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Learning Individually : a Life-Long Perspective
Introduction to the Special Issue

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"Learning is a way of understanding and responding to technological change."
Learning for the 21st Century (Fryer,1997)

Foreword

The initial study of the nature of learning and cognition dates back to centuries, to Greek philosophers, the antique life-long learners striving for Truth by exploring Laws of Human Mind and the Universe. Since then, the essence of learning has been studied by many disciplines in parallel. Only by the end of the 2nd millennium all studies merged their methods and achievements within a technology-enriched learning paradigm considering learners in the global information network, on a superhighway of the information society. Although biologically the learners are the same as in Antique Greece, a social sphere, their living and working conditions have changed significantly, effecting their attitude and motivation to learning, raising new demands to their knowledge, skills and capabilities. In the modern technological world, a human being became a critical link in many techno-systems and processes, so creation of conditions for efficient learning became a key issue for both a person and society.

Whether learning occurred in a group or not, it is an individual learner who learns, asserts Prof. David Merrill (Merrill et al, 1996) "*…the social context of a learning environment may provide support for its members; nevertheless the change in cognitive structure and the acquisition of knowledge and skill is an individual event*." That is one of the reasons to devote this special issue to the individual learners, their needs and difficulties, and discuss the role of technology in coping with overwhelming amount of information and permanently changing environment.

Communication and information technologies (CITs) are successfully embedded into curricula in various educational institutions all over the world. Numerous publications and electronic discussion forums cover both practical and research issues related to different aspects of technology-supported learning. A distinctive feature of this issue is its focus on a learner as an individual seeking a way to enlarge, upgrade, revive his knowledge and skills, or reconsider his attitudes. Therefore, technical details, societal demands, and organization of education are shifted to the background leaving a stage to a learner in CIT-based environment aimed at involving him/her into the learning process, arranging learning experience, facilitation of expertise growth, etc. In this issue, one can find papers of different kind, covering a variety of topics, such as cognitive support, corporate expertise transfer, engagement of a learner into a skills inventory process, and creation of learning materials for individual study. The papers contain not only results presented by explorers and scholars but also an ingenuous view of the life-long learners currently professionally involved in the technology-enriched training.

The special issue unites papers addressing a number of problems related to technological solutions for individual and life-long learning (LLL). The aim of this introduction is to show

- how those papers fit together in a large picture;
- why topics they raised are important and
- what other issues might be considered.

Technology-supported learning: determining priorities

Conditions for individual learning changes in centuries, and for centuries autonomous learning co-existing with instruction did not share the same space with it. A thorny path of cognition, without milestones, pointers, and guides, was not attractive for a mediocrity. Scarcity of information sources, language barriers, inaccessibility of

science, and segregation of education prevents the raise of independent learners. However, a history of any country proudly stores the names of people whose achievements are grounded on their individual learning, like Russian inventor of the steam engine Ivan Kulibin, or a pioneer of space flights, school teacher K. Tsiolkovsky.

Technologies opened new horizons for individual learning, enabling mouse-click access to information resources, variety of learning tools, environments and services. Technological support for a learner is implemented both for traditional, instructor-guided and independent, self-directed learning. The first approach relies on adaptation of a learning technology system (LTS) to a user based on his/her learner model or profile. As a result of this adaptation, a learning content is shaped to learner needs, appropriate presentation mode and learning activities are selected for the user's learning style, and an individual learning path is arranged to optimize the learning process. This approach works for the instructional design, whereas another one is aimed at creating environment for successful self-directed learning, i.e. for the learner's acquisition of knowledge and skills without external control. Both of them are important in the life-long perspective, although with the growing role of learning occurred outside of the traditional educational setting the value of self-directed learning increases. *"When learning becomes a part of life, support for self-directed learning is a necessity."* (Fischer et al, 1998).

Original works on self-directed learning were inspired by the growth of adult education. (Brookfield, 1994; Crafton,1998; Fisher, 1995; Lowry, 1989). They drew attention of university teachers seeking new ways to engage the learners into a creative process of building their personal knowledge structures, and experimenting with the modifications of the roles and functions of a teacher and student, and the essence of their interaction. It was found that this approach facilitates the effective learning and creates conditions for further development of the individual. Its benefit is in raising of autonomous learners able to arrange and control their learning, to take a responsibility on their learning outcomes. The transfer from traditional guided learning to an autonomous one is not easy for both teachers and students (Grow, 1991/1996). Technologies are able to make it smoother by arranging an intelligent support for learning-related activities, thus they allow for natural embedding of the learning into a professional activity.

We further consider the essential characteristics of individual learners, specific features of "life-long"-oriented systems, and learners' expectations of assistance from them.

A particular paradigm of learning may be represented as an optimization task with a target function depending on a number of variables attributed to parameters of the learning process. These parameters may correspond to the time spent, different features of the learning outcomes, amount of delivered content, etc.

In individual learning, the learning goals and content preferences are not uniform. One learner tries to maximize an amount of content or exercises for given time, another seeks for the most enjoyable way of learning. Learning content may be studied in-depth or surfed to evaluate the coverage of the resource. The priorities and criteria of an individual user are usually not reported to the LTS. Therefore, the developers of systems and tools prioritise certain features of their products at the expense of the others. For instance, in on-line dictionary design the priority is given to the convenient representation and retrieval of local information units referenced by their names. The relations between these units and an opportunity to browse the related material presented in the dictionary is out of focus, although, for autonomous learning, these issues may be at least equally important (Sinitsa et al., in press). Thus, evaluating the same product from the life-long perspective, the target function and the list of parameters should be reconsidered.

One of the recent approaches related to life-long learning, "just-in-time" (JIT), is aimed at enabling a learner to attain the required level of performance over current task by spending minimum time for training and learning. In skills-based training this approach allow for exercising newly acquired skills during the performance of authentic tasks, therefore, learning and real work are combined, so the learning outcomes are immediately embedded into practice. In complex domains, an effective performance requires expertise beyond skill level. Thus, a synergy of approaches is needed to promote a transfer of "quantity" of skills into a "quality" of performance. An idea of electronic performance support system (EPSS) is built upon just-in-time training, putting an emphasis on the creation of the resource-based environment instead of arranging human support (McGrow, 1994). A parameter to be maximized for EPSS is an access to necessary resources and help services, other parameters can be inherited from JIT approach.

Considering the key issues to be addressed in LLL, one can mention the following:

- the users of learning resources have different background, expertise, goals, and priorities, so examples and explanations must be oriented at the diverse user community;

- learners need freedom in activities and learning material selection, as well as an opportunity of flexible interaction with resource facilitating the construction and elaboration of their learning strategies;
- the units of a learning material must enable their flexible combination and independent study, provide information for selection and sequencing;
- the learners need an opportunity to acquire not only specific knowledge and skills, but also an overall learning experience, develop learning abilities and qualities necessary for effective autonomous learning.

Therefore, a distinctive feature of LLL-oriented systems is flexibility of their use, which may be manifested by means of different functions depending on specifics of individual learning activities. A reader of the special issue can reveal this feature in the systems described in the papers. It is evinced in the presentation of the learning material and arrangement of the learning activities (Kirkpatrick, 2000; Forcheri et al., 2000; Anand et al., 2000), in the team-based recommendations of the sequence of learning (Linton et al.), in a variety of supported practices (Patel et al., 2000).

Individual learner activities

Flexibility represents a system's "reaction" to diversity of users and their needs. The value for a particular user is determined by the system's ability to facilitate his/her individual learning. To clarify the needs in support, let us consider recommenations for the instructor working with self-directed learners and study the primary activities of the autonomous learner.

The instructor's role in training adult learners may be characterized by the following list of imperatives: Encourage, Help, Discuss, Recommend, Create conditions, Provide some models and examples. Thus, instead of teaching in a classical sense, an instructor creates an environment for successful learning, assists learning, motivates and inspires. The only space for instruction is left in teaching the essential learning skills. Technological solutions could follow the recommended practice to create a supportive environment for the individual learner.

In autonomous learning, traditional set of tasks performed by a learner is amplified by the tasks usually attributed to a tutor or supervisor. Whereas some instructional support and guidance may be obtained by participation in arranged courses, the most important part of learning management remains a learner's own responsibility.

An individual learner must be able to perform a variety of activities to identify learning goals and recognize starting conditions of the learning process, namely:
- to match a number of career opportunities to a personal profile, including professional expertise, general skills, attitudes and preferences, and evaluate discrepancies;
- to recognize the need of learning and determine the goal in some form (in LLL, it may bear a task- or skill-oriented connotation: "what I must be able to do", "what abilities I should demonstrate");
- to audit current skills and knowledge in respect to desired goal, to evaluate chances and expenses of attaining the goal, reconsider the goal, evaluate intermediate steps.

During the learning, besides the typical learning activities, aimed at mastering new knowledge and incorporating it into a mental model, an individual learner performs also control, evaluation and monitoring functions. The list of these "meta-learning" activities includes (Sinitsa et al., in press)
- determination of current status of one's knowledge in relation to a task under consideration;
- setting some learning objectives, describing the amount of the content that should be learned, procedures that should be mastered, etc.;
- search for appropriate information sources, tools, services;
- selection of the adequate units for learning, taking into account both external (technical, economic) and internal (learning style) preferences and restrictions;
- arranging necessary activities to practice the application of the newly acquired knowledge;
- monitoring and sequencing learning;
- assessment of one's own understanding.

The papers selected for this volume present various viewpoints and focus on different stages of learning process – orientation, selection, comparison, static and dynamic planning, knowledge and skills acquisition, self-assessment, and monitoring. Below is a short overview of the special issue content.

An outline of the issue

A core idea of supportive environment for individual learning is illustrated in (Patel et al., 2000). An intelligent tool described there facilitates the acquisition of cognitive skills in domains where qualitative decisions and reasoning are preceded or justified by extensive numerical data analysis.

Expertise in domains of that sort includes a variety of knowledge that must be combined in complex procedures. A cognitive apprenticeship tool proposed by the authors facilitates a gradual progress by stepwise engagement of a learner into the process of performance of the authentic tasks. An effect of the cognitive apprenticeship is twofold. At a planning stage, i.e. during a creation of the problem-solving procedure, a learner can make use of hints or follow an expert's advice. At an implementation stage, during actual problem solution, separate steps are checked by the system and may be performed automatically.

This approach is remarkable in two respects. First, it allows to apply a method of training similar to the one that works well in exercises aimed at simple skills formation - a choice of tasks "from simple to complex". Working with the tool, a learner focuses on particular steps in problem solution and his mastery is growing both in execution of particular steps and in handling the authentic tasks. And second, a knowledge-based interactive environment creates a background for individual support and consulting, usage of flexible procedures in problem solving, and assistance in performance of a user-defined tasks.

A paper by Linton et al. (Linton et al., 2000) describes a Recommender system that may be considered both as a guide to the mastery of a complex system and "a motivator" justifying mastery of a particular skill. The paper presents a framework to determine the functions to be mastered by a user based on the statistics of their usage by other employees sharing the same style of work.

The Recommender basically falls within "just in time" paradigm. Modern software tools tend to incorporate more and more services and options, which make them attractive and friendly for experienced user but pose significant obstacles to novices. Companies have to preserve a balance between professional training of their employees to help them cope with technology upgrade and tight production deadlines requiring focusing on knowledge and skills that could be immediately applied. In complex software tools, a number of functions applied for a particular task is relatively small, therefore, the priorities in mastery of a set of functions become an important issue. The right sequencing of functions to be mastered enables to incorporate new skills in one's "professional toolbox" and practise their application while performing professional duties.

Two papers from UK, (Maddocks et al., 2000 and Grant et al., 2000) focus on support for a learner during setting the objectives, planning actions and reflecting on the results. The first describes a system for recording his/her achievements and newly obtained experience in a structured way, which facilitates an analysis of his/her skills in terms of employers' demands. The project covers several objectives including

- raising awareness of employability skills as an initial state in a process of revision of one's own skills, knowledge and abilities;
- assistance in evaluation of the personal and professional profile;
- planning of learning actions to attain the desired professional state.

The system is based on structural representation of skills taking into account their applicability in the professional sphere.

RAPID file described in another paper offers less support and is oriented at more independent and self-directed learners. RAPID is introduced within a traditional education framework to teach skills necessary for continuous professional development. The system keeps records of one's knowledge, skills and experiences, current activities and planned learning actions, thus preserving the information necessary to evaluate his/her current state and set new goals. First experiments showed that students without previous professional experience are not prepared to perform self-analysis and reflect on their results, and therefore are unable to plan their learning without external guidance and advice.

Two papers of this issue are focusing on flexible content design. The paper of Kirkpatrick (Kirkpatrick, 2000) presents an attempt to grow shoots of individual learning within an available framework. The course on contaminated sites is introduced as a part of university curriculum, but its implementation addresses the needs of students with diverse professional background. Course developers paid a lot of attention to arrangement of learning material, organisation of supplementary resources and creation of flexible learning activities. A team work on a project promotes not only enhancement of the professional competence and demonstration of the

expertise, but also facilitates the elaboration of communicative skills and enables to practise performance of the authentic tasks.

In a short paper by Anand and Zaimi (Anand et al., 2000), the issue of technology incorporation into traditional education is examined both from the tutor's and students' perspectives. The authors share their experience and describe difficulties in raising students as independent learners by encouraging them to use Web-based learning resources. According to their observation, students get used to permanent guidance and attention from their tutors and often feel neglected or abused when facing a learning activity which must be planned and managed on their own. During their course, the authors tried to involve students into the process of learning materials enhancement by asking for their opinions, impressions and recommendations. This involvement effected the attitude of the students, tuned them to collaborative mood and destroyed psychological barrier to independent learning for many of them.

Many students all over the world still do not realise that they will need to keep learning to succeed in their professional career, and their ability to recognise the gaps in their knowledge, plan necessary learning actions, evaluate the results of learning and revise their professional skills will determine their promotion opportunities. Both this project and the one described in (Maddocks et al., 2000) demonstrated that adult students who joined the program after experiencing professional activity are inclined to and posses more skills for independent learning. At a working place, they realised that it is their responsibility to identify and locate the critical knowledge they need taking into account the professional context. They had stronger internal motivation driven by a perception of the situations where the acquired knowledge may be applied. Moreover, some of them may be born as life-long learners, they willingly and skilfully enhance their expertise, and are able to control the process and learn from available sources in a number of ways.

The authors of two short papers certainly belong to this remarkable group. One of them (Fusch, 2000) discusses the difficulties and barriers on the way to education for blue-collar workers presenting his own findings and analysing the results obtained by other researchers. The other, a veteran in both traditional and distance education, presents a professional view from "inside" of a distance learning program. His extensive experience in various forms of learning enabled to identify the important issues, including, among others, the design and support for interaction, timely feedback and flexible communication during the course, and the role of instructional advice and consulting (Muirhead, 2000).

A paper by Forcheri et al. (Forcheri et al., 2000) presents a panoramic view of ICT support of individual learning. The authors consider some requisites of the individual learning including perception of a need (reflecting a person's attitude to knowledge or skill acquisition, positive motivation), identification of an objective (determination in some form what result should be achieved), and implementation of a strategy for attaining the goal. The first two can be considered as some preliminary activities necessary to launch a learning process, and the last covers the learning itself.

The paper contains examples of the instructional software designed to motivate teachers to master new technologies, raise their awareness of the quality standards and certification demands, and introduce the best practice examples for technology-enriched classroom activities. Identification of an objective is often complicated by the lack of information and skills to search and obtain it, inability to match one's own abilities and capabilities to requirements and prerequisites. As one of the examples, the authors introduce a consulting program that addresses the needs of graduates in their search for a job. Strategy implementation support is illustrated by tools containing multiple representation of the same learning content and a bank of learning activities for a user, enabling both experimental approach to knowledge construction and built-in instructional guidance to a new material.

Conclusion

"Life-long learning" gradually moved from a fashionable expression to the research agenda and implementation demand. The variety of CIT applications, theoretical findings and experimental results related to an individual on a LLL path cannot be squeezed into one publication, even the one represented by a digital journal. Therefore, we do not claim that the presented collection of papers highlighted all critical issues. A lot of them remain outside, some still waiting for their discoverers. With a new millennium, one can expect further exploration of technological support of learner's

- *affection* (motivation, raising awareness, shaping attitude, involving into activity, keeping focused by providing selected information) ;

- *socialisation* (arranging medium for exchange, connecting to experts and distributed communities) ;
- *cognition* (support in information comprehension, interpretation and incorporation of new fragments into mental structure, structuring of knowledge, procedural knowledge construction, apprenticeship in problem-solving activities).

The history of information technologies teaches us to be sceptical to any predictions in this field. Nevertheless, we expect that new tools will facilitate the acquisition of the learning skills, elaboration of one's own learning strategies, recognition of the typical learning styles, selection of the appropriate learning resource, as well as enhance one's self-assessment and reflection skills. They will train the learners to grasp new things easily, incorporate the acquired knowledge into their own expertise, use analogy, deduce generic principles, generate complex procedures from fragmentary elements. Digital resources will become more interactive, adaptive and friendly, promoting learner's creativity and integration of the experience.

The topic of LLL is far from being exhausted. Current issue does not cover the societal demands to technological support of learning, access to educational opportunities, creation of a "learning culture" (Fryer, 1997), corporate solutions for continuing professional development (Hemmington, 1999), influence on educational curricula and implications for new virtual educational bodies. We hope that presentation of the bright research pieces in a kaleidoscope of technology-supported individual learning will inspire further study of the topic.

Considering the road ahead, I would like to recall the words addressed to Alice (Carroll),

> `Now, HERE, you see, it takes all the running YOU can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!'

That is exactly what happens in the Learning Technologies – one needs to work harder to cope with growing expectations of the community. And if we learn how to run faster, we can create systems that train our students for the life-long run.

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