *Dissemination of research outcomes and implementation of our developments* supplement our activities as well. All components of our work have been significantly influenced by the developments in the networked multimedia and hypermedia. To understand *how*, let us start from the Department's Homepage (http://www-it.fmi.uni-sofia.bg/) which is in itself a small evidence of these influences – we are citizens of the cyberspace now.

Through the sections "About us" and "Staff" the Department's profile and each of us are now accessible on-line, which *eases our contacts with colleagues and students and helps expanding our local and international collaboration.*

"Teaching" is a major section here. The Department is responsible for the informatics part of the B.Sc. program "Mathematics and Informatics", which prepares teachers in mathematics and informatics. We also run an in-service teacher training center and offer two M.Sc programs: "Information and Communication Technologies" and "Artificial Intelligence", and run informatics courses for an MBA program. Information about these programs is now available on-line, and contacts with responsible persons are directly possible. This enhances the *efficiency of our information provision and two-way communication.* One major change, which will be discussed in more details later, is *the orientation to on-line teaching.* Most of the on-line courses offered by the Department are accessible from here too.

Another dimension of change refers to the *nature* of our teaching. Since 1984, when the unit was established, we have gone through different phases where different models of instruction have dominated. Almost skipping the typical for those days in Bulgaria highly structured, teacher-centered classroom instruction (relying mostly on the teachers and textbooks as sources of information), we went through less-guided, learner-centered, exploratory style instructional environments; arriving at constructivist principles and stimulating active learning (Campbell 1998). *Today our teaching, especially in the graduate courses, is flexible and highly individualized.* It widely embeds the project approach (Nikolova & Sendova 1995) and strongly relies on the "active learner" assumption and her/his access to information and knowledge, both locally and virtually. This wouldn't have been possible without technological facilitation: availability of multimedia learning environments, Web, Intranets, Internet tools for communication and collaboration. The changes in the nature of the teaching can be summarized as: *from teacher-centered to learner-centered pedagogy, from classroom-oriented to more individualized teaching, from tool-oriented (as far as computer use is concerned) to technology mediated teaching and learning.*

The "Research" section links to homepages of a number of national and international research projects. Within them Internet is used for *disseminating information* - to announce our research to others; *for communication among partners, sharing project resources and collaborative development of project outcomes* during the lifetime of the project (e.g. MATCh [1]: homepage, Workspace, Resource bank; MALL2000); *for sharing research outcomes and products with users* (VALUE, GEOMLAND). In this way *project participation and international collaboration are greatly facilitated.*

The "Activities" section links to Web pages of conferences, workshops and seminars organized by the Department. While for earlier conferences we used to only provide information, recent conference Web site embed more interactivity and allow on-line registration (e.g. EUROLOGO99), which is *a step towards a higher level of organization and time saving for participants and organizers.*

The "Student project" area is used to expose good master's projects and to store temporarily some students' course projects - for peers to view and share. This transparency of their work *creates additional motivation.*

The "Electronic Catalogues" section contains topics-oriented collections of references to on-line resources. They have been developed for students by students and serve as a virtual extension of the student's library. In this way *peer support is facilitated.*

Discussion

Building our Web presence was an early grass-root initiative of our Department. It was later promoted at administrative level and all departments are encouraged now "to go" on the University Web site. We are aware that there is much room for improvement and enrichment of our Web site, e.g. to build more interactivity and services, to more frequently update the information. Nevertheless and despite that being on the Web is trivial today for most academic units in the developed countries, we should acknowledge that this "small" step, facilitated by the utilization of hypermedia technologies, really made a difference in our professional lives.

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[1] URLs are provided in the reference section as "on-line resources"

Teaching On-line

During the past few years there has been a definite tendency in the Department to integrate Web as a support tool in the teaching and learning process, to design Web-based courses (even for on-site students) and transfer existing courses, partly or fully, to the Web.

Why?

We went on-line for a number of reasons:
- we were challenged by some research projects, in which we participated, and gained initial experience from;
- this is an appropriate solution for our local environment, as a Web-based course provides the flexibility which our students need and we want to offer them;
- access to course resources and related international publications is easier for the students in this way (it may sound paradoxically, but it is true in our case, where new books in English hardly reach students' libraries)
- it extends the scope of our teaching geographically and in the number of students taught
- it eases the reuse of course materials
- it eases sharing courses and resources among staff

Some examples of On-line Courses

Most of the courses developed at the Department are supported by course Web sites, built around the virtual university and classroom metaphors (Nikolov & Nikolova 1996; Dicheva, Djakova & Bachvarova 1998). The site integrates course materials and links to on-line resources, possibilities for interaction between the instructor and students and among students themselves. Some course Web sites support group discussions through WWW boards, some allow on-line testing with automatic assessment. In most cases the courses are taught in a "simulated distance" mode – with some face-to-face sessions, but most of the students activities, assignments and communication are performed at student's convenience within a given period of time. The results are delivered to the instructor via e-mail or by uploading to the Web site. A few course examples are presented below.

Telematics and Distance Education

An elective graduate course from the "ICT" M.Sc. program (an early version of this course was the first experiment for teaching on-line in the Department). Developed as a self-initiative of the instructor, without any financial or administrative support. It was inspired by the course "Tele-learning" (Collis 1997) and is supported by a Web site (Fig. 1) which embeds course information and study materials, allows personal and group e-mailing and group discussion. The course is organized in units, each unit presuming self study of preparation material, face-to face session, off-class individual learning activities, and assignments submitted electronically. Feedback is provided either individually - by e-mail or face-to-face - or through a Web discussion board. All students develop course projects, individually or in groups of two. Project guidelines and support are provided through the Web site too.

Business English

Developed in the frames of a European project. The Web site (Fig. 2) is built around the virtual classroom metaphor (Stefanov, Dicheva, Nikolov & Djakova 1998): there are *walls* (for course description and syllabus), *message board* (for instructor's guidelines), *shelf* (for frequently used 'books'/sources), *corners* (for self-study activities), *gateways* (to the Post Office, Student Centre, Conference Centre, Video Centre, Library, and the Cafe). The units include pre-reading, reading and post-reading activities and interactive assignments.

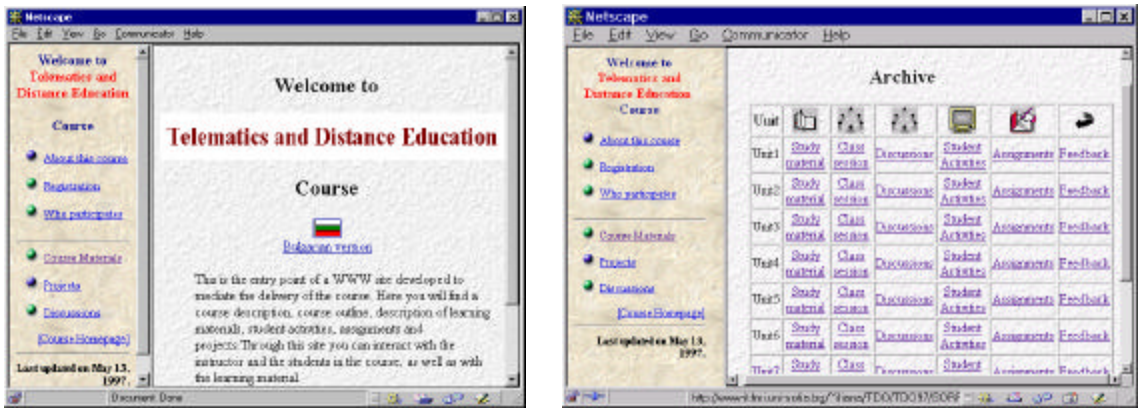

Figure 1: "Telematics and Distance Education" course

Figure 2: "Business English" course

Business on the Internet

Developed in the frames of a European project. Intended for graduate students in Economics and Business administration and clients from SME. Delivered through a virtual learning environment (Nikolov & Stefanov 1998) providing access to lectures and guest lectures, resource bank, tests and essays, group discussion.

Discussion

The experience gained so far has outlined both positive and negative aspects of Web-based teaching (Nikolova & Collis 1998; Dicheva, Djakova & Bachvarova 1998). According to students' views among the advantages are: *"flexible in space and time, which is very convenient; allows better concentration when studying on your own; allows your own pace through the course material, which enhances motivation; on-line, non-subjective testing; stimulates regular learning during the semester", while some drawbacks are: "problems with speed of access and network stability - alternative ways of offering the course material, where possible, is desirable to minimize the on-line reading time; more intensive feedback from the instructor is necessary when the course is fully on-line".*
One major specifics of the on-line courses is that they rely very much on the self-motivation and self-control of the learners, on the one hand, and appropriate technological infrastructure, on the other. Before a wider exploitation is considered, more in-depth evaluation is still needed and stronger administrative support is desired.

Methodology and Tools for Web-Based Course Design and Delivery

The Department has to deliver instruction in the field of ICT to different target groups – pre-service and in-service teachers, master students in ICT, AI and BA. The tendency to employ hypermedia technologies and the experience gained from the first Web-based courses called for a more general solution in order to offer more flexibility for the students while at the same time being more efficient in course design and development. A method for designing flexible instructional modules was developed (Nikolova 1996) to assist in designing modules, which are adaptable to different learner's needs and different delivery platforms. Later two software tools were developed to support the implementation of the method: Course Wizard - a desktop database-driven application, and Course Developer – a multi-user Web-integrated database-driven system. The method and the tools are briefly presented below.

The Method for Flexible Instructional Modules Development

The method is rooted in the theory of flexible learning (Van den Brande 1993; Collis, Vingerhoets & Moonen 1995). Flexibility is defined as offering the learner choices with respect to a number of flexibility dimensions, related to course time, content, entry requirements, instructional approaches and learning materials, delivery and logistics (Collis 1996). Telematics has an essential role to play when planning for more flexibility. For example, adding a *tele-learning* dimension to a traditional course, one can distinguish two further stages (Collis, 1996): *pedagogical enrichment* - when the components of the course and their balance are preserved, but the nature of activities changes due to the new possibilities offered by tele-learning; *pedagogical re-engineering* - when the course changes both in structure and nature of the activities.

The method is developed for an instructional provider (the Department, in our case) who, while given limited staff time and resources, has to design instruction for a range of learners' groups who share similar needs in a particular subject domain. It prescribes to construct a *generic module* which permits *adaptations* (variants for each group), the overall effort in terms of staff time and resources being less than when developing the variants separately. The method encourages team course design.

The main concepts employed by the method are: *generic module*, *adaptation* and *resource bank*. The *generic module* is designed for a particular subject domain and for a defined range of target groups. It is a *backbone* in terms of content, pedagogical profile and instructional materials. It is not a ready-to-use instructional module in itself, but a resource, which purpose is to facilitate the production of adaptations. An *adaptation* (Fig. 3) is a ready-to-use instructional module, which derives from the generic module and is designed for a particular target group. At certain moments more than one adaptation will exist around one generic module. The *resource bank* (Fig. 4) is a set of *resources* (stored in a database) which can be used to produce adaptations and to revise the generic module. Elements are added to the resource bank during the whole process of method application.

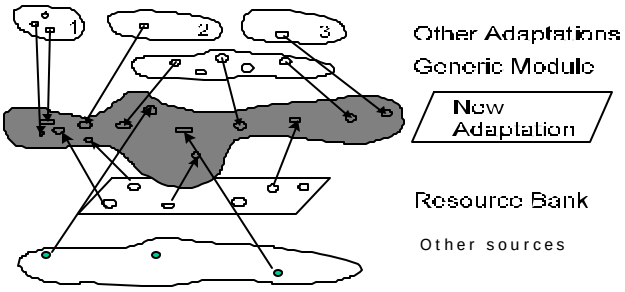

Figure 3: How an adaptation derives

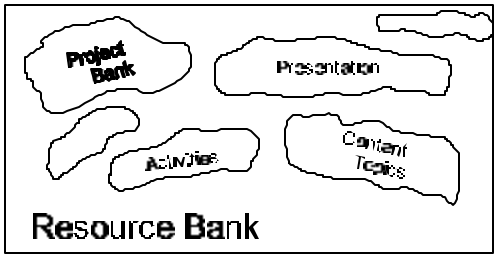

Figure 4: A Resource Bank

The Course Model

A course is a set of units. Each unit can have its own structure (Fig. 5), which is a subset of a predefined component set (default pedagogical profile). The latter includes: lecture or demonstration, communication b/n instructor and learner, group discussions, individual study and preparing exercises, individual or group project, student's testing, feedback from the instructor (Collis 1997). To each component one or more instructional materials can be assigned. The instructional materials are part of the resource bank and are stored in the course database. The database also stores information (as links) about the structure of the course and its units.

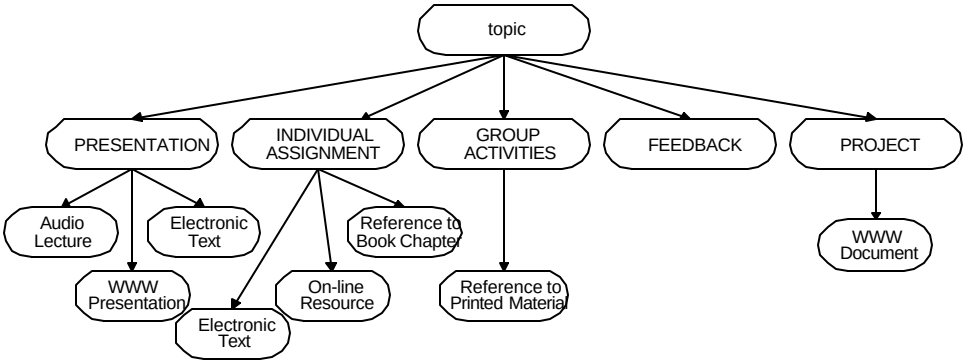

Figure 5: Sample unit structure

Course Wizard: A Desktop Program for Course Design and Course Web Site Generation

Course Wizard is a desktop application (Nikolova & Pelovski 1998), which leads the designer through the process of building a generic module and/or an adaptation. Throughout this process the course database is created - the designer provides course information, schedule and structure, assigns materials. Then the course Web site is automatically generated by using an existing template and asking the designer to specify additional information to customise the layout (Fig. 6). The Web site of the "Telematics and Distance Education" course (Fig. 1) is an illustration of the result. Course Wizard eases the multiple uses and updates of a course. The program is implemented in Borland Delphi and uses Borland Interbase Server.

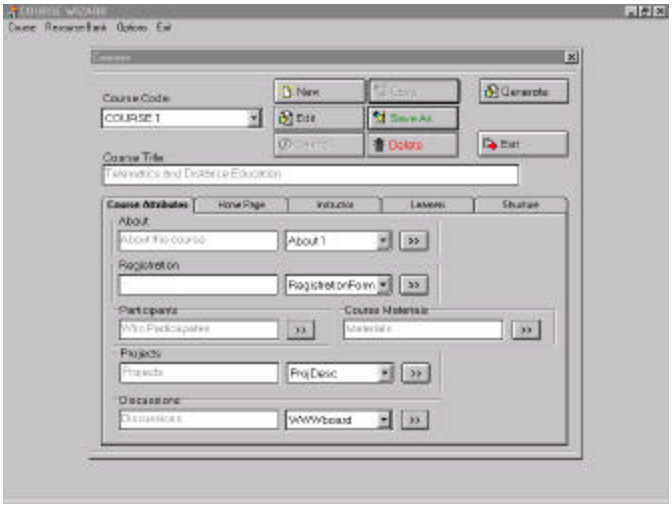

Figure 6: Course Wizard: Specifying the course homepage

Course Developer: A Web-based Course Support System

Course Developer (Nikolova, Boyanov & Dimitrov 1999) is an ancestor of Course Wizard in terms that it supports the design of courses of the above model and generates a Web site to mediate the course delivery. It has additional features and functionality though, which make it a powerful course support system. It has a Web interface (Fig. 7) and enables team development/update of a course over the network. It allows different types of users - administrator, designer, tutor, student and guest - with different access permissions. Supports not only the process of course design and development, but also course delivery by offering registration of tutors and students, access to course materials, internal course mail, discussion center and information on student progress and tutor's tasks. A module for automatic test generation and student assessment is also available. Course Developer is a Web-integrated, database-driven system, which uses dynamic pages based on the ASP technology.

Figure 7: Course Developer's homepage

Discussion

Web-based course environments require powerful infrastructure and are expensive to produce. Many professional systems for Web-based course support exist nowadays (http://www.online.uillinois.edu/oakley/): Mallard, CyberProf, Web Course in a Box, TopClass, WebCT, Lotus Learning Space and many more. Our Course Developer system is a result of the research effort of a small group of people and was developed with almost no financial support. In this sense it can hardly compete with the above systems. The advantages are that it is tailor-made – it closely fits our needs, and the work on it allowed us to not only be users, but also engineers of such environment, which has an added value for better understanding the anatomy of the process, tools and outcomes. If we move to a large-scale on-line teaching, we will probably choose companies' products, but the experience gained will still be valuable and helpful.

Sharing Research and Development Outcomes and Providing Support to Users

A significant part of the Department's research and development outcomes is directly useful for schools and teachers, but there is neither appropriate infrastructure, nor organizational and administrative support for bringing it to them. It is quite cumbersome to manage the flow of individual and group requests coming from all over the country, organize in-service teacher training and follow-up activities, as a voluntary supplement to one's regular activities. Still we continue doing it as teachers inquire us and we feel we can help. But it is very important to be able to do it with minimum time, effort and distraction from our direct work. Some examples of employing the Web to ease the transition from research labs to potential users are presented below.

VALUE – A Virtual Almanac for Logo Users and Educators

The project "Learning by developing with Comenius Logo", initiated by the Teacher Training Center run by the Department, aims to bring the spirit of Logo and Logo educational philosophy to the Bulgarian schools (Nikolova 1997). Comenius Logo (Blaho & Kalas 1998) - an attractive and sophisticated environment with considerable conceptual and operational power - was chosen as software platform. We adapted the system to the Bulgarian language, developed Bulgarian on-line help, and a whole range of reference, teaching and learning materials (lessons, problems, projects, microworlds) for teachers and students. In this sense the project is a good example for initiating and supporting educational innovations (Fullan 1991). We used the Web as a supplementary channel for delivering our production to users, getting feedback and establishing collaboration with motivated teachers. VALUE: A Virtual Almanac for Logo Users and Educators was created (Nikolova & Ginkulova 1998). We integrated there the developed materials and embedded communication and discussion (Conference Room metaphor), event announcement (Message Board), building virtual Logo community (Guest Book metaphor). For easier orientation within the site a *site map* (Fig. 8) is available. A lot of users benefit from VALUE, which lowers significantly our load and contributes to the effectiveness of the implementation process.

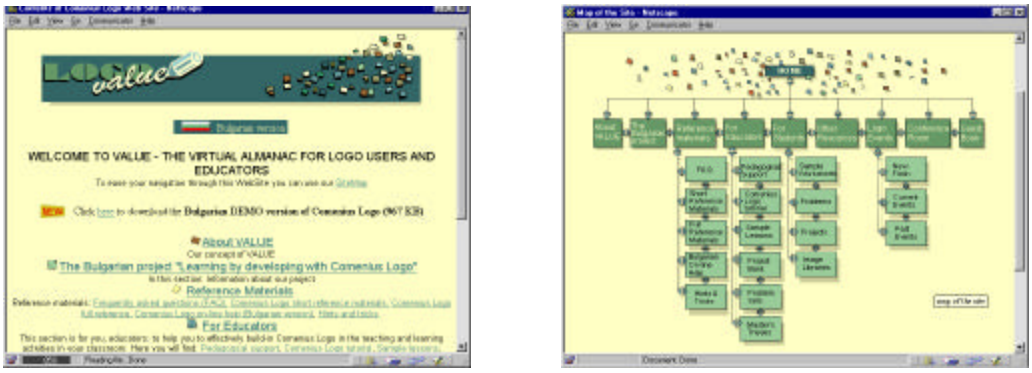

Figure 8: VALUE: Homepage and Site map

GEOMLAND – A Laboratory for Mathematics Explorations in Logo Style

GEOMLAND (Sendov & Sendova 1997) is a powerful Logo style learning environment for mathematics explorations, developed at the Department. Its dissemination and school implementation is accompanied with similar problems as the ones mentioned above. A recently developed Web site (Fig. 9) makes it convenient to provide users with what they need – the software is downloadable from there, research and methodology papers, demonstrations and examples are available. The time spent until recently on personally advising users, providing information and demonstration for them can be now allocated to other tasks.

Figure 9: A GEOMLAND Web page

School Resource Bank – A Subject-Oriented Web Resource Catalog

Our students make field-oriented Web searches and develop useful collections of annotated on-line resources. One example is the School Resource Bank (Fig. 10), which is a subject-oriented educational catalog. It is included in the Department's Web site and offered also to the Bulgarian I*EARN section for use by schools with Internet access.

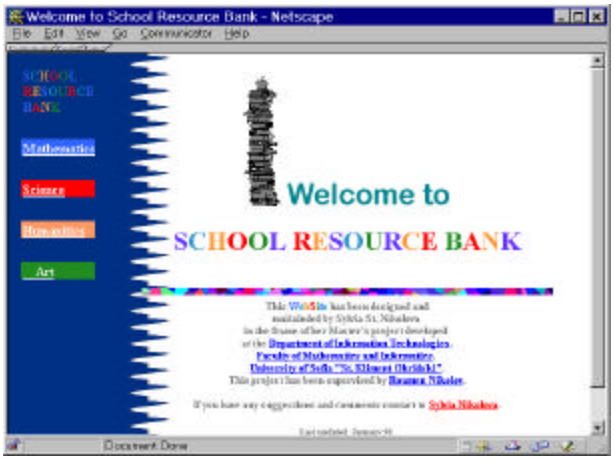

Figure 10: School Resource Bank

Discussion

Maintaining educational Web sites does not only save time and help reach more users. Feedback from users is facilitated, two-way communication channel and mutual collaboration are established. Another positive effect is, that offering meaningful material and helpful interactions to teachers in such a way, they get used to using Internet for educational resources and motivated to make their own Web developments.

MATCh: A Multimedia Authoring Tool for Children

A recent European project with partners form Slovakia, Hungary, Holland, UK, Greece and Bulgaria was devoted to developing an environment for multimedia authoring for children (Triantafilou et al 1997).

MATCh Overview

The system employs the constructivist learning philosophy and supports creative thinking and expression by means of multimedia technologies. It consists of five tools – Frame, Sound, Animation, Story and Web editors. In the Story editor the user can create applications (stories) by combining multimedia resources – either already available or self-produced by the Frame, Sound and Animation editors. The Story editor can be entered at three levels (Fig. 11): *beginner's*, *intermediate*, *advanced*, and two modes: *run* (to play a story) and *edit* (to create a story). The Web editor can export (with some restrictions) a story into a Web presentation. During the school testing the environment was well accepted by the teachers and students and proved to be an appropriate component of today's technology rich classroom. Especially the Story editor, with the ease of use and attractiveness of the final result, was valued as a motivating and rich context for active learning and creative expression. An important requirement for the effective use of the system is the availability of rich libraries of multimedia resources for the children to start.

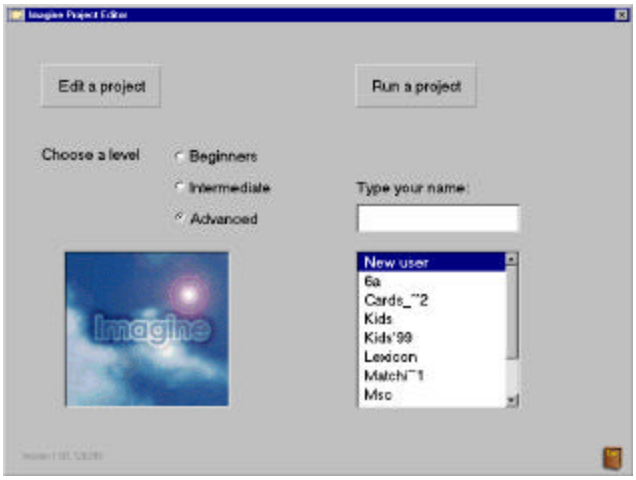

Figure 11: Story Editor: Entry Screen

Applications Developed by the Bulgarian Team

Several MATCh applications were developed to demonstrate the power of the environment and serve as system testbeds. Some of them are quite complex and have an educational value on their own.

Multimedia Screen Cards

A *multimedia screen card* is a moving, speaking, singing card, the user can play with (click on certain elements to make something happen), print, modify, export into a Web page. Each card has its own scenario, i.e. is a short multimedia story. The application faces children with most popular European traditions and festivals and with personal occasions, when people interact with each other by sending greetings, expressing good wishes or appologies. It tends to stimulate children for a more social style of behavior and interaction by using new means of expression - multimedia technologies. Sixteen sample cards for different occasions were developed (for Christmas, St. Valentine's Day, Easter, Mother's Day, Birthday, GetWell, Apology, etc.) and built into a consistent Screen Card World with a well designed visual navigation. The user is taken by hand by the main character, the Duck, who tells a story about each occasion (Fig. 12). Then the sample cards for this occasion can be played with (fig. 13). Not only can the child enjoy the Screen Cards World – its cognitive value, intriguity, variety, brightness, dynamics and interactivity. There is more: she can use the rich collection of resources developed for this application – actors, images, sounds, music, recorded speech, backgrounds – and combine them in her own way, thus designing her own cards and multimedia stories.

Figure 12: Multimedia Screen Cards application

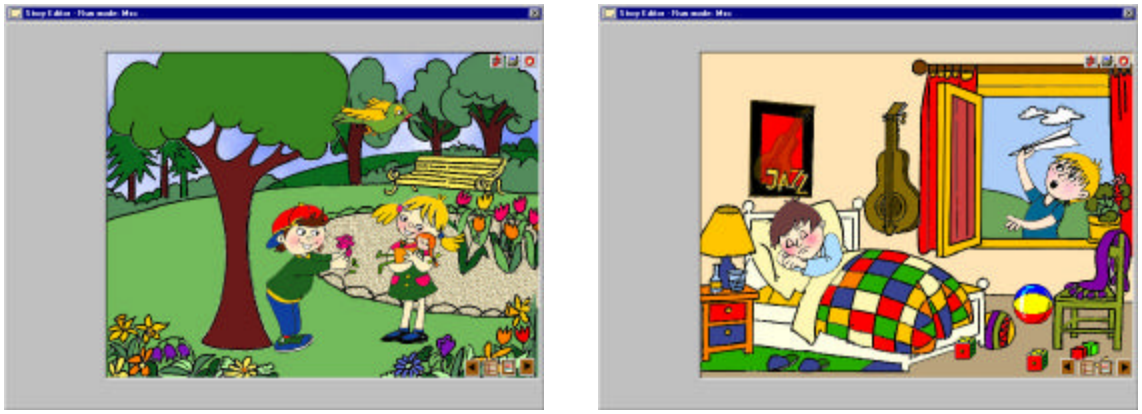

Figure 13: Playing sample cards: "Apology" and "Get Well"

Save the Animals

This application illustrates the possibility to design multimedia games with Match. It is a story where the child plays the role of a Zoo Detective, trying to help an animal in danger (Fig. 14). The application has a modular structure and allows modification and extension. A rich collection of resources was developed for it: animated actors and animals, media files and backgrounds.

Figure 14: Save the Animals (Editing a page of the story)

Children's Projects

While testing the system and applications in school, children made their own production with MATCh – individual screen cards and class projects: "Meet our class" (Fig. 15) and "Class album". This work kept them very much involved. An interest to different types of information was provoked and children were motivated to learn more about using and processing texts, pictures, movements, sounds and music.

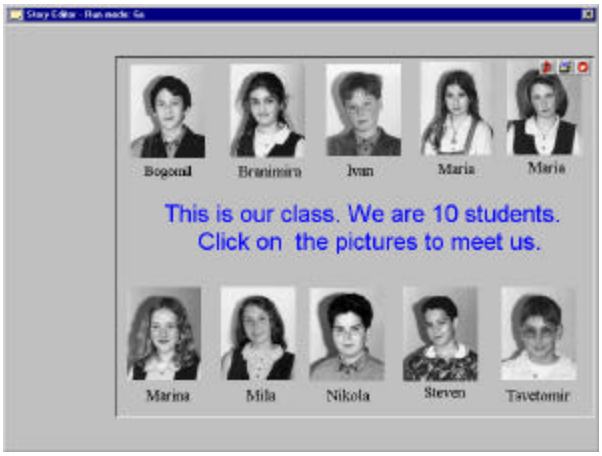

Figure 15: Meet Our Class project

Discussion

Why multimedia authoring for children? To provoke children's thinking, imagination, expression, active learning (Druin & Solomin 96). To enable children taste the process of creating multimedia and personalize the basic concepts of the multimedia world surrounding them. To create a context, in which each child can contribute to an enjoyable collaborative activity with what s/he is talented for – choosing/creating/mixing music, telling a story, creating an interesting scenario, drawing, producing animation, designing interface. There are various roles as various the children's preferences can be.

Reflections

The dimension of change illustrated by the above is not only a technological one. It is much broader, concerns attitudes and culture and refers to both professional and personal level. The overall tendency of virtualization and globalization of our professional lives is sometimes in conflict with the intuitive reaction to defend ourselves from an intra-personal Internet invasion. On the other hand, armed with the modern technologies, we were able to establish a meaningful context for challenging and rewarding professional activities within an environment, which is still suffering from social, economic and organizational deficiencies.

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Van den Brande, L. (1993) *Flexible and distance learning* Chichester UK: John Wiley.

On-line resources:

Business English course (http://sparc10.fmi.uni-sofia.bg/BEC/)
Business on the Internet course (http://www-it.fmi.uni-sofia.bg/business/)
Department of Information Technologies homepage (http://www-it.fmi.uni-sofia.bg/)
EUROLOGO99: Seventh European Logo Conference (http: //iea.fmi.uni-sofia.bg/eurologo99/)
GEOMLAND (http://iea.fmi.uni-sofia.bg/PGS/)
MALL2000 project homepage: (http://www-it.fmi.uni-sofia.bg/mall2000/)
MATCh project homepage (http: //www-it.fmi.uni-sofia.bg/MATCh/)
MATCh Resource Bank (http://www-it.fmi.uni-sofia.bg/MATCh/resources.html)
MATCh Workspace (http://www-it.fmi.uni-sofia.bg/MATCh/workspace.html)
Telematics and Distance Education course (http://www-it.fmi.uni-sofia.bg/~iliana/TDO/TDO97/)
VALUE: A Virtual Almanac for Logo Users and Educators (http: //iea.fmi.uni-sofia.bg/value/)

Acknowledgements

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The author would like to specially acknowledge the ultimate role of Dr. Roumen Nikolov, Head of Department of Information Technologies for the achievements presented in this paper. The overall development of the Department as a modern academic unit would not be possible without his broad vision, innovative spirit and constant efforts to implement visions into practice.

The following text is an excerpt from Chapter 2, Nikolova I. (1996) Design of a Method for Flexible Instructional Modules Development Master's thesis Master's Programme "Educational and Training Systems Design" University of Twente, The Netherlands.

2.2. Flexibility, learning and instruction

> *"Course providers will need to become 'module providers' in order to provide more flexible range of options from the content, sequence and pacing perspective than is possible if one continues to think only for 'courses'".*
>
> *(Collis, 1995 b, p. 35)*

The issue of flexibility in learning has gained significant attention recently. Several researchers (among others: Holmberg, 1977, 1989; Cunningham, 1987; Van den Brande, 1993; Collis, Vingerhoets, Moonen, 1995) have contributed to the elaboration of the concept, its operationalization and the analysis of related issues. A number of European Commission programs have been initiated to provide ground and support for research and development in the field of flexible and distance learning as well. Among these are: COMETT I&II, EUROTECHNET, FORCE, ERASMUS, LINGUA, DELTA (for a description see van den Brande, 1995, p. 36-43). Several cross-national initiatives on flexible and distance education in an European context have been undertaken, such as: EADTU - an Association of distance teaching universities throughout Europe, SATURN - an independent association of users and producers of distance training, EUROSTEP - an educational broadcasting channel, CHANNEL e - educational television programs, EuroPACE - educational satellite service, JANUS - a Joint Academic Network using satellites, PLUTO - a project to link teacher training institutions for joint development work in CIT and languages (for a description see Van den Brande, 1993, p. 43-52).

The profound research and development related to flexible and distance learning have clarified the concept of flexibility and identified its major aspects and have provided a basis for many smaller scale projects which address local needs and aim at solving current problems by employing the issue of flexibility. This work is one such example.

2.2.1. What is 'flexibility in learning'?

Flexibility is considered in terms of adaptation of learning to the individual needs and preferred learning modes (Van den Brande, 1993). Enabling interaction between tutors and learners and/or among learners themselves is seen as critically important.

> *"Flexible learning is enabling learners to learn when they want (frequency, timing, duration), how they want (modes of learning), and what they want (that is learners can define what constitutes learning to them).*
>
> *(Van den Brande, 1993, p. 2)*

2.2.2. Why is flexibility important?

Flexibility is considered a *key construct* in the European training (Collis, Vingerhoets & Moonen, 1995). The research performed under the TeleScopia Project (Trans-European LEarning Systems for Crossborder OPen and Interactive Applications - a one-year special EC joint project initiated in 1994), has put forward a new training paradigm - *increasing flexibility for the learner* - and has formulated and systematically tested the hypothesis *the more flexibility in training offer, the more productivity*[1] *in the training system* (Collis, Vingerhoets & Moonen, 1995), where the underlying axiomatic assumption is that more productivity in training output is desirable. Increasing flexibility is considered important for personal, educational and economic reasons. Telematics is seen as a powerful facilitator of a more-flexible training offer.

2.2.3. What constitutes 'flexibility'?

A recent study on flexibility (Collis, Vingerhoets & Moonen, 1995) has identified 19 different *flexibility dimensions*, grouped into five categories, as shown in Table 2:

- time of course participation
- content
- entry requirements
- instructional approaches and learning materials
- course delivery and logistics

Thus flexibility is defined (Collis, 1995b) as *giving the learner choices with relation to these flexibility dimensions*.

[1] 'More productivity' is defined as improving the cost-effectiveness ratio of the training system and is claimed to occur by maximizing the effectiveness of the training system with respect to costs (Moonen, 1986) .

Table 2. Flexibility dimensions (after Collis, B., Vingerhoets, J. & Moonen, J., 1995, p. 12)

Categories	N	Flexibility dimensions	Possible options
Time of course participation	1	Time (date) at which the course begins	pre-defined by the instructor, pre-defined by the learner, any time
	2	Times for participation within the course	fixed hours, periods during the workday, weekends, blocks of released time
	3	Tempo at which the learner moves through the course	fixed, flexible in pre-set boundaries, the learner decides
	4	Time when assessment occurs	fixed, the learners negotiates with the instructor, the learner decides
Content of the course	5	Topics covered within the course	fixed, the learner participates in content selection, the learner decides
	6	Sequence in which topics are covered in a course	fixed content path, the learner makes choices among alternatives
	7	Amount of learning activities expected to be completed within the course	complete all, possibility to not participate in some activities, the learner decides
	8	Level of difficulty of the course content	basic, intermediate, advanced
	9	Assessment standards relative to the course content	fixed by the instructor, negotiated between the learner and the instructor
Entry requirements	10	Pre-requisites for course participation	fixed requirements, when the learner decides is useful
Instructional approaches and learning materials	11	Social organization of learning	follow the course individually, follow the course as part of a group
	12	Language for communication in the course	fixed, choices among alternatives
	13	Learning materials	paper format, multimedia DB, educational software, WWW resources, video
	14	Pedagogy of the course	fixed, making choices: instructor as consultant, collaborator, facilitator
Course delivery and logistics	15	Times and places where support is available	fixed, within pre-defined boundaries, learner's choice - 'just-in-time'
	16	Method of obtaining support	face-to-face, from a distance - telephone, fax, computer communications
	17	Types of support available	individually, within a group
	18	Place for study and course participation	learning center, home-based, network-based
	19	Delivery channels for the course	face-to-face sessions, post, television broadcast, computer network

Not all choices are always feasible, moreover - some options are mutually exclusive, for example: if "home-based" technical platform is chosen, than the option "part-of-a-group" as social organization of learning will be difficult to implement; if a fully remote delivery form is chosen, then "real-time real human-to-human interaction" will not be a possible option; if "group-activities" are to be emphasized, then the choices of the learners about content, pace, language get limited.

In Section 2.3, Table 3, flexibility dimensions which are realistic for the Department to implement, both, in a short and long term, are identified.

2.2.4. How does 'more flexibility' reflect on the instructional process?

If we consider a typical traditional course, we shall find little or no room for learner's choices: start and end dates of the course are fixed; the content is determined by the course deliverer in advance; there are normally certain prerequisites for taking the course;
the instructional approaches are chosen by the instructor and a fixed set of learning materials is carefully selected and prepared in advance; course organization is also pre-defined. This is one extreme.

On the other extreme of the continuum is *a flexible learning process*:

> *"just-in-time, workplace-based, problem-induced learning, about which the learner makes key choices and which occurs life-long"*
>
> *(Arnett, 1993)*

Such "just-in-time learning" is defined as:

> *"access to integrated learning materials, information banks, communication channels, ant tools, so the learner, at his desktop, can call up the appropriate amount and content and type of learning material when it is necessary and useful for his work and performance"*
>
> *(Barker, Richards, S. & Banerji, 1993)*

Somewhere between these two extremes are the more-flexible learning patterns of today.

2.2.5. New roles for teachers and learners

Flexible learning gives more freedom and choices to the learner while at the same time it imposes higher demands on learner's self-directness, self-motivation, self-control. The "active learner" assumption is axiomatic.

The teacher has to step out of the traditional instructor's role; instead, a role of consultant, collaborator, facilitator becomes dominating.

2.2.6. The role of telematics

Telematics plays an important role in providing more flexibility for the learner: computer networking and computer-based telecommunications empower connectivity and communication between the instructor and learner and among learners themselves, allowing both - synchronous and asynchronous one-to-one and one-to-many communication. This facilitates the learners' choice to study "when they want". Interactivity in its broad sense - not only human interaction, but interaction with the learning material - is naturally built in the WWW - the most popular platform nowadays for flexible and distance learning. It allows the learners to define their own path through the learning material - to study "what they want". The fact, that, in principle, WWW 'is always there' - day and night - makes the learner independent in time and space if WWW is chosen as instructional delivery platform.

2.2.7. Flexibility and this study

In this study we approach the issue of flexibility from two sides (we build two hypotheses):

From a learner's perspective, as client satisfaction is a main focus in the Department's concerns (see item *c* of the criteria for our method): A flexible instructional offer would better approach the needs of the learners allowing them to choose the options most suitable for them and as such, would lead to a better training output (as a tailor-made dress - assuming the tailor is good! - will fit the figure better than the mass-production one and will produce a better practical and aesthetic effect). This hypothesis is built upon findings from the theory, e.g.:

> *"From a psychological perspective, situating learning in meaningful problems and giving the learner control over his learning choices are seen as critical to learning effectiveness"*
>
> *(Jonassen, Campbell & Davidson, 1994)*

One important point to make, is that 'more-flexibility' is conceived in this work as mostly offering the learner choices *prior to instruction*. Normally, once an option has been selected, it is valid from this moment on, for example: the level of difficulty at which the course starts; social organization, most of course delivery and logistic elements. There are though, some flexibility dimensions for which options remain open *during the instruction* as well, for example: choice of communication channels; method of obtaining support.

From the instructional designer's perspective, i.e., from the Department's point of view: (see items *a* and *b* of the criteria for our method). This perspective is discussed in the coming sections. Section 2.3 shows how more learner's flexibility reflects on the instructional profile of a module and relates this to our particular case by identifying which flexibility options are realistic for the Department to implement, both, in a short and in a long term. Section 2.4 deals with the issue of designing flexible instructional module, i.e. which allows adaptations, approaching it from a curriculum development side and in terms of designers effort and

resources. Section 2.5 discusses the factors influencing the organizational acceptance or resistance to a new approach.

2.3. Perspectives of flexibility in the "instructional profile" of a module

To operationalize the representation of an instructional module we use a framework from the literature - *Instructional profile* or C*ategorization of course components* (Collis, 1996 a, Ch.1, 1.5.1). We extend this framework by two additional categories: "Instructor's feedback" (this aspect was considered in the original categorization, though not as a separate component, but as an integral part of other components) and "Integration" (the idea for course components integration is expressed in a recent work of the same author - Collis, 1996 b - and has been illustrated by the use of a course WWW environment).

How does flexibility map onto the instructional profile of a module? Table 3 presents the result of this mapping: we suggest how each instructional component can be shaped to allow more flexibility. The multifaceted nature of flexibility makes it difficult to represent the results of this mapping in a two-dimensional form. For this reason Table 3 does not show all possible variants, but only a subset related to instructional approaches, learning materials, course delivery and logistics. The last two columns in Table 3 relate the theoretical considerations to our particular case - here we identify which flexibility options are realistic for the Department to offer, both, in a short term (ST) and long term (LT).
One can notice, that interactive video, for example, has not been considered neither in short, nor in long term. This is due to the fact that this technology is not popular in the Bulgarian educational system and it will be too costly to implement it, as buying equipment and building attitudes and skills will be involved. Technical and financial reasons determine the Department's attitude to telephone and video-conferencing as well.

Table 3. Instructional profile of a module which incorporates more flexibility related to instructional approaches, learning materials and course delivery and logistics

	Instructional components	Variants reflecting different flexibility dimensions	ST[2]	LT[3]
1	Lesson presentation and demonstration by the instructor	- face-to-face session (group mode)	✓	
		- printed lecture (individual mode)	✓	
		- computer-based multimedia (individual/group mode)		✓
		- interactive video (individual or group mode)		
		- TV-lecture (individual or group mode)		✓
		- WWW presentation (individual or group mode)	✓	
2	One-to-one communication b/n the instructor and a learner	- face-to-face	✓	
		- post	✓	
		- telephone, fax		✓
		- electronic chat or e-mail	✓	
3	Group discussions	- face-to-face	✓	
		- telephone conferencing		
		- video conferencing		
		- computer conferencing (on-line, off-line)	✓	
4	Individual study, reading and following prepared exercises	- printed materials		✓
		- electronic texts	✓	
		- educational software	✓	
		- computer-based multimedia		✓
		- WWW resource	✓	
		- interactive video		
5	Individual production, making a project or an essay	- the instructor formulates the topic	✓	
		- the learner negotiates the topic with the instructor	✓	
		- the learner works on a self-chosen topic	✓	
6	Group project where each member of the group contributes to the group's problem	- by face-to-face interaction and collaboration	✓	
		- collaboration via post	✓	
		- collaboration via telephone, fax		✓
		- collaboration via computer network	✓	
7	Being tested on what has been learned	- conventional objective testing (multiple-choice, …)		✓
		- computer-assisted testing		✓
		- computerized adaptive testing		✓
		- performance assessment (essay, problem-solving, project)	✓	
		- portfolio assessment	✓	
8	Feedback from the instructor	- at fixed moments within the course	✓	
		- on learner's request (just-in-time)	✓	
		- individually	✓	
		- in a group	✓	
		- face-to-face	✓	
		- remote (post, telephone, fax, e-mail, computer conference)	✓	
	Integration of the components	- face-to-face sessions	✓	
		- e-mail from the instructor	✓	
		- WWW environment	✓	
		- discussion group (LISTSERV)	✓	
		- newsgroup	✓	
		- conferencing system		✓

[2] Flexibility options which the Department can implement in **S**hort **T**erm.

[3] Flexibility options which are realistic to the Department only in a **L**ong **T**erm.

2.4. Perspectives on designing a module with flexibility in mind

Striving for more flexibility for the learner, it's wiser to bear flexibility in mind during the design phase - be prepared to give the learner choices and design the course accordingly. A course designed in such a way would not have to be re-engineered or even reconceptualized (Collis, 1995 b) in order to enable the learner choose a preferred option. What is involved in designing such a flexible training solution? Below we analyze this from a curriculum development side (Section 2.4.1) and from the Department's perspective - estimating the effort and resources involved (Section 2.4.2).

2.4.1. From a curriculum-development side

Thinking about content selection and organization approach for our Method, we studied different approaches to designing and organizing curricula. These include (Henson, 1995): Subject-Centered curriculum, Broad-Fields curriculum, Core curriculum, Trump Plan, Spiral curriculum, Mastery Learning curriculum, Open education curriculum, Problem-Solving curriculum. None of these curriculum designs is really unique - all have something in common with others - but each involves a unique combination of features according to scope, sequence, continuity (smoothness over time), articulation (smoothness over content and sequence) and balance (Henson, 1995, p. 178).

Studying these designs we identified the Core curriculum approach (which originated from Fransis Parker) as most appropriate for our purposes of designing a flexible training solution. This choice is based on the following characteristics of the Core curriculum design, the essence of which is graphically represented on Figure 4:

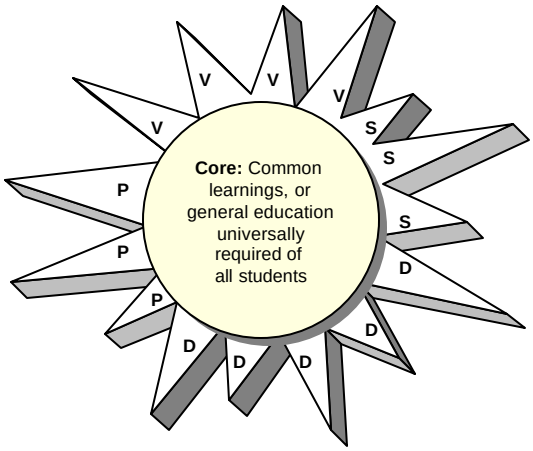


Figure 4. Structure of the Core Curriculum Design (after Henson, 1995, p. 157)
V-vocational course; S - special interest course, P-pre-professional course, D-academic discipline course

- The theory behind the Core curriculum approach is that some content is indispensable for all learners - this constitutes the core, while at the same time a versatility dimension should be provided in the curriculum - a combination of content and activities to meet particular goals - to better approach individual student needs. We value this focus on students in the Core curriculum approach.
- Besides, as Oliva (1992, p.305) has identified among his six characteristics of the Core curriculum: it "encourages teachers to plan with the students" (which is in tune with the flexibility dimension related to content), "…the primary method of learning is problem solving…" (which corresponds to our philosophy of "learning-by-doing"), it "provides student guidance".

According to "how to" apply the core curriculum approach: Content and activities can be selected on the base of the desired learning outcomes (Henson, 1995, p. 171). This is what will possibly be valued by our clients (item *c* of the criteria for the Method). In the activity selection, as already mentioned above, an emphasis on problem-solving, and especially - problem solving in a cooperative manner, is desirable.

> *"Group problem-solving has something for everybody, and can motivate different students in many different ways. While solving group problems, students can learn about teamwork, leadership, the subject-matter area of the problem and the problem itself.*
>
> *(Dormody, 1991, p.4)*

According to unit planning, a possible "anatomy" of a learning-teaching unit, as described and illustrated in (Henson, 1995, p. 315), is presented here on Figure 5.

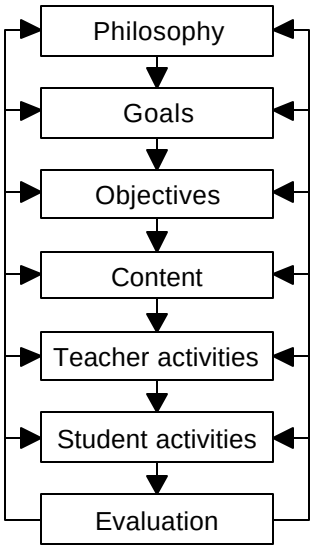


Figure 5. A learning-teaching unit (after Henson, 1995, p. 315)

Among the many ways to involve students, a variety of "learning avenues", e.g.: textbooks, discussions, field-trips, reports, projects, homework is suggested in (Henson, 1995, p. 340-348), which are appropriate to consider as options in our instruction.

2.4.2. From the side of staff effort and institutional resources

Table 4 shows our rough estimation of costs - in terms of staff effort and Department's resources - to design and deliver a flexible instructional module (learner's flexibility is considered here mainly is related to social organization of learning and instructional and delivery media). We do the estimation by weighting relatively the options within each instructional category in Table 3.

Legend for Table 4:

The cost measurement assigned to each alternative is chosen according to the scale:
***** - *relatively cheap;* ****** - *relatively expensive;* ******* - *expensive;* ******** - *very expensive,* and there is no vertical relation (an '*' in Category 1 and an '*' in Category 2 do not represent equal costs):

, - separates costs for two options, listed next to each other;

/ - separates the costs when either *selection (purchase)* or *self-production* is involved

How we determined the costs in Table 4? We identify what are the underlying staff activities and estimate the time and intellectual effort involved. For example, for the category "One-to-one communication": in face-to-face communication, in general, only the time for the communication itself is involved (no time to write down, print, send), but the intellectual effort is relatively high for such real-time communication - concentration is needed for a quick, adequate reaction right-on-the-spot; while in off-line computer communication more time is needed to write and send the message, but the intellectual effort is relatively lower, as more time is available to think over and react. Thus the two option get the same weight - *. For on-line computer communication time as for the off-line and effort as for face-to-face communication are involved - this option gets **. For the group activities, for example, the time and effort of the instructor for organization, coordination of the activities is also taken into account. Department costs for computer communication are determined as low, considering that no direct costs from the Department are actually involved (another body, University, for example, pays).

Table 4. Costs, in terms of staff effort and resources, to design and deliver a flexible instructional module

	Instructional components	Alternatives related to flexibility	Costs (staff effort)	Costs (Dept. resources)
1	Lesson presentation and demonstration by the instructor	• face-to-face session (group mode) • printed lecture (individual mode) • multimedia computer presentation (individual / group mode) • interactive video (individual or group mode) • TV-lecture (individual or group mode) • WWW presentation (individual or group mode)	** * ** / **** ** / *** *** ***	* ** ***/**** **** **** ***
2	One-to-one communication between the instructor and a learner	• face-to-face • post • fax, telephone • computer communication (on-line, off-line)	* ** **, * **, *	* ** *** *
3	Group discussions	• face-to-face • telephone conferencing • video conferencing • computer conferencing (on-line, off-line)	* ** ** **, *	* ** *** *
4	Individual study, reading and following prepared exercises	• printed materials • electronic texts • educational software, computer-based multimedia • WWW resource • interactive video	** * **/**** *** **/***	** * *** ** ****
5	Individual production, making a project or an essay	• the instructor formulates the topic • the learner negotiates the topic with the instructor • the learner works on a self-chosen topic	** *** *	* * *
6	Group project where each member of the group contributes to the group's problem	• by face-to-face interaction and collaboration • collaboration by telephone and post • collaboration via computer network	* ** **	* ** *
7	Being tested on what has been learned	• conventional objective testing (multiple-choice, …) • computer-assisted testing • computerized adaptive testing • performance assessment (essay, problem-solving, project) • portfolio assessment	* */ *** */ **** ** **	* ** *** ** **
8	Integration of the components	• face-to-face sessions • e-mail from the instructor (one-to-many) • WWW environment • conferencing system (many-to-many)	* ** **** ***	* * *** **

As indicated before, not all options considered in Table 4 are applicable to our Department - for example, those, related to interactive video, telephone conferencing, video conferencing, are not feasible in our circumstances due to technical and financial reasons.

Studying the data in Table 4 one can easily conclude that providing choices for the learner is not the cheapest way to design instruction in terms of staff time and resources.
Obviously, there are real constraints for shifting from fixed to more-flexible instruction and sometimes learner's flexibility can be seen as (Collis, 1995b, Table 9):

unmanageable - from a tutor's and course provider's perspective;
not acceptable - from a policy, organizational or cultural perspective;
not affordable - from an economical point of view;
not realistic - some flexibility combinations are not compatible.

NETLogo Teachers' Course: A Web-based Self-Learning Course on Logo

(or *When the Web entangles the Turtle...*)

Iliana Hristova Nikolova, Evgenia Iovkova Sendova, Ivan Kurtev Ivanov, Ivailo Ognyanov Ivanov

Abstract

The paper discusses a WWW course on Logo for teachers, developed recently in the frames of the European NETLogo Initiative. The purpose of the course is twofold: to demonstrate how Logo applications (microworlds) can support learning in different subject areas, and, to enable teachers experience the Logo programming language and Super Logo environment and motivate them to become developers with Logo themselves. The course content is organized, respectively, in two parts – *Logo applications* and *Logo core*. The course is intended and designed for self-learning. It utilizes hypertext and hypermedia as content presentation medium and WWW as main delivery platform. An off-line (CD) version of the course is also available. This paper focuses particularly on the Logo Core content and on the Web design issues: course structure and organization and navigation strategies.

1. Introduction

The scope of the NETLogo Project[1] is the establishment and operation of a European WWW reference point for the use of open-ended educational environments [4]. The result was the *NETLogo: The European Educational Interactive Site* [3]. This paper discusses the *NETLogo Teachers' Training course*, which is part of the *NETLogo Teachers' Educational Center*. The objective was to develop a self-learning course for teachers in the use of Logo, which covers the basics of the Logo programming language and various Logo applications, integrating also pedagogical issues on using Logo in the classroom. The course was designed and developed by a Bulgarian[2] and a Hungarian team[3] in cooperation with the NETLogo partners[4]. It utilizes hypertext and hypermedia technologies as means for content organization and presentation and WWW as main delivery platform. The fully functional version of the course will be served over the Internet via the NETLogo Web server. Course materials with slight modifications are also available on CD-ROM.

[1] The NETLogo project (http://www.netlogo.org) was set up within the framework of the European Educational Multimedia Programme (European Commission, 1997-1999).

[2] The course content, dealing with Logo programming, and the overall Web design and development of the course was done by a team, including the authors of this paper.

[3] The course content, dealing with the Logo applications, was developed by Marta Turcsanyi and Andor Abonyi-Toth

[4] The list of the NETLogo partners is available from http://www.netlogo.org

2. Course Overview

The NETLogo course is a self-learning course for teachers. No special tutoring, formal testing, assessment or certification is assumed. The learning units are developed in such a way as to offer enough material for exercising and self-checking. The user interface has been designed as to provide an intuitive orientation in the course and easy access to course materials.

The most natural way to work in the course is to have two windows open at the same time: the Web browser's window, displaying the course material, and the Logo window (preferably Super Logo) - to experiment. Copying, pasting and modifying code from the course window to the Logo window is envisaged.

2.1. Target Group

The course is intended for primary and lower secondary school teachers who want to stimulate and facilitate creative learning in their classrooms by involving their students and themselves in attractive and engaging activities with Logo.

2.2. Goals and Objectives

The course has two major goals:

- to demonstrate how Logo can be applied to support learning in various subject domains: by exploring ideas and constructing knowledge while investigating, modifying and extending Logo microworlds;
- to motivate and help teachers acquire knowledge and skills in Logo language and environment and become developers with Logo themselves.

After completing the course the teachers are expected to be:

- fluent users of existing Logo applications - able to tune them according to their needs and integrate them in a meaningful way in the learning context;
- developers with Logo - able to design and develop Logo applications by themselves.

As an extra value, the course demonstrates an innovative use of the WWW for teachers for leaning-related purposes and provides stimuli and context to increase the teachers' Internet competence.

3. Course Design

This section discusses the main design issues concerning the course [1]. The user profile is the starting point for the design decisions which have been made.

3.1. User Profile

We may categorize the users of the course as mainly PC users, who have some basic skills and experience with computers, limited to the usage of some popular

application programs such as word processors and web browsers. We also assume that users' computer configuration includes the wide used displays and video cards, which support at least 800X600 graphics resolution with 256 colors and is equipped with CD-ROM drive or network connection.

3.2. Course Structure and Content Presentation

The course content is organized in two main parts: ***Logo Core*** and ***Applications***, with thematic links between them. Each part is divided into several *sections*. Each section comprises of a number of *units (lessons)*. Each unit has a pre-defined internal structure. The *Applications* deal with applications of Logo in five different subject domains: *Language, Geometry, Arithmetics, Drama and Problem Solving.* Each application unit is based on a pre-defined microworld, which is meant to be used and configured by teachers. While exploring this part, the learner's attention is focused mainly on the subject domain and its simulation, not on the underlying instrument itself – the Logo language.

The purpose of the *Logo Core* is to acquaint the learners with the Logo language and (Super Logo) environment and to help them better understand the examples from the *Applications.* While the learner works with the Applications, she/he acts primarily as a user of already developed applications. Movement to the Logo core is a step, which brings the learner closer to the implementation details and thus, closer to the Logo language and environment. Here, the acquired knowledge should give the learners ability to develop their own applications.

Most of the course units are accompanied by *additional resources:* pre-developed microworlds for the *Applications*, and pre-developed Logo projects and configuration files for the *Logo Core.* The learner is expected to run, explore, modify and/or extend them while working on the course. The presence of supplementary course materials – *additional resources* - requires an easy access to them with explanations how to download, setup and configure the Logo environment and the examples. These requirements are satisfied by including a *Resources* section in the course WWW site

The expected prior experience of the learners and the capabilities of their computer configuration and network bandwidth, enforced avoiding the use of sophisticated multimedia technologies for the course development. Two main types of media – text and images are used to represent the main part of the course materials. Sound is used in some of the projects and microworlds accompanying the course units.

3.3. Navigation

The navigation strategy is derived from the previously outlined user profile. The main guideline the designers have followed is to allow the users to navigate through the course in a natural way, not extremely different from the way they are used to (having in mind their basic computer skills). This is why a "Windows Explorer"-like metaphor has been adopted for the main navigational instrument. The learners can quickly and easily – in maximum three clicks - to go to the desired place in the course.

The second factor is the need for different paths for the users with different level of competence and at different stages of the learning process. The user can choose her/his own path through the course content depending on her/his background, personal goals, current knowledge, and interests. For example, one teacher may choose to skip the *Logo Core* part because she/he is highly skilled in Logo language and to go directly to *Applications* or vice versa.

The navigation in the course is designed at three levels:

- *Global* – through the course site
- *Local* – through the course parts, sections and units
- *Internal* – within a course unit

3.3.1. Global Navigation

The navigation through the course site is supported by the following facilities: *the primary navigation bar* and by three buttons: *'Course Map'*, *'Help'* and *'About'*.

The primary navigation bar

The Course Web site has five main components (entry points): *Overview, Getting Started, Content, Glossary, Resources.* They are accessible by clicking the corresponding buttons of the *primary navigation bar* (fig. 1), which is located at the top of the course web pages and is always visible.

Figure 1. The primary navigation bar

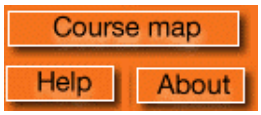
The meaning of each entry point is:

- *Overview.* Gives a short overview of the course, the intended target group, course goals and objectives, philosophy, content and structure, and credits. This is the first page, which the user sees when she/he enters the course.
- *Getting Started*. It is an important part intended to give the user all the information needed to develop a strategy for working in the course. After reading this part the learner should be able to go to the desired part of the course and to be informed about the global, local and internal navigation. This part gives also a detailed description of how the course material is organized using the WWW as a presentation media.
- *Content.* This is the largest and the most important part of the NETLogo course Web site. It presents the course content and provides the local navigational facilities for accessing the course sections and units. These facilities are described in details further.
- *Glossary.* The Glossary is a useful reference containing a list of the main concepts, terms and primitives used in the course materials. It is compiled on the base of the course content and the Super Logo Help files. The Glossary items are sorted alphabetically and are referred to from within the course units. The

navigation within the Glossary is implemented by a speed bar in the top of the Glossary, containing all the letters from the alphabet.

- *Resources*. This part provides access to the a*dditional resources (learning aids)* for the course, namely:
  - *Course Examples* (the complete set of microworlds for all application units);
  - *Super Logo Demo version and Limited Super Logo Help* (for practicing in the course);
  - *References* (used while producing the course materials);
  - *Logo Books and Magazines* (a link to the relevant section in the NETLogo Information Center).

'Course map', 'Help' and 'About' buttons



They are located in the down-left part of the page. The *Course map* button displays a map of the course content (fig. 2), which depicts the names and relative position of all course items. Clicking on an item loads the first page of its presentation.

The *Help* button is linked to a context sensitive on-line help, related to the Course Web site. The *About* button provides information about the authors and developers of the NETLogo course.

Figure 2. The Course Map

3.3.2. Local navigation

By pressing the *Content* button from the primary navigation bar the user can browse and explore the course materials. Now the screen is divided vertically into two parts (fig. 3). The left part displays the main navigation facility – the Navigational tree –

where from the desired unit can be selected. The right part is the place where the content of the selected unit is displayed.

Figure 3. When a course *part is* selected

Figure 4. When a course *section* is selected

The Navigational tree

The course structure (*parts*, *sections* and *units*) is directly mapped to the navigational tree (fig. 3, left), which follows a *Microsoft Windows Explorer*–like style and provides the same functionality. When an item in the navigational tree is clicked upon, the corresponding content is displayed in the right part of the screen. The content depends on the kind of the item. If it is a course *part*, *e.g. Logo Core* (fig. 3) or a *section*, e.g. *Teaching with Logo* (fig. 4), an explanatory page for this item is displayed. If it is a unit, e.g. *Meet the Turtle* (fig. 5), the name of the unit on the left is marked with ✓and is colored in white, and its content is displayed on the right.

Figure 5. When a course *unit* is selected

3.3.3. Internal navigation

Secondary navigation bar

It reflects the internal structure of the units and is different for the two course parts - *Logo Core* and *Applications.* The internal structure of each application unit consists of: *Summary, Model, Case Studies, Enhancement and References* (fig. 6).

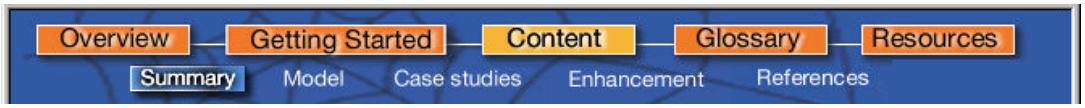


Figure 6. Secondary navigation bar for *Applications*

The units in the Logo core part have the following internal structure (fig. 7):

- *Summary* (what can be learned in this lesson);
- *Task setting* (lesson presentation in a step-by-step, "learning by doing" style);
- *Self-checking* (questions and problems for self-testing);
- *Activities* (suggested practices for mastering the content);
- *Reflection* (what has been learned, how it relates to the rest of the course, how it can be extended);

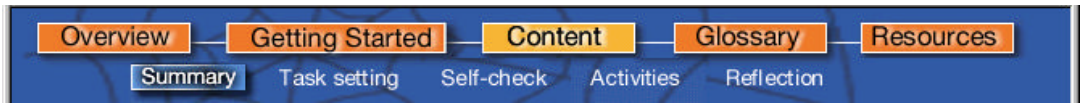


Figure 7. Secondary navigation bar for *Logo Core*

To switch between the different components of the internal structure, the user may either follow the implicit sequence of the buttons in the secondary navigation bar (from left 

to ri 

oose the or buttons in each content page.

3.3.4. Context Help (related to the course content)

Another type of links embedded in the course pages are links attached to Logo concepts and primitives. They link a word to a Glossary item. When such links are traversed, a new small window is opened with the explanation of the word, as it appears in the Glossary.

3.4. Communication and Administration Facilities

The NetLogo Teachers Course is part of the NETLogo Project site, which provides facilities for user registration and tools for communication and collaboration, in both synchronous and asynchronous mode. The designers of the NETLogo site decided that the course users should use these already provided facilities instead of offering them course-specific registration and communication tools.

4. Logo Core Content

The initial idea behind the *Logo Core* was to meet the curiosity of those teachers who would like *to lift the hood and see how* the Logo applications *work*.

Approaching the design of the Logo core from two different aspects (the emphasis being on the language vs. the emphasis on the programming environment) we finally did it in such a way that the users would be able *to voyage* between the interface and the programming language and to do this with a learning goal in mind.

The course is structured in six modules. We shall consider them both from two aspects: the **informatics topics** (supposed to cover the basics of Logo as a language and an environment) and the **projects** they were introduced with.

- **Direct manipulation in Super Logo**

Informatics topics:

Basics of Super Logo Environment Creating new turtles in a dialog mode. Working with multiple turtles Creating turtle's shapes with the Image Editor

Projects:

- Some basic instructions for controlling the movement of the turtle are presented by buttons together with a special *MiniDemo* button which gives an idea about the potential of the environment in terms of the turtle characteristics (shape, color and width of the pen, mode of animation, etc.), text animation and sound.
- Several turtles with the shape of cars are created to participate in a motor race. A further version of the motor race is with cars whose wheels are turning.

- **Turtle graphics**

Informatics topics:

The basic turtle graphics commands. The notion of *cycle* Arithmetic. Variables. Metaphors. Defining procedures. Procedures with inputs. Tail recursion. Defining operations Top-down programming

Projects:

- Drawing stylized letters, carpets, regular polygons, houses, figures consisting of circles and arcs, and more complex structures (including self-similar ones) using the above figures as building blocks;
- Calculating arithmetic expressions directly and step by step to check the priority of operations.
- Designing, drawing an running an electronic chronometer

At this stage the users start working with the language by entering commands to control the relative displacement and turning of the turtle. They draw figures on the screen by using various characteristics of the turtle pen

The way arithmetic operations are presented in Logo is shown and their execution is visualized by *function machines*.

How to define variables of text and image type is demonstrated by means of the language and the environment alike. The same applies for the way procedures are defined, edited and debugged.

Procedures with inputs and tail recursion are introduced as a very convenient way to describe fractal-like figures.

The style of top-down programming is illustrated in the design of an electronic chronometer.

- **Absolute graphics**

Informatics topics:

Controlling the turtle in a Cartesian way Absolute directing of the turtle Creating turtles by means of the language

Projects:

- Drawing stylized pictures presented as a set of points specified by their Cartesian coordinates.

Editing the procedures for drawing the pictures so as to get their symmetric images with respect to the coordinate axes.

- Directing the turtle in an absolute direction or towards specific point is introduced in the context of a project in which the turtle plays the role of a space-pilot traveling from start to star.

- Generating multiple turtles by means of the language is demonstrated in a model of the well-known *four-bugs problem* and variations on it. This problem is rich in variations - various types of behavior are simulated in terms of human relations, or according to physics laws.

- **Control and data structures**

Informatics topics:

Logic Expressions. Conditional instructions. Predicates - primitives and user-defined. Words, Lists and Images. Operations on them.

Projects:

- Simulating the behavior of various creatures: turtles, bees, etc. depending on their location.

- Generating a *Character sketch* in which the computer tells you what kind of a person you are (your name appearing as an acronym) based on a list of words for human qualities - for each letter of the name a word from the list appears starting with that letter.

A more systematic presentation about the logic of Logo and its control structures is presented. The pursuit of making the logic expressions more readable motivates the introduction of user-defined predicate operations.

The data types in Super Logo are systematized together with the operations on them. The connection between the words and images as sequences of characters and frames, respectively, is demonstrated in the context of a project generating special graphic effects with the user's name. With the introduction of lists, the project is developed in producing a user's character sketch.

Interactive programming

Informatics topics:

Communication by keyboard (in a program) Communication by mouse (in a program)

Projects:

- Transmitting messages by using the Morse code of the key, pressed on the keyboard.
- The *Eater* game, in which the player can control a *greedy* creature by the arrow keys.
- Creating a Graphic editor for drawing in *a free hand style* by means of the mouse.

Options for choosing the color and with of the pen, the pattern of the trace together with automatic drawing of geometric figures are presented by means of buttons. The project is further developed and enriched by assigning the functions of the Buttons to turtles whose shapes are buttons.

- **More advanced multimedia features**

Informatics topics:

Working with sound and music Multimedia extensions of Super Logo

Projects

- Creating a virtual piano, in which each key is a turtle playing a specific note when pointed by the mouse.
- Creating multimedia cards with animated elements on a music background (performed by means of Wave file).

- **Teaching with Logo**

Informatics topics:

Tips for adjusting the environment according to the needs of the teachers Analysis of Logo both as a programming language and as an educational philosophy.

The new role of the teacher equipped with a computer, that of Columbus, daVinci or Prometheus is discussed based on the experience in Bulgaria and other countries. Some lessons learned from successes and failures are conveyed.

5. The structure of the lessons:

Summary - an idea (in a jocular form) about what is to be expected in the unit together with **a table** of the new notions, concepts, primitives to be learned, and activities to be carried out *hands-on*.

Task setting - a lesson presentation in a step-by-step, *learning by doing* style. The tasks are to be considered in the context of a larger project.

Self-checking - easy problems, aiming at reassuring oneself that the main notions, syntax rules etc. have been acquired.

Activities - a chain of problems with increasing complexity which are: further developments of the lesson's tasks and suggested practices for mastering the content. While the tasks are in fact digested so that the teachers could accumulate self-confidence, the activities are the source which would hopefully give rise to many powerful ideas.

Topics for reflections - relatively short sections on what has been learned in the lesson, how it relates to the rest of the course, how it can be extended, etc.

6. Course Implementation

The course is organized, built and delivered using the WWW platform and its supporting technologies. JavaScript is extensively used as main instrument for client-side programming. The entire functionality of the navigational tree and roll-over images is implemented in JavaScript. This approach moves considerable amount of page processing on the client side and results in improved performance and reduced number of server requests. Every JavaScript enabled browser should be able to render the page content and execute the scripts.

7. Conclusion

The design decisions for this course have been made having in mind the main task - to develop a self-learning course – and the potential users – mainly primary school teachers. The asumption is that they are powerful learners, but not yet fluent Web users. In Bulgaria the course will be tested with pre-service teachers and primary in-service teachers. Their feedback will be the starting point for course improvement.

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   Æåíè, òè ìàé ìåï èòàøå çà òîâà – òîâà íååñòàòèÿ (îôèöèàëíàï óáëèêàöèÿ), à ÷àñò îò çàäúëæèòåëíàòà íè ðàáîòà ï î NETlogo – îï èñàíèå àðãóìåíòàöèÿ íà íàìåðåíèÿòà íè îòíîñíî äèçàéíà, êîèòî ï ðåäñòàâèõìå íà ï àðòíüîðèòå çà îäîáðåíèå, ï ðåäè äà çàï î÷íåì êîíêðåòíàòà ðàáîòà ï î ðåàëèçàöèÿòà. Òîâà å ò.íàð. project internal deliverable.

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Flexible Learning and Design of Instruction

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Abstract

The paper deals with the problem of designing flexible learning and instruction. Flexibility is considered both from learner's and designer's perspective. The potential of telematics in the design, development and implementation of flexible and distance learning is discussed. A Method for flexible instructional modules development is presented which aims at assisting the educational designers in the development of flexible instructional modules, i.e. modules, which are easily adaptable to different learner's needs, allow learner's choices and different delivery platforms, including distance delivery. Examples of Method applications and current development of a software system to facilitate the Method implementation are reported.

Introduction

This paper presents a Method for flexible instructional modules development (Nikolova, 1996). The purpose of the Method is to assist the educational designers in the development of modules which are easily adaptable to different learner's needs and different delivery platforms, including distance delivery.

Flexibility, learning and design of instruction

Flexible learning has gained significant attention recently. Flexibility is nowadays a *key construct* in the European training (Collis, Vingerhoets and Moonen, 1995). Several studies, among others (Holmberg, 1977; Cunningham, 1987; Holmberg, 1989; Van den Brande, 1993), have contributed to the elaboration of the concept, its operationalization and the analysis of related issues. A number of European Commission programs and cross-national projects (ERASMUS, DELTA, PLUTO, etc.) have been initiated to stimulate research and development in the field. The TeleScopia Project (Collis, Parisi and Ligorio, 1995; Fuchs, Parisi and Collis, 1995) has put forward a new training paradigm - *increasing flexibility for the learner* - and has formulated and systematically tested the hypothesis *the more flexibility in the training offer, the more productivity in the training system* (Collis, Vingerhoets and Moonen, 1995). Increasing flexibility is considered important for personal, educational and economic reasons. Telematics is seen as a powerful facilitator of a more-flexible training offer.

Flexibility - the learner's perspective

> *"Flexible learning is enabling learners to learn when they want (frequency, timing, duration), how they want (modes of learning), and what they want (that is learners can define what constitutes learning to them).*
>
> *Van den Brande, 1993, p. 2*

Flexibility is considered in terms of adaptation to the individual learner's needs and preferred learning modes. The interaction during the learning process between tutor and learner and among learners themselves is seen as critically important. Flexibility calls for new roles for teachers and learners and imposes higher demands on learner's self-initiative, self-motivation, self-control. The *active learner* assumption is axiomatic. The teacher has to step out of the traditional instructor's role: instead, a role of consultant, collaborator, facilitator, becomes dominating. Offering more flexibility to the learner puts higher demands on the teacher and often requires more teacher's time and effort.

What constitutes flexibility? Research under the TeleScopia project has identified nineteen different *flexibility dimensions* (Collis, Vingerhoets and Moonen, 1995) which can be grouped into five categories (Table 1). Flexibility is defined as *giving the learner choices with relation to these flexibility dimensions* (Collis, 1995b). The last column in Table 1 illustrates some choices which can be offered to the learner. *More flexibility* is considered as mostly offering the learner choices *prior to instruction.*

Table 1: Flexibility dimensions (after Collis B, Vingerhoets J and Moonen J, 1995)

Categories	**N**	**Flexibility dimensions**	**Some possible options**
Time of course participation	1	Time (date) at which the course begins	pre-defined by the instructor, pre-defined by the learner, any time
	2	Times for participation within the course	fixed hours, periods during the workday, weekends, blocks of released time
	3	Learner's tempo through the course	fixed, flexible in pre-set boundaries, the learner decides
	4	Time when assessment occurs	fixed, the learners negotiates with the instructor, the learner decides
Content of the course	5	Topics covered within the course	fixed, the learner participates in content selection, the learner decides
	6	Sequence in which topics are covered in a course	fixed content path, the learner makes choices among alternatives
	7	Amount of learning activities expected to be completed within the course	complete all, possibility to not participate in some activities, the learner decides
	8	Level of difficulty of course content	basic, intermediate, advanced
	9	Assessment standards relative to the course content	fixed by the instructor, negotiated between the learner and the instructor
Entry requirements	10	Pre-requisites for course participation	fixed requirements, when the learner decides is useful
Instructional approaches and learning materials	11	Social organization of learning	follow the course individually, follow the course as part of a group
	12	Language for communication in the course	fixed, choices among alternatives
	13	Learning materials	paper format, multimedia DB, educational software, WWW resources, video
	14	Pedagogy of the course	fixed, making choices: instructor as consultant, collaborator, facilitator
Course delivery and logistics	15	Times and places for support	fixed, within pre-defined boundaries, learner's choice - 'just-in-time'
	16	Method of obtaining support	face-to-face, at a distance - telephone, fax, computer communications
	17	Types of support available	individually, within a group
	18	Place for study and course participation	learning center, home-based, network-based
	19	Delivery channels for the course	face-to-face sessions, post, television broadcast, computer network

The role of telematics

Telematics plays an important role in providing more flexibility for the learner: computer networking empowers connectivity and communication, allowing synchronous and asynchronous one-to-one and one-to-many communication. This facilitates the learners' choice to study *when they want*. Interactivity in its broad sense - not only human interaction, but interaction with the learning material - can be integrated in WWW, one of the most popular platforms nowadays for flexible and distance learning. It allows the learners to define their own path through the learning material - to study *what they want*. The fact that, in principle, WWW can be accessed any time and from everywhere, makes learning via WWW independent in time and space. WWW can be used as both: *process* support - during the design and development of a course - and as *product* support - as a platform to embed and deliver the course.

Flexibility - the designer's perspective

In a traditional course there is little or no room for learner's choices: usually, course dates are fixed, the content is pre-determined, instructional approaches are chosen and learning materials are prepared in advance; course organization is pre-defined. This is one extreme. On the other extreme of the continuum is a *just-in-time, workplace-based, problem-induced learning, about which the learner makes key choices and which occurs life-long* (Arnett, 1993). Such learning can be defined as:

> *"access to integrated learning materials, information banks, communication channels, ant tools, so the learner, at his desktop, can call up the appropriate amount and content and type of learning material when it is necessary and useful for his work and performance"*
>
> *Barker, Richards, S. & Banerji, 1993*

Somewhere between these two extremes are the *more-flexible* learning patterns of today.

> *"Course providers will need to become 'module providers' in order to provide more flexible range of options from the content, sequence and pacing perspective than is possible if one continues to think only for 'courses'"*
>
> *Collis, 1995 b, p. 35*

What would a *more-flexible* instructional module look like? To operationalize the representation of a module we use the framework *Categorization of course components* (Collis, 1996a) and represent a module by its *pedagogical profile* - a set of components and their balance. This categorization includes seven instructional components (Table 2, Column 2) which a course normally includes. We extend this framework by two additional categories: "Instructor's feedback" (it has been considered in the original categorization as an integral part of the other components) and "Integration" (The idea for component integration has been expressed and illustrated by the use of a WWW environment in Collis, 1996b).

Employing this framework, how would flexibility map onto the instructional profile of a module? The third column in Table 2 represents a possible result of such mapping: we suggest how each instructional component can be shaped to allow more flexibility. The multifaceted nature of flexibility makes it difficult to represent the results of this mapping in a two-dimensional form, so Table 2 only shows a subset of possible variants, and mostly those, related to instructional approaches, learning materials, course delivery and logistics.

Table 2: Instructional components of a module and variants of implementing each of them as to allow more flexibility related to instructional approaches, learning materials, course delivery and logistics

	Instructional components	Variants reflecting some flexibility dimensions
1	Lesson presentation and demonstration by the instructor	face-to-face session, printed lecture, computer-based multimedia, interactive video, TV-lecture, WWW presentation
2	One-to-one communication b/n instructor and learner	face-to-face, post, telephone, fax, electronic chat or e-mail
3	Group discussions	face-to-face, telephone conferencing, video conferencing, computer conferencing (on-line, off-line)
4	Individual study, reading and following prepared exercises	printed materials, electronic texts, educational software, computer-based multimedia, WWW resource, interactive video
5	Individual production, making a project or an essay	the instructor formulates the topic, the learner negotiates the topic with the instructor, the learner works on a self-chosen topic
6	Group project where each member of the group contributes to the group's problem	by face-to-face interaction and collaboration, collaboration via post, collaboration via telephone, fax, collaboration via computer network
7	Being tested on what has been learned	conventional objective testing (multiple-choice, …), computer-assisted testing, computerized adaptive testing, performance assessment (essay, problem-solving, project), portfolio assessment
8	Feedback from the instructor	at fixed moments within the course , on learner's request (just-in-time), individually, in a group, face-to-face, remote (post, telephone, fax, e-mail, computer conference)
	Integration of the components	face-to-face sessions, e-mail from the instructor, WWW environment, discussion group (LISTSERV), newsgroup conferencing system

Implications for designing instruction with flexibility in mind

Striving for more flexibility for the learner, it's wiser to bear flexibility in mind during the design phase - be prepared to give the learner choices and plan the modules accordingly. A module designed in such a way would not have to be re-engineered or even reconceptualized (Collis, 1995b) in order to enable the learner choose a preferred option.

Telematics has an essential role to play when planning for more flexibility. According to Collis, 1996b, adding a *tele-learning* (Collis, 1996a) dimension to a traditional course, one can distinguish two further stages (layers): *pedagogical enrichment* - when the components of the course and their balance is preserved but the nature of activities changes due to the new possibilities offered by tele-learning, and *pedagogical re-engineering*, when the course changes both in structure and nature of the activities.

A Method for Flexible Instructional Module Development

This Method is developed for an instructional provider, who, while given limited staff time and resources, has to design instruction for a range of potential groups of learners (we call them *client groups* further in this paper) who share similar training needs in a particular subject domain. The Method prescribes to construct a *generic module* which permits *adaptations* (variants for each client group), the overall effort in terms of staff time and resources being less than when developing the variants separately. Learner's flexibility is taken into account at each stage of the design process.

Description of concepts underlying the Method

The folowing concepts are employed by the Method: *generic module, content element, adaptation, resource bank.*

Generic module. The *Generic module* is designed for a particular subject domain and for a defined range of client groups. It is a *backbone* in terms of content, pedagogical profile and instructional materials. It is not a ready-to-use instructional module in itself, but a resource, which purpose is to facilitate the production of *adaptations* - ready-to-use instructional modules, each intended for a specific client group. The generic module constitutes of *content elements*, each corresponding to one *instructional unit* (about 10-12 hours of instruction associated with one topic of the course). Each content element has a name (the topic of the instructional unit) and is identified by an unique number. These numbers impose an order - the *default sequence* of the generic module content. For each content element it is indicated for which client group(s) it is appropriate. Based on this information a *recommended content path* for each client group can be identified within the generic module. Figure 1 shows a generic module content map with the recommended content paths for client groups CG_1 and CG_i.

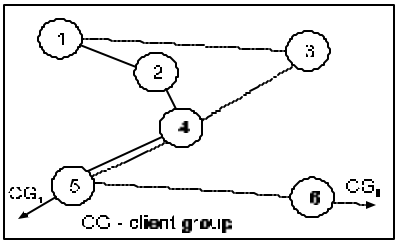

Figure 1: Generic module: Content map

A pedagogical structure is developed for the generic module - it determines the *default pedagogical profile* of a content element (i.e., instructional unit). For each component of the pedagogical profile instructional materials can be developed. Thus a *generic set of instructional materials* is associated with the generic module. Once designed, the generic module can be further revised - content elements can be added or removed, the pedagogical profile can be modified and the generic set of materials can be modified or expanded. While designing the generic module a *resource bank* (explained further in the text) is created.

Content elements. A content element is a three-level tree structure (Figure 2): at the 'root' level there is topic of the instructional unit, the second level represents the pedagogical profile of this unit, and the third level - the 'leaves' - represents the instructional materials associated with each component of the pedagogical profile. The 'leaves' of all content elements form the generic set of instructional materials.

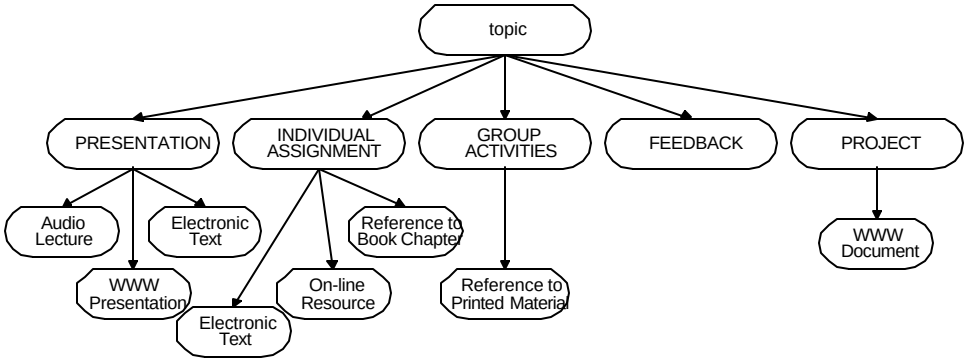

Figure 2: A 'content element' map

An adaptation. An *adaptation* is a ready-to-use instructional module which derives from the generic module and is designed for instruction of a particular client group in the subject domain of the generic module. At certain moments more than one adaptation will exist around one generic module. An adaptation is designed by:

- *As related to content:* choosing part of the generic module content and eventually adding other content elements, specific for that particular client group (adopting either the sequence embedded in the generic module, or establishing a new one);
- *As related to pedagogical profile:* adopting the generic module pedagogical profile, or a modification of it, or by designing a new one;
- *As related to teaching-learning materials:* using materials from the generic set, from the resource bank and/or other existing adaptations and, eventually, adding more materials. While designing an adaptation the resource bank is being both upgraded and used.

The Resource Bank. The *Resource Bank* is a database - a set of *resources* (electronic and references to conventional) that can be used to produce adaptations and revise the generic module. Elements are added to the Resource Bank during the whole process of Method application.

A resource can be:

- a fully or partially developed content element (either only a topic with an indication of the client group(s) it is appropriate for, or a topic associated with a pedagogical structure or a topic with pedagogical structure and instructional materials);
- a text, piece of software, on-line material, etc., relevant to the generic module scope (potential leaf of a content element tree); these items are further organised in the resource bank by their intended purpose - for *presentation*, for *practice*, for *project*; thus forming sub-sets in the resource bank: *project bank*, etc. (Figure 3).
- a reference to an off- or on-line resource, relevant to the generic module scope;
- a conventional resource: book chapter, periodical, paper, audio-tape, video-tape, slides, overhead, etc. They are intended to serve as leaves of content elements but in this case the leaf is just a reference to the material and not the material itself.

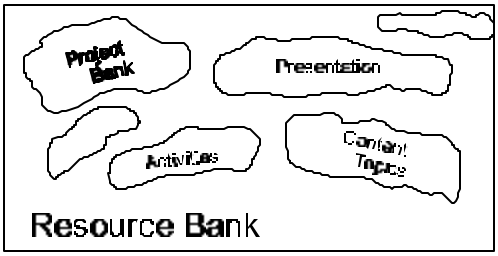

Figure 3: The Resource Bank

Description of the Method

The Method prescribes the process of designing a generic module (Phase 1) and adaptations (Phase 2) for a particular subject domain. It is illustrated - in terms of process and product - on Figure 4. Each phase should be seen as not a single step, but as an iterative process over time - subsequent revisions of the generic module and the adaptations are possible. During the whole process the Resource bank is being both updated and used.

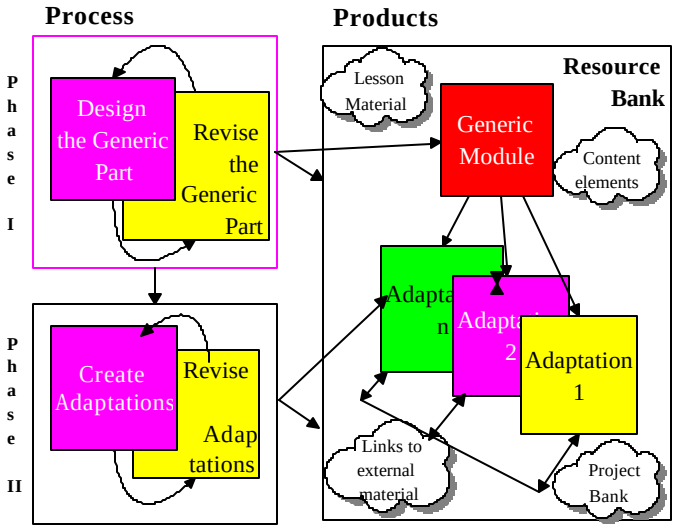

Figure 4: The Method - As Process and Product

Preliminary activities. The Method is intended to be used after a Problem Analysis has been performed and instruction has been identified as (part of) the solution. So, it is assumed that up to the point of Method application, the instructional designers will have already identified the subject domain and client groups, described the learners and identified existing constraints.

Figure 5 "zooms" into the phases of the Method.

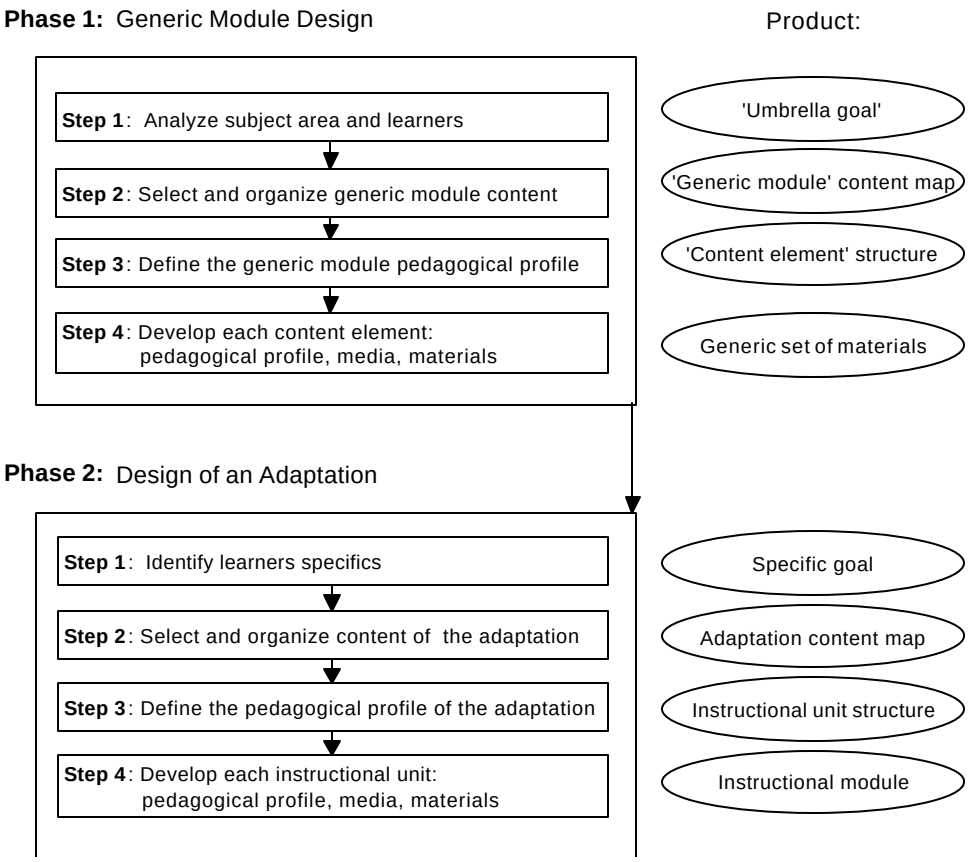

Figure 5: The Method: Zooming into Phases

Phase 1: Generic Module Design. During this phase the generic module is being designed and developed. This includes: defining an "umbrella" instructional goal, determining the content for the generic module, designing the pedagogical profile of the generic module, and developing a generic set of materials. Thus the initial version of the resource bank is also created. To allow more flexibility and still care for efficiency, when deciding on the format of the instructional materials, a "replace-ability" factor should be considered, i.e., formats which can easily generate other formats should be chosen.

Phase 2: Design of an Adaptation. This phase involves:

- defining specific goals;
- determining the content by using the generic module content and, eventually, the resource bank, other adaptations and completely new content elements;
- pedagogical engineering of the adaptation - here the pedagogical profile at module and unit level is determined (it is not necessary that all units have the same pedagogical profile) by either adopting the pedagogical profile of the generic module, or modifying it;
- developing teaching and learning materials for the adaptation - by using the generic set of materials, the resource bank, the existing adaptations and, eventually, other sources, i.e.

modifying existing external materials or developing new ones. These materials are also included in the resource bank.

Figure 6 illustrates how an adaptation derives.

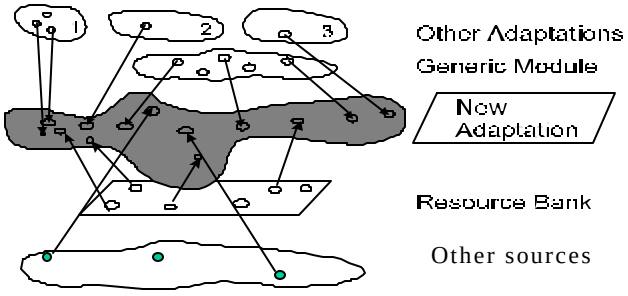

Figure 6: The "birth" of an adaptation

Testing and evaluation

The Method was first tested on designing an "Internet and its educational applications" module as an example of Method application. Later on it was applied in two real cases.

Initial evaluation

The results of the first user and expert evaluation can be summarized as: the Method is conceptually powerful and has an added value, but to be easily applied it needs to be more precisely described at the operational level and clearly illustrated by an example.

The authors reached also the following conclusions with respect to the Method implementation:

- *Support for the design process:* A software tool to support the design process is highly desirable: either a stand-alone database with special user interface, or a database integrated in a WWW environment - a "Designer's corner". The purpose of the Designer's Corner is to support the Method implementation by providing an uniform interface to the generic module, existing adaptations and the resource bank and by visualizing the process of design and revisions of generic module and adaptations. It could also provide means for discussion among the designers.
- *Support for the instructional process:* Development of a WWW site (in either Intranet or Internet environment) as an integrator for the follow-up instructional process within a particular adaptation is recommended.

Further applications of the Method

Later on, along with a further clarification and elaboration of the Method, it was generally applied in two other cases:

The "Development of Internet applications" module. In this case three different client groups were identified and for each of them the initial version of the module was adapted accordingly. For the first group more classical form of instruction was provided - in face-to-face mode, mediated by an instructor. The instruction of the second group was partly mediated by a specially developed WWW site which provided access to learning resources. The third group was offered a guided

resource-based learning: along with the WWW site the students used a collection of books, papers, URLs, etc. and worked on projects having the opportunity to contact the tutors personally or via e-mail for guidance and feedback.

The "Telematics and Distance education" module. This module was intended for a group of graduate students, but there were undergraduate volunteers too. So, two variants of the module were made. For the first group the instruction was more formal and structured and mediated by a specially developed WWW site (Figure 7 shows the entry point of it). It was organized in a simulated-distance mode: one face-to-face session per week and then self-learning and project development activities at student convenience during the week. There was a WWW-based group discussion and instructor-student e-mail communication. At the end of the module each student defended her project. The second group did not have formal group instruction (though some students used to join the face-to-face sessions of the first group); they were provided with access to resources, ideas for activities and individual guidance on their own demand. There was no examination at the end.

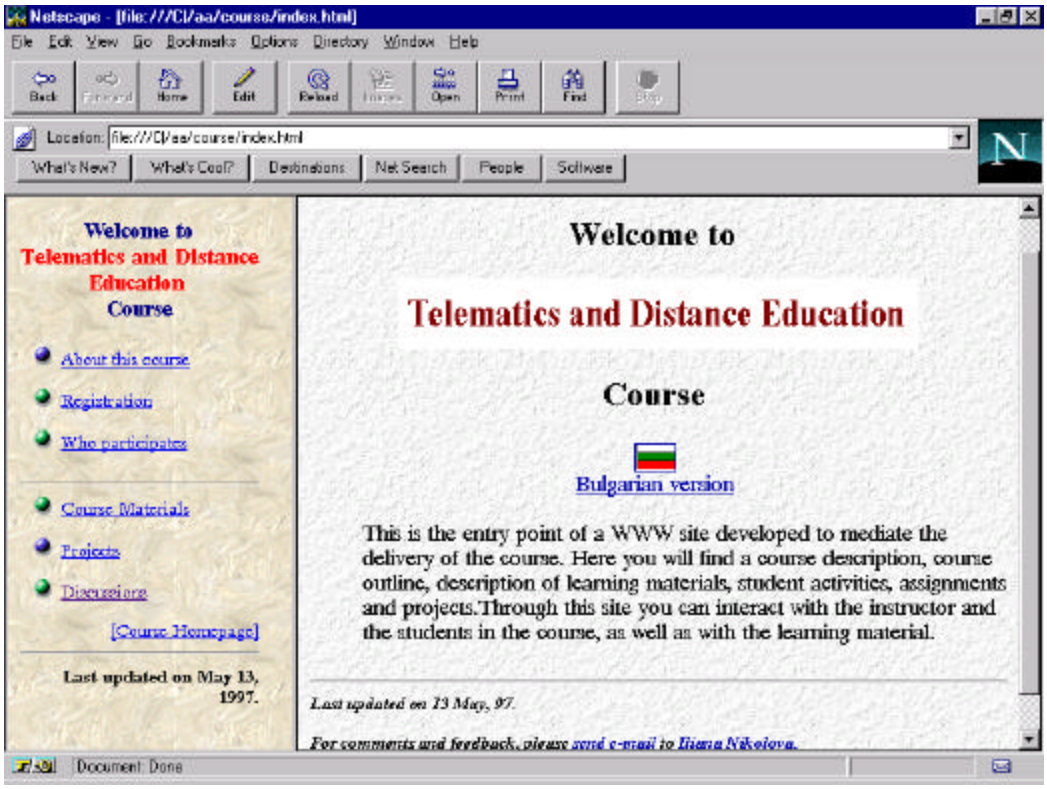

Figure 7: The entry point of the "Telematics and Distance education" WWW site

Reflections on the Method applications

Basically, they proved the Method's adequacy and pragmatics, but also confirmed the authors' concerns about the necessity of a software tool to facilitate the implementation and, especially, the application of the Method by *a team* of designers. Another point worth mentioning is that in the two cases above there was already some existing version of the modules. So the designers did not start to formally design a generic module, but to build new adaptations from the existing one. Thus, the experience suggests a variation of the Method to be considered.

Further developments

Based on the experience and reflections so far, a software tool - Course Wizard - is being developed now. It serves a twofold purpose: (a) generates the database for the module (the resource bank) and the generic module and adaptations following the Method steps, and (b) automatically creates a WWW site - with preliminary defined structure - for module delivery. Currently the Course Wizard is a stand-alone program implemented in Borland Delphi and using a Paradox database (other databases can be used via ODBC). A WWW-integrated Course Wizard is under consideration. Figure 8 shows a screen dump of the Course Wizard.

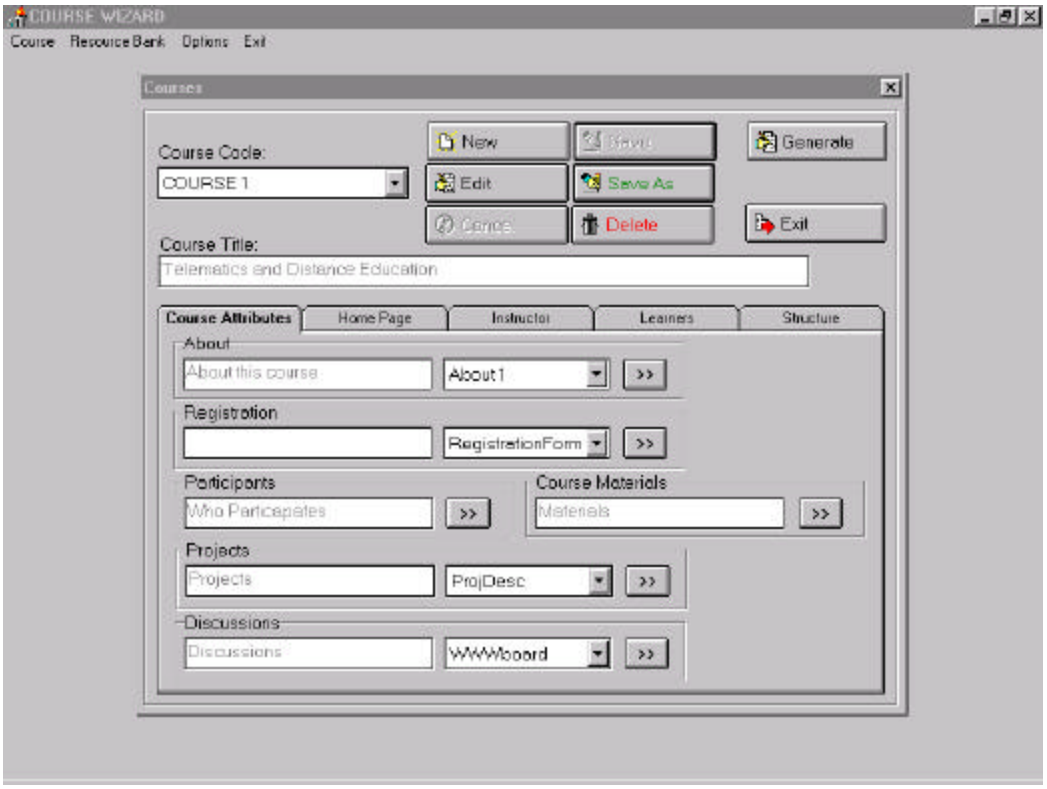

Figure 8: The Course Wizard: Specification of course homepage

Conclusions

The ideas and results presented in this paper came after intensive research and creative work. We should admit that we are even more excited and challenged now than we were in the very beginning as the current implementations suggest that the Method is a shot in the right direction. Whether it reaches the target will become clear from the evaluation planned after a fully operational version of the Course Wizard becomes available.

Acknowledgments

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Learning and Working in a Virtual Hypermedia Environment

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1. Introduction

The latest technologic, industrial and social changes in the society caused by the new information and communication revolution mark the features of the new *Information Society*. Europe is getting ready to meet the challenge of this society[1] and a number of professionals and experts are trying to answer the multitude of questions in this connection. Particularly considerable changes are expected to take place in education where the printing technology gives up more and more territories to the multimedia, hypermedia and communication technologies. This trend can also be observed in the field of distance learning where the tools and services of the Internet become preferred technological platform[2].

2. At the Doorsteps of the Information Society

The major technologic background of the Information Society are the digital multimedia and global communications. The digital coding and global computer networks make possible the use of a universal presentation of all kind of information, to copy this information (without the threat of mistakes) at extremely law prices, to provide practically unlimited computer memory and to *convey any kind of information to any user at any time*. In his book *Being Digital* Nikolas Negroponte, the manager of the laboratory for higher information and communication technologies *Media Lab* at Massachusetts Technological Institute in the USA, clearly outlines the trends and dimensions of the social and economic changes in connection with the Information Society[19]. As soon as the computers left the air-conditioned laboratories they approached the people, entered their work places, their homes, powerful notebook-sized, even pocket-sized computers appeared.

The idea of Alan Kay raised back in 1971 for creating a notebook-sized computer playing the role of a *dynamic book* - dynabook[16], as well as a telephone, credit card, post box, drawing tool, music synthesiser, typewriter, tape recorder, interpreter, etc. becomes reality. As a consequence of the fact that people are able to get in touch with each other via Internet from their work places, from school, from their homes, even while travelling, a number of small or larger *electronic societies* appear. People in these societies seem to rise over the realities: they exchange information, study and work without being dependent to distance and time, create their own laws and rules. Following the history of the computer, today we can say that the main attention of the researchers and professionals in this area has gradually moved from the hardware problems to the software ones, today the problems of human computer interaction are in the highlights, and in the near future - to clearly social problems caused by the new information and communication technologies.

3. Priority Trends of the Information Society

Some of the priority trends of the European science-research programmes and projects are[1]:

- working from a distance (teleworking) - providing the possibility to work at home and creating virtual offices with the help of satellites, which will allow the people to avoid the long travelling to their work.
- distance learning - in today's dynamic society all its members are forced to learn all life long - 1996 was announced to be *Europe's Life Long Learning Year*[4]. Gradually a new *learning society*[7] investing in knowledge appeared. One of the main tasks in this direction is to create distance learning centres which will provide software resource materials, training and specialised learning services for small and medium-sized enterprises, large companies and organisations, as well as extending of the possibilities for distance learning at the schools and universities
- creating networks of universities and research centres - connecting the whole Europe's intellectual potential in one network. By the end of 1997 about 30% of the universities and research centres will be connected by means of the global telecommunications.
- telematic services for small and medium-sized enterprises - creating favourable conditions for the globalisation of business, administrative services, education, serving customers, advertising, marketing.

- city information superhighways - providing the households with access to the global telecommunication network and tools for using real-time multimedia for services and entertainment in local, regional and global scale. Together with the traditional services - telephone, fax, television, radio new services on demand appear: digital and dialogue television; digital video; Internet; multimedia electronic mail; electronic conferences - asynchronous and real-time; news on demand; distance learning; work, business and trade from distance; advertising and marketing through Internet; bank transactions; tickets reservations; subscription for electronic magazines and newspapers; computer games, etc.

4. The Student - the Centre of the New Education Systems

Among the most important changes today is the huge information overload of the people and organisations because of the law prices of the multimedia products as well as their distribution. and delivery through the number of available information channels. The problem with the information overload begins to transform itself into a new problem - the problem of the loss of too much valuable information. Only a small part of the ocean of available information can become useful knowledge. The success of the separate individuals and organisations in the global economic and intellectual competition, possible thanks to the new technologies, depends on their skills to quickly and exactly in the right moment to transform the available information into useful knowledge that can be used for learning, to take important management decisions, and so on. The search and filtering of a huge amount of information is not an easy problem and it is still not possible to use optimally the new technologic achievements.

The above indicated changes in society inevitably lead to thorough changes in the educational system, in the tolls and methods for education. The telecommunications and digital multimedia create new possibilities for acquiring knowledge because they activate more human senses. The latest research results show that people acquire about 80% of the available information if at the same time watch, hear and work with it[12]. The new reform in education will be determined by the changes in the technology - the dominating in schools and universities printing technology gradually will be replaced by the digital multimedia technology and telecommunications. More and more a new kind of literacy will be necessary - multimedia literacy, i.e. the ability of people to read, write and communicate through digitally coded multimedia materials containing text, graphics, animation, video, sound. In order to use the new technologic resources more thoroughly, the educational system must be reformed completely. According to some experts the education in

the Information Society will be based on: *asynchronous in time and place, interactiveness and virtual restructuring of the school area* [18, 19]. These principles are at the root of the projects and elaborations of the Information Technologies department at the Faculty of Mathematics and Informatics, the University of Sofia "St. Kl. Ohridski" [8, 20, 21, 22, 23, 24, 25, 29, 30].

The Information Society categorically forces the move from the instructor-centred educational model to student-centred educational model. The main characteristics of this model also reflecting the specifics of the Information Society are:

- the educational/learning disciplines are based not on printed learning materials but on electronic libraries and object-oriented multimedia resources. Students can study on their own using aesthetically formatted and dialogue multimedia materials. For example in 1991 IBM and the National Science Foundation of the USA invested 2.4 million dollars in a two-year project for development of interactive mathematics study materials[17]. The World Wide Web (WWW) offers the students huge amount of information resources and in its extreme variation it could cover in its web the whole cultural heritage and knowledge of the humankind. Every user could become an author and publish documents open for everyone;
- the students don't receive ready-made knowledge - they have to construct their own knowledge, to study individually according to their skills, interests, preferences and cognitive characteristics. They *learn how to learn*;
- students can take part in the defining of the learning goals and take responsibility for their acting (or inactivity). They can control the learning process, work in a team, take part in discussions and to search for effectiveness of the learning, even to choose their tutors;
- the tutors are more like assistants of the students, their older *class-mates*, that help them find how optimally to cover the rich in information resources global information systems and to find the most suitable learning materials - printed of in electronic format, how to organise, arrange and assimilate them;
- the so called *project pedagogy*[18] is dominating, which is typical mostly for the university and vocational training, but is lately more and more applied in schools. The achievements of the students are assessed on the end result (product) basis, which can be presented, defended and published both locally and globally. The self assessment is encouraged.
- *co-operative learning* and work are dominating over *the competitive learning*. The global information environment is contributing to this offering various software applications that assist the collective learning and work[10, 14, 28]. The tutors can work individually as well as with

small groups of students. They can have student-assistants, that help their class-mates with acquiring the new software tools or with solving some particular problems[26].

- the school and the university are open to the world - the tasks and problems being solved are taken from the real life and often are defined by the students themselves. Problems are being solved collectively with the help of the tutors;
- space, time, hardware and all study materials and software are being used in a very flexible and effective way. The distance and time limitations can be overcome as together with learning in the classrooms and auditoriums, where the presence of the tutor and the students at the same time is required, elements from the distance learning are applied including asynchronous communication with electronic mail or electronic conferences. The student can work in a dynamic and interactive multimedia learning environment where aside from the tutor and the other students he/she can communicate and work with his/her virtual friends from all over the world. The student becomes a member of global collectively learning communities.

The above listed principles uncover great perspectives and the pedagogic theory and practice obtain the unique chance to fill the presently existing precipice between them. The new information and communication technologies and the instrumentality of the distance, open and flexible learning are in the root of these opportunities[2, 24].

5. Distance Learning via Internet - State and Perspectives

The development of the methods and tools of the distance learning via Internet is synchronous with the overall trend for globalisation of the education in a world scale as well as the use of new forms of international co-operation. The European Association of Distance Teaching Universities (EADTU) is responsible for the tutoring of over 325, 000 students[2]. A great number of these universities move from the classical form of distance learning based on printed materials and postal services to new flexible forms of education with effective use of the new technologies.

The Global Network Academy (GNA), created at Massachusetts Technological Institute is one of the most ambitious world projects for distance education and globalisation of education[13]. GNA offers a global virtual market for educational products and services - courses and programmes of hundreds of universities, companies and schools from all over the world. At the end of February, 1997 was offering over 700 courses in Mathematics, 561 courses in computer science, 1357 business courses, 424 courses in the field of education and many more. GNA is also demonstrating the tendency for turning from the distance education paradigm to that of the

distributed learning, based on a *knowledge web* and communication infrastructure for distributed access to experts, resource materials, virtual learning environments, co-operative search for resources and others[6]. The development of new models *for mobile learning* based on the mobile communications can be expected.

The workers and clerks in their work need a constantly changing *portfolio of knowledge and skills*, therefore distance learning via Internet and Intranet has huge application in vocational training at different organisations and institutions. It becomes obligatory in some dynamic areas such as computer technologies and business where the conditions, the method of working, products and tools are changing extremely fast[11]. In vocational training the computer learning systems become popular because of their allowing collective work (groupware, hypergroupware, computer supported collaborative work systems), learning while doing, just-in-time and just-in-place learning, electronic performance support systems, etc. The trends in vocational training show orientation to creating computer environments for distance and co-operative learning[11, 23, 30].

Though slowly, different forms, technological tools and models for distance, flexible and open education find their application at schools[25, 31]. From the international register of the schools having access to Internet and actively using WWW[31] we can judge about the avalanche growth of their number. For instance one could mention that more than a half of the registered schools are in the USA and that a Bulgarian school is not yet registered, although there are already several local experiments in this direction. Well known are the concepts for *global classroom*, *cyberspace school*, etc.

6. Models for Distance Learning via Internet

There are two known models for distance learning with Internet - the evolutionary and the revolutionary models. A typical characteristic of the evolutionary model (it is the popular model) for distance learning is that the existing educational institutions create their own virtual complements which allows them to offer the distance equivalent of their courses from the regular programme to a broader audience. In the revolutionary model a whole virtual educational structure is created with no real equivalent. A typical representative of the second model is GNA which is convincingly demonstrating how the information superhighways allow some futurist scenarios from utopia to become reality[13]. The aim of GNA is to create a fully accredited university with user group to aim at all the people in the world having access to Internet. A specific virtual educational

environment is created allowing different access levels to the services and products of GNA. For example students using only electronic mail can receive only textual messages and resources while those with access to WWW may count on all the advantages of multimedia and electronic communication. A similar model is *Virtual Educational Environment* (VEE) at Athena Virtual On-Line University (VOU) in the USA, as well as the elaborations for the GENII project, which main goal is to create a virtual faculty for secondary school teachers and experts in education[9]. The developed virtual environment demonstrates the potential of Internet to stimulate the co-operative work of people who have never met face to face before, as well as the possibilities for virtual integration of higher and secondary school.

Another similar model is the *virtual college*[15] where the learning and teaching are not limited neither by time nor by place and where the communication is a key component. The virtual college has three main variations:

- real-time access to resources, programmes and services of a real university or college;
- integrated services for distance learning based on strong co-operation with universities, colleges, schools and business organisations;
- fully virtual formations having their own academic departments, educational plans and programs, administration.

7. A Model for a Virtual Environment for Distance Learning via Internet

The Virtual Environment for Distance Education and Training (VEDET) combine the basic characteristics of both the evolutionary and the revolutionary models for distance learning via Internet[21, 23]. It consists of several kinds of virtual educational institutions, places and services, e.g: virtual university; virtual school; virtual enterprise; virtual language learning centre; virtual library; virtual publishing house[22]; virtual market for educational goods and services; virtual meeting place (virtual café); virtual post office; virtual service for express delivery of electronic materials and software; virtual office for international exchange and co-operation; virtual exhibition halls and entertainment centres.

For some of the components of VEDET there are already working prototypes. Experiments are also being conducted for distance learning with the following courses:

- Communication and Information Technologies, with teachers from the Gloushkov Institute on Cybernetics, Kiev, Ukraine;
- Business on the Internet[23, 30];

- Business English with teachers from Sofia and Exeter, England[8];
- separate courses from the Information and Communication Technologies in Education specialisation at the Information Technologies Department;
- separate courses of the Master's program on Educational Systems Design at the University of Twente, the Netherlands;
- study/learning modules from the programme for educational of the International Association for Evaluation of the Achievements in Education IEA.

Since the distance learning is one of the three forms of learning approved by the new laws for higher education together with the full-time and extramural education, the Information Technologies Department intends to broaden the sphere of the offered courses for distance learning as well as the potential teacher and student auditorium inside and outside the country. The first step in this direction is the creation of the International Consortium "Education without Boundaries" which head office is in Sofia as well as prototypes of university centres for distance learning[20].

8. Conclusion

Virtual Organisations such as GNA, VOU, VEDET can be considered as the educational institutions of 21st century. Through pedagogical re-engineering[3] and *virtual reconstruction* of the educational institutions we can achieve combination of the advantages of campus learning with distance learning via Internet. The globalisation of education and the competition concerning the offered educational products and services put Bulgarian education and economy to new provocation. Many countries including Bulgaria, are endangered to lose their national and cultural identity. It is necessary a programme for *informational ecology* to be proclaimed under the aegis of the international institutions which will help to preserve the variety of national cultures on the Earth the same way the ecological programmes preserve the biological variety[27]. Many Bulgarian universities, schools and business organisations soon will de forced to go out in the global cyberspace. Perhaps this would be our chance - the cyberspace is subject to intellect, and in this difficult for our country transitional moment this is the most valuable (and perhaps the only) national capital which we would no more be forced to export at a knock out price abroad.

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LEARNERS *IN A GLOBAL KNOWLEDGE SPACE:*

Dr. Roumen Nikolov

1. Introduction

At the eve of the 21st century we are facing a dramatic change in the world that might be entitled as *Removing the Walls* - both in political and technological sense. The power of the new Communication and Information technology (CIT) is influencing human life and economy so deeply that makes all of us learners both as individuals and members of (real or virtual) learning communities and learning organizations in a learning society.

Learners need Information to know, they need Knowledge - to make decisions and act, and Wisdom - to decide, act and take the responsibilities for the consequences of their actions. We should target our education and training towards building an Information Society where minds and technology work and learn together in a *global knowledge space*. Global knowledge space - ground where *global wisdom* can grow. Now, one of the most important tasks of UNESCO, European Commission (EC), International Federation for Information Processing (IFIP), and other international organizations is to *seed* global wisdom, to cultivate it and to ensure appropriate political, social and technological climate for its growth.

The Information Society built upon global information world-wide networks offers new challenges for policy makers, researchers, educators and learners. The European Commission White Paper *Teaching and Learning: Towards the Learning Society* approved by the Commission on November 29, 1995, states that tomorrow's society will be a society which invests in knowledge, a society of teaching and learning. The Report to UNESCO of the International Commission on Education for the 21st Century: *Learning: The Treasure Within*[8] as well as the fact that the Second International UNESCO Congress *Education and Informatics* and the IFIP World Conference Teleteaching'96: *Practicing What we Preach*, are held during the European Year of Lifelong Learning (announced on 2 February 1996 by Commissioner Edith Cresson) shows the concern of UNESCO, EC and IFIP in ensuring conditions for a world-wide diffusion of a technology driven educational reform. A reform which would let learners all over the globe get access to the world's cultural heritage and to locally unavailable educational services, expertise and resources.

2. Information, Knowledge, and Wisdom in the Era of Digitalization and Communication

The main branches of the Communication and Information Technologies (CIT) deal with storing, processing, transmission, and presentation of information. The notion *information* is as fundamental as the notions *matter* and *energy*. There are purely theoretical and philosophical problems associated with the enormous acceleration of the computer power and the capacity of the telecommunications.

The information itself always uses some material medium, but it is not identical with this carrier. One of the pillars in the progress of information processing are the technologies ensuring high ratio between the unit of information and the amount of matter needed to carry this information. There is a tremendous advance in these technologies, based on deep knowledge of the physical sciences for the structure of the matter. The efforts to develop high performance computers are connected with attempts to reach the ultimate capacity of the human mind. Today computers, parallel computing systems, and telecommunications are the basic instruments for processing and providing of information. They ensure conditions for technology and minds work together, and the ultimate capacity of this synergetic system could be much higher than the capacity of a single mind. To have more clear view for the perspective to reach this goal, we have to know more about the different categories and structures of the information and its representation in the human mind.

Information could have different degrees of structure. Information with lowest level of structure is called *data*. Knowledge is defined usually as structured information. At the present moment, we are making a tremendous progress in developing instruments for storage, processing, and transmitting of different forms of information, but the advance in defining and understanding different levels of informational structures is not so fast. If we compare the development of information sciences and material sciences, it is obvious that we are only at the beginning of differentiating levels of information structures and related information sciences.

When trying to understand the work of human mind we might successfully employ the informational metaphor. For instance the *Information Processing Theory* [18] and the *Information Pickup Theory* [13] became general theories for human cognition and perception . Some other theories look at the human mind as a computer, processing information. There is nothing wrong to compare the function of the human mind with a computer, but it is wrong to believe that human mind works with the same structures of information as

the computer does. A deeper understanding of different levels and categories of information structures will help us to better adapt computers and humans work together.

The received information in the human mind evolves into knowledge. One and the same information builds different information structures (different knowledge) into different human minds. The learning is often identified with memorization. In fact the effective learning is an active process of transforming information into usable and applicable personal knowledge. *Wisdom* is a special quality of information which has not been widely discussed so far. As the knowledge might be expressed by human decisions and actions, the wisdom might be expressed by wise decisions and actions. Wisdom is a higher level of information structure than knowledge and we should include this category into our educational objectives.

The recent advances in the CIT are related with the digital networked multimedia systems. Digital multimedia is the field concerned with the computer-controlled integration of text, graphics, still and moving images, animation, sounds, and any other medium where every type of information can be represented, stored, transmitted, and processed digitally[12]. The digital coding and networking make possible the use of an universal representation of all forms of information, to reproduce this information with low cost and error-free transactions, to ensure unlimited storage, to rapidly transmit any type of information to any user in any time. The main scientific and technology advances that made advent of multimedia systems possible, are *data networking, higher processing power and memory* density of computers, sophisticated *data storage and compression algorithms.* Looking back at the communication and information technology history we could clearly observe that the main attention of researchers and technologists has been gradually moved from hardware to software, next - to human-computer interface, and now - to social issues related to global communication and collaboration.

The school will no longer be the sole nor the most attractive source of information and knowledge[25]. Quick and unhindered acquisition of knowledge in a pleasant atmosphere will be widely provided by TV, Radio, and, hopefully very soon - by means of the *information superhighway*: Internet, video-phone via existing TV, digital and interactive TV, multimedia electronic messaging, electronic conference (asynchronous or on-line), computer-supported cooperative work systems, pay-per-view digital video programmes on demand, full movies on demand, remote group computer games, generalized access to public Internet servers, topical news on demand, teleteaching, teleshopping, telebanking, teleticketting.

Among the most important changes nowadays is the *enormous information overload* of individuals and organizations due the low cost of multimedia information production and distribution and the diversity of distribution channels available. The information overload problem is being transformed to an *information overkill* problem as the filtering of the great volume of information can not be easily made and only small amount of information can be transformed into usable knowledge. The competitiveness of individuals and organizations highly depends on their ability to rapidly transform the information into applicable knowledge, which should be selectively distributed and used for just-in-time decision making and learning. Networked multimedia and hypermedia offer new opportunities for facilitating knowledge acquisition by activating more human senses. According to recently reported data humans retain more than 80% of the information they are exposed to, if they see, hear, and do at the same time[6]. These opportunities could be provided by a new generation *intelligent and highly interactive multimedia and hypermedia learning environments* built upon *learner centered educational models*. The *computer literacy* should be extended to a *multimedia literacy* related to the students abilities *for reading, writing, and communicating with digitally encoded materials* - text, graphics, still and moving images, animation, sounds. To make use of the new opportunities offered by the CIT the educators should re-design the educational system as a whole. In a world with powerful instruments of producing and getting access to any kind of information at any time and any place, the content and the structure of the knowledge of the people able to effectively use this information have to be different from the one obtained through today's educational system[25].

3. New Educational Reform - Reflections on an Educational Experiment

From 1979 to 1991 a large scale educational experiment lounged by the *Research Group on Education* (RGE) was carried out in twenty nine schools in Bulgaria[22,27]. The main philosophy was centred around the assumption that due to the advent of mass produced microcomputers the educational system should be reformed as a whole. As a subject of education was considered not simply the student, but *a student equipped with a microcomputer* and the students capabilities and the machine power would complement each other[26]. The main educational principle was *the principle of integration of school subjects*. When this principle was applied the students could see the objects and phenomena in the world from many sides and could get better knowledge and understanding of them. They solved many problems by looking for answer in various fields of human knowledge. The students took on the role of researchers, who observed

and measured, created and revised hypothesis reaching scientific generalizations and forecast, which were the first steps to formal knowledge.

During the classes different activities were mixed and followed each other in a mosaic that kept the students interests awake. The students learned by themselves from richly illustrated and aesthetically designed textbooks, used a lot of reference materials, solved problems, designed, drew, played, sang, worked on computers. The textbooks were trying to give *systematic information* as an alternative of the unordered information coming through many channels and media.

The new task of the school was defined as *not to teach only but to teach how to learn by yourself*. The students were shown that knowledge was infinite, ever changing, that nobody could possess it totally (including the teacher). *Learning was defined as an active process*. Another principle applied was the *principle of non-explicitness*, i.e. the students were not supposed to receive ready made knowledge, but they were stimulated to discover it in the process of satisfying their natural curiosity. The *interaction* between students and teachers was considered as *a way out of the information overload*. The teachers and learners were given *more degree of freedom*, but increasing their responsibility.

Informatics and its integration into all school subjects and activities was a powerful mean for realizing all mentioned principles[20,27]. Informatics interferes and in this respect *changes the contents of learning*[26,27]. A *learning environment in informatics* was created as an integrated complex of computer equipment, information resources, educational software, textbooks and other learning materials. Although the computer resources were limited some innovative approaches of school activities were introduced[21], e.g. *working on a project, collaborative learning, dividing students into groups of different size, collective discussions, experimenting in mathematics, filling up a database, language games, publishing a student magazine, students' software house, teaching students in a university laboratory, competitions,* a *final students' computer performance,* etc.

The described educational experiment might be considered as a model for a computer-driven educational reform. The trial did not change substantially the Bulgarian educational system as a whole because it was not ready for such dramatic change. But it gave rise to several educational initiatives and projects both at school and university settings. An *exploratory learning environment in geometry*[29] and a set of *integrated*

textbooks on mathematics and informatics for 8-12 grade for the general educational system was written as well where most of the mentioned principles were applied[28].

Most of the RGE educational principles are even more valid now and the experience gained could guide us when designing *the School of 21st Century*. The main obstacles in fully achieving the RGE educational goals were the constrains imposed by the traditional *print-based schooling system* relying on a common set of fundamental strategies having been successfully applied during the last five-six centuries: using textbooks, grouping children primarily by age, and secondly by ability, dividing curriculum into subjects, packaging the subjects into annual installments, and mapping them onto a sequence of grades the students should *climb up*[16]. The basic unit of school space was (and still is) the classroom, where one teacher taught about 25 student. The basic units of the school time was the school period, school day, and school year.

Nowadays, with the advent of the networked multimedia and hypermedia it is a high time to gradually reform the existing *print-based educational system*, which eventually would reside into a *CIT-based educational system*[16]. During the transition through a *technology enriched learning environment* towards *pedagogical re-engineering of the school*[5,19] the main RGE educational principles might be realized in their full extent:

- As a subject of education we could consider not simply *a student equipped with a microcomputer, but a student with an access to the superhighway and being a member of a global cooperatively learning community.*
- instead of *integrated textbooks* the principle of integration of education would be based on using *virtual electronic libraries and subject-oriented clearinghouses containing multimedia resources.* In a *library learning* all educational resource materials will be accessible by students and teachers at any time and any place. The students can learn by themselves from richly illustrated and aesthetically designed, highly interactive and intelligent multimedia and hypermedia based courses, initially complimented by textbooks. They would also learn how to search for and retrieve other relevant reference materials. Learning on a *library based subject* means that the students should optimize their work by navigating into educational resources and taking decisions what is appropriate and what is not. The subject would include all relevant information which could be found in the local library or in a virtual, networked library.

- *Learning to learn* and *critical thinking* are becoming important educational outcomes not only for the best students, but for everyone studying in a CIT-based educational system.
- The *interaction* between students and teachers, as *a way out of the information overload,* would be organized both in a face-to-face manner and by using asynchronous and on-line computer conferences.
- *Cooperative learning*, as an alternative of the *competitive learning*, would be realized better in a highly interactive (virtual) learning environment comprising computer support cooperative learning systems.
- The *working on a project* school activity would be accepted as an alternative of the lesson and realized according to the *project pedagogy* typical for university teaching, but worth to be shifted to a school level now[16]. Networked multimedia communication would enable project teams working together independently of time and space.
- The teachers would be given *higher degree of freedom* as the networked multimedia would allow them to work together across their classrooms and freely share ideas and experience. They would facilitate students' inquiry, manage their learning process, and help them navigate in a shared global information space.
- The design principles of the learning environment would be based on *asynchronous space and time*, *responsive environments*, and *virtual reconstruction*[16]. By complementing face-to-face and synchronized interactions with a full capacity for asynchronized ones, the physical constraints obstructing one-to- one consultation between a teacher and a student, as well one-to-many and many-to-many type of discussions, can be significantly lowered, and all sorts of new pedagogical groupings may become both feasible and effective. Every student would have her own responsive CIT-based learning environment allowing communication with her peers, teachers, virtual friends, network servers, etc. The virtual reconstruction of school spaces would make possible physically distinct spaces to be joined into virtual auditoriums, workshop rooms, reading rooms, cafes, libraries, where students in different locations can interact as if they were together face-to-face. The virtual reconstruction might even reduce the huge capital investments in school buildings.

4. Towards a Learner Centred Pedagogy

The main principle in the *learner centered pedagogy* is that the learner does not receive ready-made knowledge. He should discover and construct his knowledge which does not mean to reinvent it though. There are several other important characteristics:

- the learner participates in learning objectives formulation and takes the responsibility for his activities. That makes him more motivated, self-directed and looking for personal efficiency.
- student-teacher relations are democratic ones. The student takes part in formulating the teaching rules and their application (the *contract method*). The student can even choose her teachers.
- the students take the initiative and they are quite more active compared to the students in a traditional school.
- the students get opportunities to *construct* their knowledge both in the school settings and outside school system. The students obtain new knowledge while solving real problems and transfer their knowledge to other students. They learn autonomously taking the responsibility for their learning and following their individual cognitive styles, interests, preferences. The students *learn how to learn*. The theoretical basis for the constructivist learning are the theories of Bruner and Piaget.
- the teachers are mostly facilitators, *co-learners*, persons ensuring the right educational resources at the right time, helping students get access to other relevant resources. They also diagnosis the students' problems, and help them any time when needed. The formative evaluation of students' achievements and evaluation based on project outcomes is dominant. The students are also encouraged to self-evaluation of their achievements and outcomes and are enabled to present them. (CIT offer new opportunities for *global student presentations*.) The teachers work both individually and in small groups with the students. They might be assisted by *students-mentors* who would help them and other students in using software tools[23].
- the school is open towards the world. The problems the students solve are formulated either by themselves or by the teacher and come from their everyday life. The students and the teacher cooperatively solve these problems. The project pedagogy based on the theory of John Dewey and William Kilpatrick and empowered by the CIT[16] is considered as an alternative of the lesson-based pedagogy.
- The space, the time, the equipment, and all teaching materials and information resources are used in an extremely flexible way.

- the curriculum and the teaching and learning processes are highly individualized. Different pathways and support for learning are offered to students who can progress with a different speed.
- the system of forming classes by age might be quitted and students in different age might work and study in small groups.

Most of the mentioned principles give rise to some new developments both in educational science and in technology and provide the unique chance to fill in the gap between the scientific studies and the real school practice. Among the most important recently developed learning paradigms and theories, derived or related to information technologies, are: *cognitive flexibility theory*[32], *anchored instruction*[3], *minimalism theory* [17], *Soar*[15], ACT*[1], etc.

The project pedagogy, flexible and distance learning, and collaborative learning tend to be widely used in technology-rich university settings. Another tendency is the globalization of higher education and the international collaboration. One example of such initiative is the European Association of Distance Teaching Universities (EADTU), which includes the main distance teaching higher education institutions responsible for over 325,000 students[2]. The Globewide Network Academy (GNA) is one of the most ambitious projects for virtualization of education - it offers thousands of distance education courses and hundreds of programmes deposited by universities from all over the world. The GNA and other virtual educational organizations show the tendency the distance education paradigm to be transformed into a *distributed learning paradigm*[7] which will be based on *knowledge webs* enabling distributed access to experts, archived resources, shared investigations, learning environments. A *mobile learning paradigm* might be elaborated in the near future. The partnership between universities and enterprises in distance learning and training turns universities into a new type of educational and training service providers to broader audience.

Education and training in organizations is area where CIT is widely used. As working needs knowledge and skills, learning becomes an obligatory element of working. The needs, constrains, and technological alternatives of learning support at work differ from those of school learning[11]. For instance as the work situation is not static the workers should adapt themselves to new circumstances and working methods. This means that two separated support systems should be updated continuously - the system for work and the system for learning. The team learning approach supported by a collaboration network (*hypergroup-ware*) is reported as a quite successful strategy[10]. The concepts of *learning while doing*, *just-in-time* and *just-*

in-place learning applied by using Electronic Performance Support Systems (EPSS) and Computer Supported Collaborative Systems (CSCL) systems are dominant in learning at work place, together with the emerging CIT-based flexible and distance learning strategies for corporate and professional training based on the Internet and the Intranet concept.

The direction of the recent changes in CIT based education and training is from computers as teaching machines towards computer-based collaborative (distance) learning environments.

5. Multimedia and Hypermedia Learning Environments

One of the main design principles computer-based learning environments is the principle of *interactivity*[30].The implementation of interactivity can be perceived as an art because it requires a comprehensive range of skills, including an understanding of the learner, a deep understanding of software engineering, deeper knowledge about the contemporary instructional design principles, and aesthetically designed multimedia interface. Development of effective interactive learning environments will motivate and engage the learner.

Designing human-computer interface for computer-based learning environments might be based on different concepts and instructional strategies, e.g. *browsing, media integration, metaphors,* etc. For instance browsing (or navigation) allows learners flexibly explore a programme or a data base, but there is a real danger of being lost in the *cyberspace*. The interface design should incorporate a concept how to minimize the risk of loosing orientation while browsing.

The World Wide Web (WWW) is built around three main ideas: physically and geographically distributed documents, unambiguous location of distributed documents, and a uniform interface. Anyone can create a document and include it into the web without any registration mechanism. Especially powerful is the idea of *uniform interface*, because the user should not switch from one interface to another when using different data bases. The idea of uniform interface is central in the Intranet concept - using the Internet concepts and principles in organizations, creating *institutional webs* of information. The next step is adapting the uniform interface according the personal needs of any learner by using *learners modeling* and *intelligent Internet agents*[4].

The openness of the WWW and the opportunity every user to become a miltimedia document author give rise to a new generation computer-supported cooperative learning (CSCL) and computer-supported cooperative work (CSCW) systems, such as: *ComMentor*[24], *CoNote* [6], *Teacher's Curriculum Assistant* and *Remote Exploratorium*[33], *SharedARK* applying the "*what you see is what I think you see*" (WYSIWITYS) interface concept for physically separated users, as an alternative of the "*what you see is what I see*" (WYSIWIS) interface concept[31], *Collaborative and Miltimedia Interactive Learning Environment - CaMILE* [14], etc.

6. Educational Policy Issues

Although most of the educational organizations, businesses, governmental and non governmental organizations, and homes are still far from being wired to the superhighway, even those in the developed countries, the rudiments of the Information Society might be observed. How it would be built depends in a great extent on the efforts of UNESCO, whose primarily goals are to promote development of human resources, reduce the poverty and unemployment, work for better integration of youth in the society, ensure equity in sharing information and knowledge, ensure access to science and technology for all, give anyone chance to receive education or second-chance to be educated, and finally creating a commonly accepted policy of cooperation, cultural and educational exchange, peace and global wisdom. How could these goals be realized against the global tendency of rich getting richer and poor getting poorer?

In the global Information Society there should be mechanisms that channel the information exchange as to prevent countries loosing their cultural identity. One of the main tasks of UNESCO now should be to launch an *Information Ecology Programme* which would aim at preserving the cultural diversity in the world the same way as the environmental protection programmes aim at preserving the biological diversity on the Earth. The issues of technological and especially of cultural portability of educational services, products, resources, and software are matter of highest importance now.

Along with the portability issues we should be aware that a wide educational market appears and each institution or organization providing educational products and services should apply a specific advertising and marketing strategy. Advertising, as we know it from traditional media - TV, newspaper, posters, etc., does

not apply if we use Internet. People on the Internet do not like aggressive advertising. Making a Web page a place which is worth to visit again is the best advertisement. It could be achieved by making it highly interactive, providing regularly updated information and curiosity, offering unique events, etc.[9]. There are a number of security issues that have not been completely solved yet: *authentication* of data, people, products, transactions; *site security*; *privacy; encryption; identity verification*, etc.

Other issues related to Information Ecology is to prevent Internet becoming a weapon of crime and information invasion, a new media for 'bad news'. (The TV and radio keep trying to prove that 'good news is no news'. I would hardly believe in a successful implementation of an Internet service *bad news on demand*.)

The distance education and telecommunication offer plenty of educational and training opportunities for people and organizations. However there exists fear that schools and universities and would loose their specific traditions and flavor and their autonomy. There is a tendency of imposing common standards for all educational institutions. As the distance education gives opportunities one professor or tutor to teach thousands students, would it lead to unemployment in universities and schools? No doubt that the distance education and CIT make possible students in geographically distinct places communicate. However there is a real danger for people, who normally communicate face-to-face, to 'switch' to electronic communication mode and loose their human contact.

Before a substantial amount of money and efforts are invested in the CIT-based education, a number of open questions should be answered:

- What are the educational objectives and the educational outcomes expected?
- How can we make possible bridging the gaps between current educational and training practice and the advances of educational information technology?
- How can we prepare university and school teachers as a human infrastructure ensuring effective application CIT in education and training?
- How can we organize locally and internationally produce educational courseware and educational multimedia resource materials?
- How can we assess the impact of the CIT and new educational technology methods on the education and training?

- How can we promote the 'best practice' cases?
- How can we ensure equity in access to CIT for all students and teachers?
- How can we preserve diversity of cultures?

Most of these questions could be answered by the Global UNESCO Project for Introduction of the New Information Technologies in Education: *UNESCO Network of Technology Enriched Schools*.

7. Conclusions

The educational reform needs synergetic efforts of UNESCO, the EC, governments, local governments, non governmental organizations such as IFIP and International Association for the Evaluation of Educational Achievements (IEA), policy makers, educators, business communities, public interest groups, parents and all citizens. For the countries in transition it is a matter of crucial importance participation in the EC educational and training initiatives and programmes, such as *Phare* (incl. *Tempus*), *Copernicus, Socrates and Leonardo,* as well as in all UNESCO initiatives and projects. The Second UNESCO Congress "Education and Informatics" being the last congress of the kind during this century, should draw clear direction for world-wide developments leading to a CIT-based education.

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User Interface for a Virtual Learning Environment: Two Study Cases

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Abstract: A recent powerful idea in the design of Web-based learning environments is the usage of *virtual places*. The employment of interface metaphors is one of the approaches enabling inexperienced users to feel comfortable in such *virtual* environments. We have designed a Virtual Environment for Distance Education and Training (VEDET), which provides basic virtual spaces, resources, and services. In this paper we discuss the user interface of two Web-based distance learning courses *Business on the Internet* and *Business English*, developed on the basis of VEDET. Web-based learning environment has been implemented to support the delivery of these courses. Two examples of interface metaphors have been developed and adopted, each presenting a coherent image of the environment.

KEYWORDS: Distance Learning, Human Computer Interface, Business/Commerce, Internet, Languages

1. Introduction

The power of the new communication and information technology influences human life and economy so deeply that makes all of us learners as both individuals and members of (real or virtual) learning communities and learning organisations in a learning society. Looking back at the history of the communication and information technology we could clearly see how the main attention of researchers and technologists has been gradually moved from hardware to software, next - to human-computer interface, and recently - to social issues related to global communication and collaboration. The computer mediated communication leads to establishment of *virtual communities* formed on the basis of topics of mutual interest, collaborative work, business, or other joint activities. These communities cross national and cultural barriers and demand for re-conceptualisation of the social life, including education and business.

One of the approaches allowing inexperienced users to make effective use of computers is the reference to *interface metaphors*. Metaphors help users to understand a new system interface by invoking their prior knowledge. This understanding is important since it allows the users to interpret and predict the behavior of the system.

The essence of the interface metaphors is that the objects (activities) are transformed into pictorial representations, which the user could easily identify and understand. This basic understanding gives the user an idea as to how to use the system. The interface has to be designed in such a way that the activities that the user could do in the physical world could be done on the electronic versions. One of the main design problems with the *metaphor as model* approach is how to incorporate additional functionality, which is not part of the interface metaphor but which enables the computer to be more powerful than non-electronic means (Preece, 1994).

This paper discusses the interface metaphors developed for two World-Wide Web (WWW) based distance learning courses *Business on the Internet* and *Business English*. WWW-based learning environment has been developed to support the delivery of the courses. Two examples of interface metaphors have been developed and adopted to present a coherent image of the environment.

The paper is organized in the following way. First, the general model underlying the environment is presented and the Virtual Environment for Distance Education and Training (VEDET) is discussed in brief. Then the two different examples of interface metaphors are described: the cases of *Business on the Internet* and *Business English* courses. Finally, some practical results as well as future plans are discussed.

2. General Educational Model

The success of the separate individuals and organisations in the global economic and intellectual competition depends on their skills to transform quickly and in the right moment the available information into useful knowledge that can be used for taking important management decisions. Employers demand that their workers are able not only to memorise facts but rather to learn new methods, new programs, new professional skills. The search and filtering of huge amount of information is not an easy task and the new information and communication technology achievements still does not support it efficiently.

For the purposes of the *Business on the Internet* and *Business English* courses a learner-centred educational model was chosen. The instruction is based on electronic libraries and object-oriented multimedia resources rather than on printed materials. Students can study on their own using aesthetically formatted and interactive multimedia learning materials. They have to construct their own knowledge, to study individually according to their skills, interests, preferences and cognitive characteristics, to *learn how to learn*. Students can control their learning process, work in a team with other students, take part in discussions, and search for effectiveness of the learning. The tutors are students' *classmates*, that help them find how to cover and traverse optimally the rich in information resources global information systems and to find the most suitable learning materials. The achievements of the students are assessed on the final result (product) basis, which can be presented, defended and published both locally and globally. The self assessment is encouraged. *Co-operative learning* and work dominate over *competitive learning*. The tutors can work with the students individually as well as with small groups of students. The student can work in a dynamic and interactive multimedia learning environment where aside from the tutor and the other students s/he can communicate and work with his/her virtual friends all over the world.

Authors see World-Wide Web (WWW) as one of the best mediums for implementing this model. WWW could support teaching and learning in a number of ways:

- as a source for reading materials;
- as a corpus for self-exploration;
- as a medium for writing, publication and dissemination: publishing on the WWW allows writing for a real audience (classmates, the Internet community) rather than just for the teacher;

- as a forum for communication: students get confidence in using English as a language of communication; they learn to organize and present ideas in a clear way; they have the chance to get in touch and communicate with other students all over the world.

Our efforts to incorporate World-Wide Web into instruction are aimed at using it both as information resource and as a basis for organizing long distance collaborative learning.

3. A Model for a Virtual Environment for Distance Learning via Internet

The idea of *uniform interface* is the most important one for the success of the World-Wide Web nowadays. It is central also in the Intranet and Extranet concepts, unifying the principles of presenting and using information, creating *institutional webs*, applying *learners modeling* and *intelligent Internet agents* technology in various types of organizations.

A recent powerful idea in the design of the Web-based learning environments is the availability of virtual places: auditoriums, workshop rooms, cafés, libraries, etc., where students from different locations can meet, interact, and work together, as if they were face-to-face.

A prototype of a Virtual Environment for Distance Education and Training (VEDET) was developed at the Department of Information Technology, University of Sofia. VEDET contains four types of learning organizations: a virtual university, a virtual language learning center, a virtual school, and a virtual enterprise (Nikolov and Nikolova, 1996). It includes also a number of virtual services such as: a virtual library, a virtual post office, a virtual student house, a virtual exhibition and entertainment center, a virtual electronic publishing house, a virtual help desk, a distance education brokerage service, a virtual electronic document and software delivery service, a virtual course customization service, a virtual transportation service, a virtual liaison office, a virtual public arena.

The kernel of VEDET is the virtual university, which includes:

- an administration office, where students can register and discuss organisational issues with the university staff;
- a virtual lecture hall (auditorium), where a lecturer could deliver a lecture for a particular virtual learning community;
- virtual seminar rooms, where the virtual class can discuss issues related to subject matter topics;
- virtual workshop rooms, where collaborative work can take place;
- a virtual reading room, which contains all locally prepared learning materials.

The virtual university learning environment includes *branches* of most of VEDET services.

Similarly, the virtual language learning centre consists of an administration office, virtual classrooms, virtual reading rooms, a video centre, a phono lab, a student centre. It also includes branches of some of the VEDET virtual services. All the language courses currently offered are announced at the *information desk* of the administrative office. One can get registered for a course at the *registration desk* of the administrative office. Each course takes place in a *language classroom*. The classroom is the central place for a language course: the place where the actual virtual teaching takes place.

The virtual library has an integrated catalogue of locally available electronic resources, as well as a gateway to other virtual libraries, such as GNA library (GNA, 1993).

The virtual post office provides electronic news services, multimedia e-mail and listserv services, electronic journal subscriptions and delivery, postcards construction and delivery, etc.

The virtual publishing house (Nikolov *et al*., 1997) offers customised publishing of stand-alone and networked hypermedia materials, such as: electronic textbooks, videos and audio, teacher and student guides, questionnaires, presentations, catalogues, advertisements, etc. The customers order publishing services by providing resource materials - text, scripts, audio, images, logos, ideas for illustration and animation development, links to related Internet sites, instructional design requirements (Ducket *et al.*, 1995).

The virtual electronic document and software delivery service allows learning resources to be supplied at any time and to any place *locally* and *globally*. It supports the learning resources flow and workflow planned by the instructors and administrators.

The virtual electronic entertainment centre provides access to virtual museums, art galleries, exhibitions, concerts, movies, computer games, etc.

The virtual help desk provides support in specific activities.

The virtual public arena including a virtual café is a place for informal talks. The virtual café can have a number of different rooms for students, teachers, parents, employers, as well as cross-meeting places for discussing carrier opportunities between students, parents, and employers.

The virtual course customisation service deals with distance course customisation and adaptation to the needs of the local learning community, by taking into consideration the local educational and training traditions, language, culture, and even individual needs of a particular group of learners.

The virtual liaison office deals with the administration and co-ordination of international co-operation projects, student and staff *virtual mobility* schemes, etc.

The distance education brokerage service plays the role of a market place for educational services and products. Any educational institution can do global marketing research for its own products there and order and *purchase* educational products and services.

The virtual transportation service provides fast *shuttle-bus* transportation service between the virtual places of VEDET and a *space-shuttle line* between different virtual environments.

VEDET provides only basic virtual spaces, resources, and services. The users could reconstruct VEDET virtual space by adding new customised facilities, spaces, and services according to the particular instruction requirements. For instance, for the purposes of a session of electronic commerce a new virtual workshop room could be created and *equipped* with a business Web pages development toolkit, software and electronic conference tools appropriate for collaborative projects in marketing on the Internet, etc. (Farraro *et al.*, 1995; Favorin, 1995; Guzdial *et al.*, 1995)

VEDET offers a comprehensive interface metaphor to be used both for human-computer interface and instructional design purposes. The two distance courses, described in this paper, could be seen as examples of the power and flexibility of the proposed approach. This approach also enables the process of restructuring traditional education and training by complementing them with virtual components.

4. Main Design Principles

4.1. Business on the Internet course

The *Business on the Internet* course could be regarded as a case study for instructional design principles for on-line courses as well as a technological framework for distance course implementation (Stefanov *et al.*, 1997). The main technological platform for course delivery is the WWW integrated with other Internet services such as E-mail, computer conferencing, WWW interface to data bases, etc.

In the proposed approach the cooperation takes a key role. The participants work within a learning community where the emphasis is on:

- providing a wide choice over content and direction of learning;
- managing by participants of their own learning and cooperation with others through processes of negotiation and discussion;
- providing a critical perspective on learning and other academic issues with strong relationship to participants' professional practice;
- taking collective responsibility by participants and tutors for the design and evaluation of the program with constant reviewing and modification of the design, procedures and ways of working.

Some important aspects of the proposed design are: openness in the educational process; forming a learning community; self-managed learning; supportive learning environment; collaborative assessment of learning; assessment and evaluation of the on-going learning process, etc.

Main design decisions

The above mentioned design principles led to the idea of developing a *template* - a WWW-based tool, consisting of a set of WWW pages, with uniform design metaphors (Wilson, 95) and consistent layout. The template represents a virtual learning environment including the following virtual components: Wall Tray (including introduction, course philosophy, and course organisation), Students' Help desk, Teachers' Help desk (assisting teachers to apply in a flexible way the chosen instructional design), Virtual Library, Café. The template consists of two main parts:

- *introductory part* - helping the students with overall course orientation;
- *study part* - promoting the real learning according to the chosen model.

All Web template pages have been designed with strong consistency in mind, so the users (teachers and students) could easily navigate and become oriented what part they are using/exploring, for what purpose, what to do next, how and where to go next, etc.

Both the introductory part and the study part of the template include various units, all linked together and having common purpose and functionality. The units are designed so as to be easily modifiable and have a standard interface. They are also self-contained, manageable sections that can stand alone and are often interchangeable.

The main units in the introductory part, when filled in with appropriate information, will constitute the course home page, introduction to the course, course outline, course micro-planning, evaluation and statistics, simple demo version of the course, students and teachers authorisation. All they have common frame structure.

The main units in the study part, when filled in with the necessary information, will constitute the basic course learning units, each one containing sub-units, corresponding to different learning activities.

The pilot *Business on the Internet* course is accordingly structured in two parts: introductory part and study part. The study part (see Figure 1) includes six basic units containing the following sub-parts: a lecture, guest lecturers, tests, questions, case studies, an essay, a resource bank, discussions. A large unit could be further divided into sub-units each with its own objectives, activities and tests. The learning objectives are short, clearly defined, measurable goals that students could achieve.

The learning activities are important parts of the lessons and they actually promote learning and move students towards the course objectives. Each specific student target group is offered selected readings. The lecture notes are available on-line at the beginning of the course and can be refined during the course. Each student is assigned the task of constructing Web pages on a specific theme and their hypermedia reports could be published on a Web page. This allows both students and tutors to enrich the learning environment. The students have on their disposal also examination study hints with hypertext links to important materials. Private correspondence among the students, tutors and experts is encouraged. *Guest lecturers* are *hired* simply by including hyperlinks to their materials on the Web or by scheduling on-line or asynchronous presentations of them. The students can present their reports online or publish them on a Web page. Online discussion groups are formed dynamically and some students are assigned to lead off discussion. Special conferences are open and the students are invited to discuss specific problems, case studies or proposals. Quizzes and tests included in each unit allow students to measure their own progress and mastery of the course components. A number of small projects linked to form a larger project are given to all students. The students can learn at their own pace. They also have the opportunity for free exploration using the resource banks attached to each unit as well as the course library. Web course materials and online interactive sessions are stored for further use in classes.

4.2. Business English course

Traditional approaches to foreign language instruction are usually entirely teacher directed, closely following a chosen textbook. In contrast, most of the emerging WWW LEFL (Learning English as a Foreign Language) sites offer resources or activities which the learners can freely explore, use or take part in (see for example Mike Vallance's Business Meetings on <http://www.stir.ac.uk/epd/higdox/Vallance/ Diss/ FP1.htm>). Though the principle of *learners taking all the responsibility for their own learning* is recently strongly advocated, the Business English course authors believe that for a course, which is to be credited, the human teacher should have the overall control on the instructional process. Accordingly, the main postulate was *while keeping the tutor's leading role to move towards more efficient learner centred instruction*. The last resulted in setting basic

course design principles, focussing on: constructivist learning, real-life problem solving simulation, meaningful communication and co-operative learning and work, creative language practice, interactiveness, and Web-based self learning.

Main design decisions

In order to implement the design principles a WWW-based learning environment was developed to support the *Business English* course delivery. The purpose of this learning environment is twofold: from one side to embed the main course content (with references to relevant web sites) and from another, to serve as a medium enabling learner centred activities and supporting the overall course organisation. In other words, to serve as a *virtual place* where the Business English instruction will take place.

The course material is divided into learning units, each built around one main topic. All units have identical structure and consist of pre-reading activities, reading, post-reading activities and assignments. The pre-reading activities range from expressing an opinion on a given issue or completing self-analysis questionnaire to taking decisions on a controversial problem. The aim is to provoke some brainstorming and thus lead students into the topic. Each reading section includes: basic text, complimentary texts, references The texts included in the reading sections provide only brief information on the topic. In order to expend their knowledge in this area, students will have to do a lot of self-studying in the local or virtual libraries. The post-reading activities are divided into three groups:

- *comprehension* - directly related to the text for reading: true and false exercises, filling in tables, taking notes;
- *language focused tasks* - gap-filling, phrasal verbs;
- *follow-up activities* - field studies, team building, role-play, SWAT analysis;
- *surf-the-net* - exploring a site with a specific task in mind.

Assignments include writing a memorandum, CV, covering letter, business letter, guidelines how to work in a multinational team, article to a magazine on corporate culture and others.

The virtual teaching takes place in the *Business English classroom*. On the *walls* of the classroom poster information is presented: course description and course syllabus. The course syllabus is presented in a table providing hypertext links to the actual learning material and activities. One of the walls is equipped with a *message board* and another - with a *shelf* containing books that are going to be used frequently (including English Grammar book, Merriam-Webster's WWWebster Dictionary and Encyclopedia Britanica). The message board is a board for administrative messages from the instructor, spotlight information, notes and instructions for the week, etc. It is important for the students to check the *message board* regularly because the tutor announces the tasks for the week there. All the old messages can also be viewed. The classroom *corners* are designed for self-study activities. *Gateways* lead to the Post Office, Conference Centre, Library, Student Centre, and the Café. The interface of the *Business English* course is given in Figure 2.

5. Discussion

VEDET is based on a strong integration of virtual learning institutions and services. The *human computer interaction model* of the two WWW-based courses interrelates with their instructional design strategy. Learners, instructors and administrators from different locations *inhabit* the virtual learning environment and can meet, interact, learn and work together, as if face-to-face. VEDET is

interactive, flexible, open, distributed, accessible by distance, asynchronous, filtered, containing Web *road-maps* and course archives.

The *Business English* and *Business on the Internet* learning environments developed on the basis of VEDET supports *learner centred instruction* focusing on new roles for the learner, different from the traditional ones, namely greater motivation, responsibility, accountability, self-control, ability to work on their own and to collaborate. The emphasis is on communication between the instructor and the students, which is supported in various ways: by e-mail, class list server, local bulletin board system, group discussions via asynchronous computer conferencing, etc.

VEDET can be used either for delivery of a distance learning courses or as an aid to class infrastructure allowing some functions to be carried out through web pages and web-based activities. We believe that in either case it will extend and enrich the delivered courses. The environment supports the six categories for tele-learning as a part of a face-to-face course (Collis, 1996):

- making the course materials more organized and accessible to students;
- improving the effectiveness of the lesson presentation session;
- improving communication between the instructor and the students;
- improving discussion among the students;
- improving the range and quality of resources available to the students and shifting the responsibility to the student for the selection of appropriate resources;
- improving the range and quality of learning activities available to the students, particularly in terms of collaborative learning.

The implementation of the courses was a successful beginning of the interface metaphors validation. Now the courses have entered their experimental phase. Five instructors - four university lecturers from Sofia University (three from the Department of Information Technology and one – from the Faculty of Economics and Business Administration) and one - from the American University, Blagoevgrad - are using the VEDET based courses. More than 25 students are participating, some of them at a real distance. Special evaluation forms are prepared for the students and for the tutors. Among the main goals are to test how computers can assist communication between the students and the instructor, how to make students co-operate by sharing information and how selected sites on the Web can be used to expand students' knowledge on a particular subject.

The very first impressions of this process could be summarized as follows:

- Both the instructors and the students take vigorously part in the courses which indicates that the work on/in the courses is motivating and pleasant for them. Since the students have had some previous experience in using Internet and WWW as a course environment, obviously they do like the courses, not just the use of the new technology.
- Only one of the instructors had some initial problems in using the environment. For a broader use, however, VEDET courses should be accompanied with appropriate user documentation.
- The main problems for the instructors is the lack of experience in using interactive tools in a network environment. This indicates that some demo variants should be prepared to serve as examples for instructors of how to include more interaction in their lessons.
- The instructors and the students like the better communication within the course compared to their (conventional) classroom practice.
- The interactive exercises (automatic checking) are of great help to the instructors and allow the students to see their results immediately. The experience shows that they are among the favorite activities of the students.
- The pilot versions of the courses were developed with very little special maintenance, which indicates that it is easy enough to use VEDET for a real course implementation.

The implementation of the two courses was a good experience for the authors of the paper. It helped to identify some key problems and suggested directions for further development and improvement of VEDET.

Future plans and improvements

The technological, communication and information infrastructure, especially the electronic catalogues and Internet resources collected, will be used to create a community of practice which will continue to grow after the project is completed.

One of the main directions for further development of VEDET includes adoption of the paradigm for individual learning styles. The environment should enable the learner to identify himself within one of the four basic learning styles proposed by Honey and Mumford (1992) and then to choose the appropriate content structure, learning activities and way of navigation suitable for that learning style.

Another interesting idea is related to a broader use of different types of multimedia information (audio, live video, synchronous videoconferencing, etc.). This feature could be used also in the so-called "simulated distance education" thus eliminating the technology barriers.

An important line of future improvements of VEDET is connected with database registration and accounting features, enabling more sophisticated ways of collaboration and group support activities.

Our future plans are also aimed at including *intelligence* in the VEDET environment. One of the key features strongly related to the intelligence of the interface is user modeling. This concept involves automatic construction of a model of user's current knowledge, skills, and behavior, so that the system can use it to adapt its own behavior to that particular user's individual characteristics.

Acknowledgements

The work is financially supported by the EU Copernicus COP1445 project and also partly funded by the National Science Fund, Project No. I-502/95.

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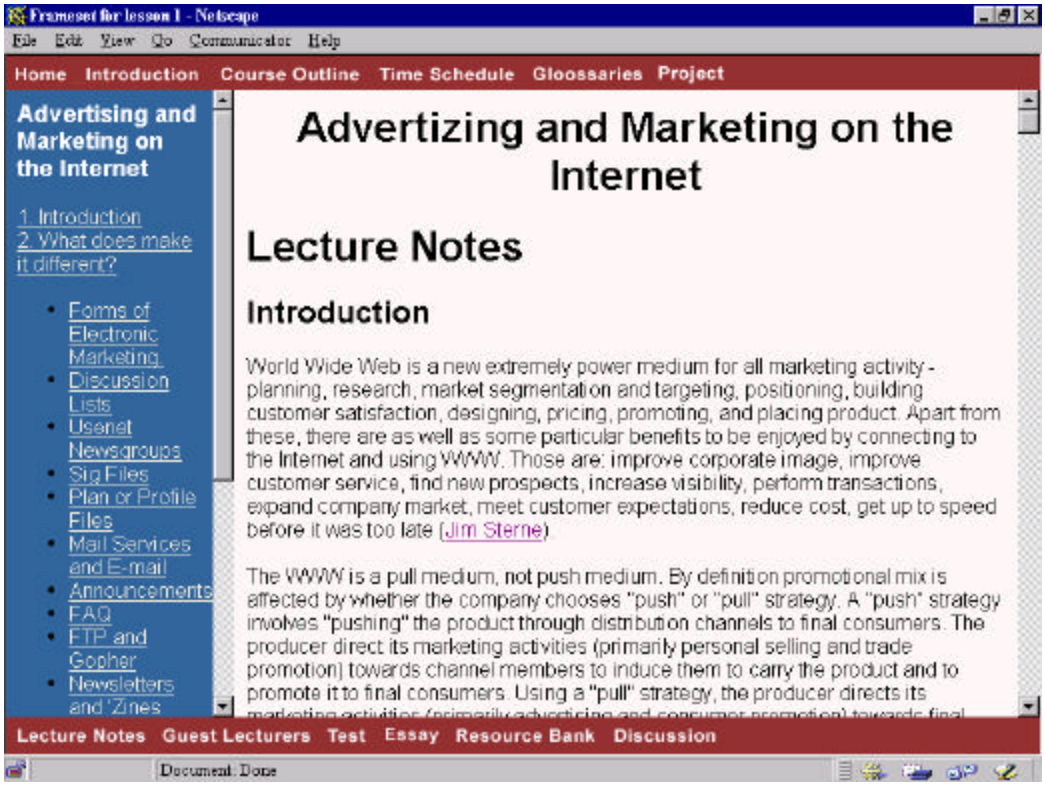

Figure 1. *The Interface of the Business on the Internet Course*

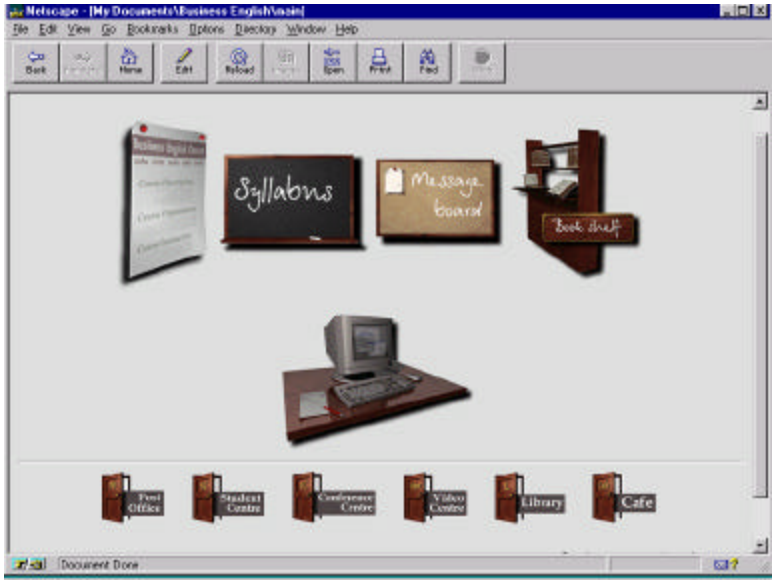

Figure 2*. The Interface of the Business English Course*

Introduction

Telecommunication networks are changing the nature of teaching and learning, especially as evidenced by the enormous increase of online educational offerings. Many universities and colleges, independent organizations, and businesses are joining the information age by offering online professional development courses for educators. These may be traditional or nontraditional courses, delivered partially or entirely online. Graduate and undergraduate degrees are now offered through electronic communications, as are individual courses for credit or continuing education units (CEU). Although the number of research studies is limited, results suggest that this form of education is effective for well-motivated students, especially those who understand the nature of this new educational experience. This paper will look at the variety of courses currently available for educators and assist you in determining what particular individual learning styles and preferences best match the environment of the various online courses. Additionally, it will offer some strategies for making the most of online educational opportunities, and suggest questions to ask prior to enrolling in such a course, to ensure that you have a positive experience in the world of online professional development.

Distance learning in various forms has been around for a long time, but until recently the ability to offer online courses to large numbers of individuals was not available. Traditional distance learning environments were based on correspondence through passive media (paper, audio and video broadcast). Recent developments in network and communication technologies have offered opportunities to improve these environments through increased communication, interactivity among participants, and incorporation of collaborative pedagogical models. Other advantages to using this type of distance learning include:

- instantaneous (synchronous) and delayed (asynchronous) communication modes
- access to and from geographically isolated communities
- multiple and collaborative participation among widely dispersed individuals
- ultimate convenience, when and where you choose
- interaction with and among individuals from diverse cultures, and
- ability to focus on participants' ideas, without knowledge of age, race, gender, etc.

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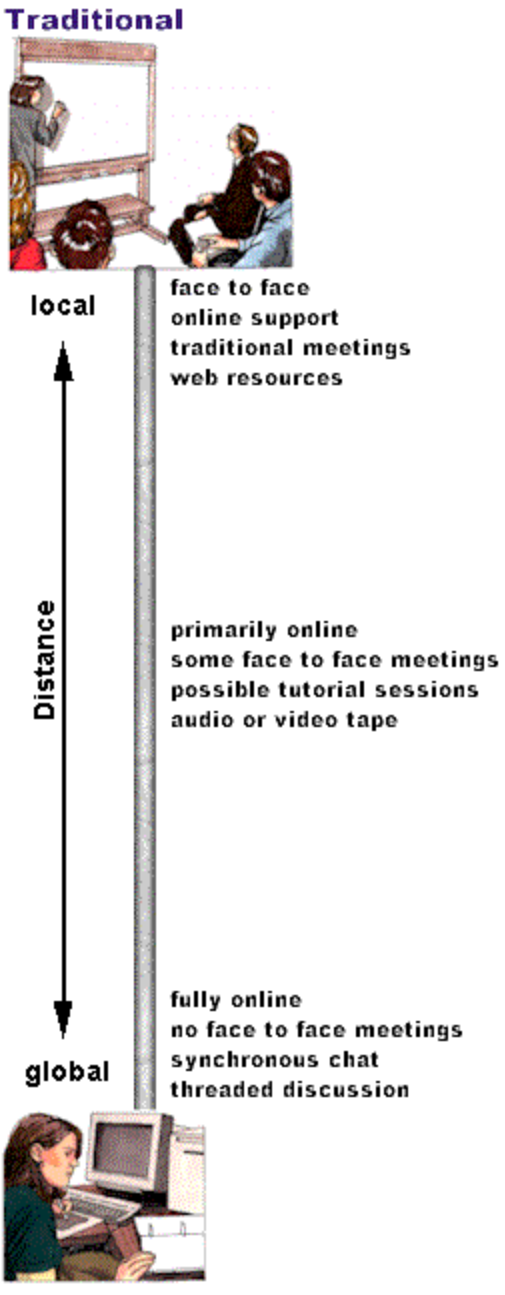
Types of Courses

According to humanistic psychologist Abraham Maslow, humans strive for self-actualization, and share a desire to acquire knowledge, be creative, and reach their full potential.* Perhaps educators are the best example of this statement! Happily, the world of graduate and continuing education has changed dramatically and we are now given many choices of where, when, and how to pursue lifelong learning.

It is helpful to think of the variety of professional development courses as a continuum. One end of the continuum is a traditional face-to-face course, with online support. Activities might be posted on a website, discussions might take place online, but basically the course is similar to many others we have taken. Also clustered around this end of the continuum might be a traditional course that only replaces a few of the scheduled sessions with Web interaction or assignments.



As we move toward the center of this continuum, we might find a course that is more typical of a distance education class. It may be an online class that is enhanced with local meetings (possibly at the beginning and end of the course), or with one or two group tutorial sessions (perhaps distributed by geographic locations). This type of course might include audio or videotapes for dissemination of certain types of materials. Clearly this type of course would need to be located within somewhat close geographic proximity to you.

Finally, at the other end of the continuum, we might find a totally online course. The participants never meet physically, and the course interaction takes place through a variety of tools. There may be a threaded discussion that is organized by topics, often called a bulletin board. Video clips and

photographs may introduce the instructor and the students to each other. A synchronous chat may be organized for once per week.

Online

Another type of course found at this end of the continuum would be an updated, technologically enhanced version of a traditional independent study (correspondence) course. The student might have several months in which to complete various assignments, and the student interacts with the instructor but probably does not work with other students. This type of course would possibly include many of the same types of communication tools, but they are used to facilitate the interaction between the student and the instructor.

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*A. H. Maslow, *Motivation and Personality*, 2nd ed. (New York: Harper & Row, 1970).

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Learning Styles

Many teachers are concerned that an online course may be very different from what they know and have been successful in completing. They are worried they might miss traditional face to face instruction. It is true that each person learns in a unique way — think about the way you remember a phone number or address. Do you write it down, say it several times, or make a rhyme out of it?

We all learn most efficiently when we are able to receive and store information in the manner in which we best process that information. In her 1992 article "Strategies for teaching word recognition to disabled readers," Rita Dunn* says that "learning style is the way people begin to concentrate on, process (global vs. analytic), internalize, and remember new and difficult information." For example, an auditory learner will have more difficulty if all information is given as text, which must be processed visually.

But learning style goes beyond the style in which you process and remember information. What do you need to know about yourself to make wise decisions about a course, and then to get the most out of that experience? To be successful in an online environment, you also need to consider your learning habits, work patterns, and comfort zone. As you begin to explore this new adventure, it will help if you take our What is Your Learning Style? quiz.

Regardless of what you score on our quiz, you may want to pay attention to the features of each course you consider taking, to make the most of the environment for your style and needs. Here are a few examples:

If you prefer or enjoy:	Try a course that includes:
Face to face interaction	A combined format course, with several face to face meetings
Lots of interaction with the instructor	One-to-one online independent study course
Immediate feedback on assignments	Ask the instructor for a plan of feedback, and assurance of multiple communication channels
Deadlines for work assignments	Traditional timing (following a school schedule)
Hands-on technical support	A locally offered online course, with contact information for assistance
Discussions with class members	A well functioning threaded discussion that is easy to follow, plus an occasional face to face meeting
To complete the course quickly, on your own	Completely online course, regardless of geographic location; ability to move ahead on your own
Ongoing support for your work	An instructor willing to engage in dialogue
Authentic assignments	An instructor with an open-ended syllabus and

	flexibility
Help staying on task	Pick a course that someone you know will take too!

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*R. Dunn, "Strategies for teaching word recognition to disabled readers," *Reading and Writing Quarterly: Overcoming Learning Difficulties*, *8*(2) (1992), 160.

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What is Your Learning Style? A Self Quiz

To be successful in a distance learning environment, you will need to consider your learning habits, work patterns, and comfort zone. As you begin to explore this new adventure, it will help you if you answer the following questions.

1. Feeling that I am a part of a class is…

A. not particularly necessary to me.
B. somewhat important to me.
C. very important to me.

2. Face-to-face classroom discussions are…

A. rarely helpful to me.
B. sometimes helpful to me.
C. almost always helpful to me.

Another concern that potential students raise is the relationship between the instructor and the student. How much interaction do you typically like to have with your instructors? Answer these questions about the nature of instructor/student discussions.

3. In a traditional class, I find that my interaction with my instructor is…

A. occasional, for clarification only; I'm confident working on my own.
B. often, to get assurance; I want to check my understanding.
C. repeatedly, for support; I need to be sure I'm doing things correctly.

4. As a learner, I would classify myself as...

A. someone who can master information just by reading it.
B. someone who prefers to hear as well as read the material.
C. someone who really needs to hear the instructor to master information.

The next important aspect of an online course relates to your work patterns. Some individuals report that they feel less responsibility for keeping up with the readings, and find that it is easy to get behind. Answer these questions to see how this issue may relate to you.

5. When an instructor gives directions for an assignment, I...

A. am comfortable figuring out the instructions on my own.

B. like to try to follow the directions alone, then ask for help as needed.
C. need to make sure that I understand what is required, interact with colleagues and the instructor before beginning the work.

6. I would classify myself as someone who...

A. often gets things done ahead of time.
B. needs reminding to get things done on time.
C. puts things off until the last minute.

Given that an online course is dependent on technology, it is important to identify your comfort using computers, your capacity to solve your own problems, and your ability to make changes to your hardware. Answer the following questions about this topic:

7. In rating my skills and experience in using a computer, sending e-mail, and finding electronic resources, I would say that...

A. I am a frequent user, comfortable, competent, and a problem solver.
B. I am a semi-frequent user, able to accomplish the tasks, but get a little frustrated at any technical problems.
C. I am just beginning to attempt these things, and need technical support that I can count on.

8. When I have a problem or complication with my computer or peripherals, I tend to...

A. willingly tackle a challenge to make it work or know when to get help.
B. feel apprehensive, but try anyway.
C. get upset, and put it off, or try to avoid it.

SCORING

- **Give yourself:** 3 points for each A response
  2 points for each B response
  1 point for each C response
- **To calculate your total score, add up the points you earned on your responses to the eight questions.**
- **Interpreting Your Score:**

17 or more points
If your total is 17 or more points, online courses may be an excellent choice for your professional development.

10 to 16 points
If you scored in this range, online courses will work for you, but you need to make a few adjustments in your attitudes and planning in order to succeed.

9 or less points
If your total score is 9 or less points, you may need to discuss your concerns with the instructor, and consider the adjustments that make sense to ensure your success.

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Finding the Best Online Course for You — Questions and Strategies

There are many questions you will want to ask before you enroll in an online course.

First, think about the organizational issues.

- How is the course structured — does it conform to the timeline of an institution or can you work at your own speed?
- Will you meet face to face during the term?
- Does the instructor have a time set aside for his/her distance students (so you can be sure to reach the instructor by phone)?
- Are some of the requirements dependent on other students, and is there an easy way to accomplish this?
- What are the recommended prerequisites for the course (technological, pedagogical, and time commitments)?

> **NOTE:** Independent courses give you greater freedom to schedule your work, but they also require more self-discipline.

Second, think about institutional issues and questions that relate to this area.

For example,

- Is the instructor doing this as an "extra job" in addition to his/her regular work? (S/he may have less time for interaction or providing timely feedback.)
- What kind of credit is given (and is it accepted by your school district)?
- If you are interested in a degree program, what are the total costs of that degree?
- Can you talk to other students who have finished the program or course?
- What type of evaluation has the institution done on the courses?
- What kind of support does the institution give to remote students? Will you have access to library resources or materials?
- What technical support do they have for the system?

Other considerations:

Many students and faculty of online courses report that content can suffer if the technological issues are not resolved prior to the beginning of a class. Make sure that you are not in the pilot group of students. It is quite reasonable to ask for a demonstration lesson, or to "sit" in on a current course prior to enrolling. This will allow you to check your equipment, connections, and compatibility.

You might want to enroll with a partner — a friend, grade level or subject area partner, or someone with whom you know you can work well. This will keep you both on target and provide you with someone to discuss the material.

Distance learning coursework can often be neglected because of personal or family circumstances. Be sure this is a good time to devote energy to completing a course. While it is true that some online courses require as much, if not more, time as attending classes and completing assignments for traditional campus courses, the benefits can be enormous.

Conclusion

As you can see, there is a wide variety in the types of online professional development courses, and it is important to look thoughtfully at the quality and characteristics of each one you explore. While in this paper we have been discussing online professional development for educators in the area of technology integration, you might also be aware that a wide variety of other online opportunities exist. Some content areas may fit into an electronic environment better than others, and you may need to think about which ones fit your needs and learning style.

In summary, online professional development is an exciting new opportunity for all educators. It offers enormous possibilities, and unique experiences await you. So, find a course that fits your needs, ask a lot of questions, and jump right in!

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Additional Resources

Following are links to several types of online courses that are described in this article. The International Society for Technology in Education hopes that you find these resources useful as you explore the multitude of distance learning options.

AT&T Learning Network Virtual Academy

The **AT&T Learning Network** Virtual Academy is an online centralized resource that provides educators with access to Web-based professional development opportunities and courses that target technology integration.

DIAL, the New School's Distance Learning Program

DIAL, the New School's Distance Learning program, provides opportunities for people all over the world to take New School courses at their own convenience. Connecting through the Internet's World Wide Web to their cyberspace campus, students receive instruction, ask questions of their instructors and each other, discuss issues, and participate in their classes.

Heritage OnLine

Heritage OnLine specializes in Internet-assisted distance education for teachers. Their current program has twenty active courses in a variety of subjects such as art, assessment, classroom management, education, foreign language, literature, math, science, social studies, writing and technology. All courses are available for Antioch University credit.

Lesley College Online Learning

At Lesley College a number of faculty members are now engaged in adapting Lesley courses to an electronically-based distance learning format. These courses can be taken at a distance from the Lesley College campus in Cambridge by using computer-based online technologies. Their Technology in Education master's degree program is designed for teachers who are interested in integrating technology into the curriculum and the school's teaching and learning community. This degree is currently offered in an online format and is designed to be completed in less than two years.

Online Innovation Institute (OII)

OII is a results driven organization, which offers professional development workshops to help students and teachers improve classroom achievement. OII provides educators with a learning environment to support integrating the Internet into their individual teaching styles.

Open School

Open School is an initiative of the BC Ministry of Education to develop teaching

and learning resources to support the K-12 education system in British Columbia, Canada. The resources are developed by professional course designers and experienced teachers, for use in schools, colleges, homes and learning centers around the province.

Professional Development Online

The interactive, multimedia courses offered through Professional Development Online provide flexibility without sacrificing meaningful content or the chance to discuss what is learned with colleagues. Each course includes interactive lessons that have been specially designed for Web-based training. Each lesson is supplemented with extensive reading material and access to discussion groups.

T.H.E. Institute

T.H.E. Institute, a new division of *T.H.E. Journal*, is dedicated to providing professional development services and consulting to persons and organizations involved with K-12 and higher education institutions. T.H.E. Institute provides targeted coursework focused on issues involving the constantly changing arena of technology as a tool for teaching and learning.

Washington State University (WSU) Virtual Professional Development School

WSU College of Education is currently developing a virtual Professional Development School for teaching Washington state's children, WSU's future teachers and administrators, and for researching education topics and issues online.

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For Further Reading

Dr. Iliana Nikolova's Recommendations

Bacsich, P. (1999) Planning and Costing Virtual Universities. In Ganor, Shultz, Nachmias (Eds.) Book of Abstracts, Euro-Med Tele'99 Conference "Technology in Learning Environments", Open University, Israel.

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Dr. Roumen Nikolov's Recommendations

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Rosenberg, M., E-Learning, McGraw Hill, 2001, ISBN 0-07-136268-1

Margaret Driscoll, Web Based Training, Jossey-Bass Pfeiffer (www.pfeiffer.com), 1998, ISBN 0-7879-4203-0

Colin McCormak, David Jones, Web-Based Educational Systems, John Wiley & Sons, Inc, 1998, ISBN 0-471-19162-0

Brandon Hall, Web-Based Training Cookbook, John Wiley & Sons, Inc, 1997, ISBN 0-471-18021-1

Web Resources

Dr. Iliana Nikolova

Resources related to Course Support Systems (CSS)

- WebCT http://homebrew.cs.ubc.ca/webct/
- Archives for the WebCT-users mailing list http://homebrew.cs.ubc.ca/webct/docs/mail/index.html
- Documentation for WebCT http://homebrew.cs.ubc.ca/webct/docs/
- Papers about WebCT http://homebrew.cs.ubc.ca/webct/papers/
- TopClass http://www.wbtsystems.com/
- TopClass Support lists http://www.wbtsystems.com/support/lists.html
- Efficacy of WEST Software in CHE 105-001 http://www.chem.uky.edu/misc/105westsurvey.html
- Questwriter http://iq.orst.edu/meta/
- Webfuse http://webfuse.cqu.edu.au/
- Flax http://www.cms.dmu.ac.uk/coursebook/flax/
- Virtual-U http://virtual-u.cs.sfu.ca/vuweb/
- Nicenet http://www.nicenet.org/
- Hyperwave http://www.iicm.edu/hyperg
- Neologic http://www.neologic.com
- A WWW Based Distance Education Program http://www.wbtsystems.com/showcase/mater.html
- Building Asynchronous & Synchronous http://137.142.42.95/west/ASLPaper.html

Teaching-Learning Environments

- Managing Online Learning by Russell Pennell http://elmo.scu.edu.au/sponsored/ausweb/ausweb96/educn/pennell/
- Tools for Developing Interactive Academic http://www.umanitoba.ca/ip/tools/courseware/
- Web Courses
- Comparative Analysis of On-line Educational
- Delivery Applications http://www.ctt.bc.ca/landonline/
- Web-based Course Management Systems http://adpsrv1.adp.uiowa.edu/ITS/ISDG.nsf/
- CourseInfo from BlackBoard Inc. (http://company.blackboard.net/)
- Screen Shots of Blackboard Campus (Blackboard's Enterprise Level System)
- WebCT (http://www.webct.com/)
- TopClass from WBT Systems (http://www.wbtsystems.com/)
- Toolbook Librarian from Asymetrix (http://www.asymetrix.com/products/)
- LearningSpace from Lotus (http://www.lotus.com/learningspace)
- Creation of Study Environments (COSE) (http://www.staffs.ac.uk/COSE/)

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