Przemysław Różewski, Emma Kusztina, Ryszard Tadeusiewicz, and Oleg Zaikin

Intelligent Open Learning Systems

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Systems Research Institute
Polish Academy of Sciences
ul. Newelska 6
01-447 Warsaw
Poland
E-mail: kacprzyk@ibspan.waw.pl

Prof. Lakhmi C. Jain
University of South Australia
Adelaide
Mawson Lakes Campus
South Australia 5095
Australia
E-mail: Lakhmi.jain@unisa.edu.au

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Przemysław Różewski, Emma Kusztina,
Ryszard Tadeusiewicz, and Oleg Zaikin

Intelligent Open Learning Systems

Concepts, Models and Algorithms

Springer

Dr. Przemysław Różewski
West Pomeranian University
of Technology in Szczecin
Faculty of Computer Science
and Information Systems
ul. Zolnierska 49, 71-210 Szczecin,
Poland
E-mail: prozewski@wi.zut.edu.pl

Prof. Emma Kusztina
West Pomeranian University
of Technology in Szczecin
Faculty of Computer Science
and Information Systems
ul. Zolnierska 49, 71-210 Szczecin,
Poland
E-mail: ekushtina@wi.zut.edu.pl

Prof. Ryszard Tadeusiewicz
AGH - University of Science
and Technology
al. Mickiewicza 30, 30-059 Krakow,
Poland
E-mail: rtad@agh.edu.pl

Prof. Oleg Zaikin
West Pomeranian University
of Technology in Szczecin
Faculty of Computer Science
and Information Systems
ul. Zolnierska 49, 71-210 Szczecin,
Poland
E-mail: ozaikine@wi.zut.edu.pl

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Abbreviations

DLN – Distance Learning Network
ICT – Information and Communications Technology
IOLS – Intelligent Open Learning System
LCMS – Learning Content Management System
LMS – Learning Management System
LO – Learning Object
ODL – Open and Distance Learning
OSLD – Open System of Distance Learning
SCORM – Sharable Content Object Reference Model

Foreword

The book addresses the problem known in the literature as Open and Distance Learning (ODL). ODL describes new concepts of the process of learning-teaching organization. ODL is becoming very popular at universities that offer education via online and/or distance learning, both in synchronous or asynchronous modes. More precisely, the book addresses Intelligent Open Learning Systems (IOLS), i.e., the systems where traditional methods of online teaching are enhanced through the use of artificial intelligence methods. Taking this approach helps to achieve the desired teaching goals and greatly improves the quality of student learning. In the book, the IOLS concept is used in the sense of an information system for learning process management. Introduction of the idea of social and information system organization, such as ODL, requires deep analysis of its nature and structure. The complexity and scale of ODL is reflected in the IOLS management capabilities.

IOLS combines characteristics of the traditional understanding of the term Distance Learning and the new understanding of the term Open Learning. The open learning is focused on each individual student. Each and every student actively cooperates with the teacher in order to learn and "discover" new knowledge during their interactions. IOLS is designed to support this kind of collaborative work. It supports the social idea of global understanding and transparency of qualifications, and open access to educational resources. In the framework of new type of education process, such as the European Higher Education, every student in spite of his or her place of residence can participate at different national and/or university educational processes through the use of the Internet and similar technologies. Moreover, each student can achieve her or his educational goals based on personalized learning characteristics.

IOLS is a complex management system. Its many components have their own goals that determine their behavior. Moreover, these components are mutually related but can have conflicting goals. IOLS's complexity arises from the fact that it strives to satisfy and make use of many different stakeholders and resources: the students, subject matter experts, organizations, IT systems, telecommunication infrastructure, and information and knowledge resources. The success of IOLS implementation depends on the system's ability to efficiently manage its aggregate components. In order to automate parts of the IOLS the information system for its management should be based on an integrated model. Having such a model is a necessary condition for interpretation of the IOLS as one coherent system.

In the book the authors treat the IOLS as an information system for the open learning process management. The success in developing such a system has important research and practical implications. The practical side of the model is

the development and implementation of the general methodology of the ODL so that it can be used by different people at different educational organizations. The ability to measure characteristics of the educational process is one of its main research outcomes. It is worth mentioning that the quality of the educational process is difficult to evaluate using traditional methods. The educational organization, like any other organization, must respond to changing environment. In case of educational systems the challenges come from using the ODL, which is the new approach to learning-teaching process organization. Each organization's success depends on having an efficient management system and the universities are no different. The every day practice of managing educational organizations needs to meet those new challenges. It needs to take into account the ODL concept that can be understood as a sequence starting from raw data, to information, to knowledge, and finally, to competence in the work place.

The authors analyze the ODL system based on the organization's mission and goals, market position and constrains, and include background knowledge understood as the basis of competence. Transformation of knowledge at any educational institution follows a specific workflow. The authors describe this workflow, its structure, and key characteristics. The presented information system enhances the learning-teaching process by making use of machine intelligence tools.

Every design of the information system should not only fulfill the requirements of mathematical verification but, ultimately, also meet the real-life validation. The authors validate the IOLS on the level of a student and an educational organization, while the real-life validation is performed using as the case study the AGH University of Science and Technology's Digital Student City. In contrast to existing information system for the learning-teaching process management, the IOLS is an example of a new class of information systems. Its main characteristic is dedication to the concept of openness. IOSL implementation affects social interactions due to different levels of its openness. This fact increases the importance of conceptualization phase of the IOLS design. Without having it it would not be possible to integrate different European educational institutions into a common widely-shared learning-teaching system.

The presented book expends traditional understanding of concepts, models and algorithms of the IOLS. The described results allow for creating new standard for this class of information systems. The standardization is performed at different levels and includes "soft" elements related to knowledge and competence. The book's contents reflect current state of knowledge and practical issues of e-learning. It covers concepts such as open information system, open access and content, competence management, ontology modeling, and tools for cooperation at the level of knowledge. The authors discussed these topics in the context of the European education system using real-world case studies and challenges they pose. For this reason I highly recommend the book to both researchers and practitioners of e-learning.

Krzysztof J. Cios
Virginia Commonwealth University
Richmond, U.S.A.

Contents

Part I: System Analysis of the Open Learning Systems

Part III: Application of Open Learning Systems

Introduction

Motivation

Development of technology and civilization progress lead to necessity of general (e.g., spread on whole population) and permanent learning. In Information Society knowledge will be the top value and every members of such Society must continuously increase possessed knowledge. Life Long Learning (LLL) is no longer theoretical postulate – in fact it is actual imperative, very important for economical and social development of contemporary countries and societies as well as their civilization and cultural promotion.

Life Long Learning is not achievable on the base of traditional school model. Organizations like primary and secondary schools, colleges, universities etc. are off course still necessary, but are definitely not enough. For effective spreading of information, for sowing of knowledge, for growing up wisdom – entirely new methods, institutions and tools are necessary. Fortunately development of the Information and Communications Technology (ICT) gives now absolutely fantastic possibilities related to so called distance learning, internet-based learning, computer aided learning and many others methods, technologies and tools short named altogether e-learning.

E-learning is now quite widespread technology used in many schools for better, cheaper and more intensive teaching and learning procedures. But what we need in fact now is Open e-Learning System, because only open resources can be effectively used for achieving civilization oriented goals in the whole society. In presented book the Open e-Learning Systems will be described, discussed, proposed and evaluated. We concentrate on the most important and most modern type of Open e-Learning Systems, e.g., we will talking about Intelligent Open e-Learning Systems. Artificial Intelligence (AI) is very important and very useful element of every e-Learning Systems, because learning process is much more effective if is planed, organized, performed and assessed in intelligent way. This AI factor is especially need in Open e-Learning Systems, because such systems must be able effectively cooperate with many different learning people – exactly as it is planned in LLL politics. Therefore thinking about the future e-Learning system we must develop Open e-Learning Systems, improving their concept, perfecting their models, developing their algorithms and spreading their application.

Presented book contains all mentioned above elements. We describe basic concept of Intelligent Open e-Learning Systems, taking into account general evolution of learning and teaching systems as well as considering actual devices

and possibilities of Computer and Information Technologies (CIT). In fact our approach is based on AI and CIT technologies and founded on system analysis principles. We discuss various models of Intelligent Open e-Learning Systems, derived from different theoretical frameworks: system science, cybernetic, computer technology, content based, educational tuned, psychological and pedagogical developed etc. Very important element of our proposition is related to competence based system designing, which is treated as a key for competence model building, intelligent teaching and learning system designing and system algorithms development.

Concepts, models, and algorithms as well as detail methods for achieving particular goals formulated for Intelligent Open e-Learning Systems discussed in the book are presented both theoretically and in context of practical applications. All applications of Intelligent Open e-Learning Systems discussed in the book are based on scientific results collected by the authors during over ten years practical research performed in the e-Learning area.

All elements described in the book: concept, models, algorithm, implemented systems and practical experience are devoted to one goal: to make Intelligent Open e-Learning Systems fundamental technology for development future Ubiquitous Open Life Long Learning System, which should be the answer for most challenging questions of XXI century civilization.

Book's Content

The book consists of ten chapters and is divided into three parts.

The first part concentrates on Open Learning System analysis. In the beginning of it, the social and educational meanings of the Open Learning System are discussed. One of the important outcomes is recognition of different openness contexts. The next chapter focuses on the distance learning environment. The new role of the teacher and the new requirements regarding the structure of didactic material characterize the new approach to learning environment design are discussed. In this chapter a cybernetic model of maintaining proper relations between the student, the teacher, and the computer, is proposed. Further on, the teaching-learning process is analyzed on the basis of the e-Quality project results. The authors took active participation in this project. The user's roles and activities are integrated in the student life-cycle. At the end of this part, the Open Learning Systems is analyzed using the system approach. As a result, the hierarchical structure and functional schema of Open Learning Systems are described.

The second part is focused on the problem of knowledge modeling in Open and Distance Systems. The first chapter covers the aspect of knowledge modeling basing on the ontology and the competence approaches. Afterwards, the Learning Object concept is discussed. In distance learning, ontology plays the role of the knowledge model. Authors propose an extended ontological model designed especially for open and distance learning. The next chapter covers the issues of designing and developing the learning objects and the corresponding knowledge repository. The last chapter of the second part talks about competence management

in open systems. The competence set theory is used to build algorithms and methods for distance learning management.

The third part describes application of the Open Learning System. Firstly, the virtual laboratory for competence transfer is analyzed. The simulation experiment methodology serves as the basis for acquiring competencies in the virtual laboratory environment. Next, the application for competence acquiring is presented. The following chapter covers the issue of Distance Learning Network. A community-built system is the main paradigm for Distance Learning Network development. Furthermore, the motivation model integrating students and teachers on the social and knowledge levels, is described. At the end, a real-life application of the Open Learning System idea is presented. The AGH student city is a working example of the Open and Distance Learning System. Authors provide some thoughts about the future development of the open system idea basing on the AGH student city's evolution.

The content of the book was prepared according to the following pattern:

- Przemysław Różewski was responsible for chapters: 3, 4, 5, 6, 7, 8, 9
- Emma Kusztina was responsible for chapters: 1, 2, 3, 4, 6, 8
- Ryszard Tadeusiewicz was responsible for chapters: 1, 2, 10
- Oleg Zaikin was responsible for chapters: 2, 3, 4

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Przemysław Różewski,
Emma Kusztina,
Ryszard Tadeusiewicz,
Oleg Zaikin
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