# Application of Information Technologies to Active Teaching in Logistic Information Systems

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**Abstract.** Information Technology has always been a popular choice among high-school graduates when deciding on a field of study. Despite the comparatively high education levels among Latvian employees, there is still a lack of knowledge and practical skills crucial for competitiveness in a market based economy. In order to ensure relevance of the qualifications and adaptability in the fast changing environment, active learning and teaching have a special importance. Recent developments in information technology call for a serious reconsideration of the actual teaching methods and provide opportunities for developing a new educational methodology. The current paper focuses on application of IT within the course of logistics information systems for developing student practical skills and abilities. The necessity for an active teaching and learning e-environment is highlighted, and a concept of its realisation based on Web 2.0 technologies is discussed within LIS.

**Keywords:** active teaching and learning, Information Technology, logistics information systems, web 2.0.

## 1 Introduction to the Curriculum of Logistics Information Systems

The symptoms of necessity for the course Logistics Information Systems (LIS) in the Master Curriculum on Information Technology were pointed out firstly during participation in the European project „INCO Copernicus AMCAI 0312 (1994 – 1997) *"Application of Modern Concepts in the Automated Information Management in Harbours by Using Advanced IT – Solutions""*. The project's results showed a great lack of logistics specialists having efficient knowledge in information technology [1].

The course of LIS was developed for the post graduate students of the Department of Modelling and Simulation in 1998 by Professor Egils Ginters and Professor Yuri Merkuryev. The course curriculum became an outcome of a project LOGIS LV-PP-138.003 "Long-distance tutorial network in "Logistics Information Systems" based on WEB technologies" (2000-2002) [2]. The LIS course is aimed at providing students with high level knowledge, skills and competencies in Logistics Information Systems through the integration of theory and practice. The course focuses on the application of information technologies to logistics management.

The LIS course consists basically of postgraduate students having an average age of 22-24. Almost 90% of LIS students are employed either in private companies or in government organisations, which makes them to be in extremely high demanded for qualitative learning and teaching processes. Most of the students work in the IT field, which gives them deeper professional skills. For that reason, lecturers need to be able to adjust course material to suit students experience and prior knowledge.

The course is structured in several blocks. It starts with a course overview. According to the first principle of andragogy which states that, as the learner's need to know why learning is important and how learning will be conducted, the course structure, goals, outcomes and requirements must be discussed first. Moreover, a response to IT professional standards should be provided underlining the role of the LIS curriculum for getting a professional diploma. This is normally done in interactive discussion sessions, if the number of students is not too great. Finally, the lecturer outlines the course structure, its goals and outcomes.

The second block of the LIS course covers the main topics. The sequence of them through the course is not precisely defined, and is flexible to any lecturer/students requirements. Along with this theoretical block, students should improve their practical skills performing several tasks during labs, namely "GPS and GIS application for object positioning monitoring", "Cargo Tracking Systems Analysis", and "Radio Frequency Technology applications in Logistics".

The next block of the LIS is aimed at both exploring and introducing the variety of information systems in the context of logistics management. Several solutions are discussed in the fields of transportation logistics, inventory management, warehouse logistics, production etc. In each case the focus is on the functionality of the system for supporting related logistics functions. However, despite exploring the functionality, technical solutions are also discussed in order to underline the correlation between information technologies and information system. In parallel with lecturer's (and invited industrial partners as well) presentations, students make their own presentations of different logistics information systems. This task is performed as team-work and is aimed at both enhancing students' professional competence and their group working skills. The block is finalised by evaluation tasks.

The student evaluation process is a critical challenge for every academic course. It should be realised in a way which: (1) allows adequate evaluation of student knowledge; (2) is effective for learning and in fact is a part of learning; and (3)covers students personal character traits (for example, some of them perform better on tests, some benefit more in oral examinations, others do better writing essays).

Initially, the evaluation of students was conducted at the end of the course and was organised as an examination. However, the main shortcoming of this is that examination at the end of the course usually leads students to postpone their studies to a few days before the exam. To improve the evaluation by making it an assessment-for-learning, in 2009 a new evaluation system was implemented. This can be called a portfolio assessment, in which students gather artefacts that illustrate their development over time. The evaluation portfolio in the LIS course consists of:

- An on-line test with 60 questions which covers the block of Logistics IT;
- Written essays on three questions in the context of block LIS;
- Team-work and lecturer presentations of the LIS.

Although, there are still some shortcomings in the current evaluation, the new way of assessing students has following benefits:

1. to motivate students to study during the course;
2. to minimise psychological stress during the assessment, by providing a possibility to improve the grade during next evaluations;
3. to provide a variety of assessment methods way for students. This is an essential point for discussion in a pedagogical context, because there is not just one 'best' way of examining the students. Some of them being "slow-thinkers" would feel a lot of pressure due to time limitations during the test. Others might feel more comfortable going deeply into the subject, and some like to give direct answers to precisely-defined questions;
4. to support both individual student work (and responsibility for the outcome) and team-work (where the responsibility for the evaluation is spread among all team workers).

The evaluation portfolio components may have differential weights which can be easily up-dated by the lecturer before the course is started.

## 2  Pedagogical Notes in LIS

There is little difference between the terms of 'teaching' and 'learning' in the current paper, however some differences still exist. 'Teaching' is explained as a part of educational process, where an active position (or role) is taken by a lecturer who presents (teaches) some material to students using different methods. Illustratively, a didactic lecture is a trivial method of teaching. In contrast 'learning' can be explained as a part of an educational process, where students actively construct their own knowledge by absorbing, understanding and analysing information provided by the lecturer. We can assume, that the student's role in teaching is more passive compared with the lecturer's, however learning is driven more by students (with some support and coordination from the lecturers side).

In LIS, the main focus now is on supporting students in active learning and, if possible, in student-centered learning. By active learning we understand "instructional activities involving students doing things and thinking about what they are doing". Active learning is the idea that different people learn in different ways. Understanding how learning can be realised, which is the better method of learning for each student and to provide different learning styles for students is one of the pedagogical objectives of LIS. Teaching aids are presented by text books, slide-show presentations and different video materials, etc.

Every teaching process consists of three components: students, teacher, and an environment. In teaching, the role of the lecturer is dominant and usually performed by a trainer (instructor, lecturer). In learning, the main components are students and the learning environment. The lecturer's function here is to support students with a variety of methods, tools, and environments. In this section, we consider the LIS course audience and discuss some teaching methods and tools.

Despite plenty of traditional didactical teaching aids, the actual focus now is on improving the quality of educational process applying different IT solutions. RTU academic personnel point out the great importance of using modern technologies in teaching. Illustratively [3, 4, 5, 6] describe the application of IT solutions in developing effective e-learning and evaluation methods.

In our experience, a lecturer must organise the course providing a balanced learning experience using different learning methods, *i.e.* lectures, labs, discussions etc., see Fig. 1. To illustrate, during typical classroom lectures, conceptual and theoretical information (intuitive learning) should be supplemented with concrete, practical information (sensory style) expressed through lecturers comments and explanations. Pictures, and diagrams of slides presented to visual learners must also be explained orally for verbal learners who seek explanations having words. Active learners prefer to do physical experiments and to learn by expressing themselves working in groups. They appreciate conducting lab exercises which can promote the students cognitive activities. For reflective learners, however, we provide tasks, such as evaluating different options, making analysis (of data acquired in Lab 1).

LIS, the most used teaching method, uses traditional lectures. This can be called a passive teaching method, where the lecturer has the main role. Lectures are used mostly in the Logistics and Information Technologies block, however it still has some active learning elements such as debriefing, discussions, and 5-minute activities done in pairs. The Logistics Information System block is organised using workshops, seminars and team-projects. Here, both lecturers and students have active roles, so this block can be characterised as an active learning support block.

Laboratory exercises are traditional method of active learning. Labs can be used to facilitate the exploration and illumination of difficult concepts. Most importantly, labs can enhance the cognitive learning process, which is often referred to as the integration of theory with practice.
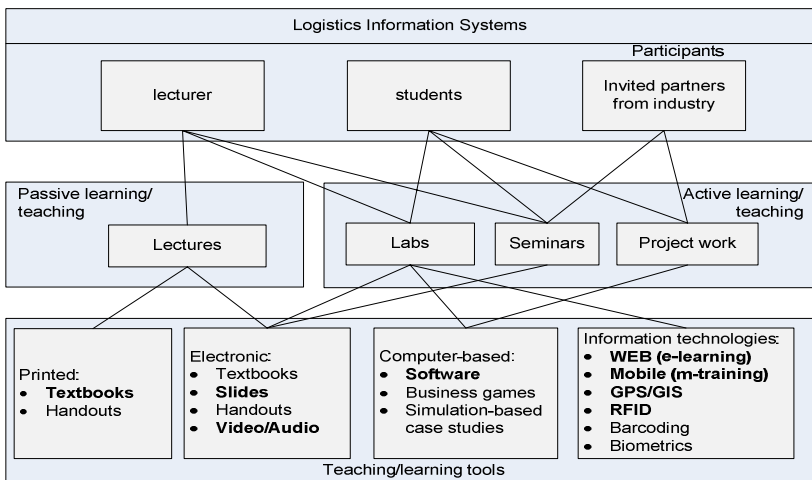


**Fig. 1.** Teaching components in LIS

In fact, information technologies within LIS are not only the subject of teaching, but rather a part of didactical tool aimed at demonstrating the power of IT in every field of application, such as logistics, education, entertainment and others. The possibility to learn information technologies/systems by applying them in studies allows students (1) to understand the main principles of IT in Logistics (which is the aim of the course), and (2) to evaluate the variety of its applications for different solutions (which is the outcome of the course). This, according to Bloom's Taxonomy of Educational Objectives, can be explained as student growth through development of their intellectual skills and abilities.

## 3   Teaching / Learning Environment in LIS

Application of modern IT for teaching/learning purposes in LIS started firstly with using on-line test as evaluation. Application of IT as an environment started in 2005, when all course materials were located at Moodle system. In 2008, ORTUS was created as a single electronic educational environment of RTU. Despite plenty of benefits being provided by these solutions, there are still some shortcomings as:

- it serves more as a storage for keeping such teaching material, as slides, video/audio, handouts etc. The active processes are forums and on-line tests.
- it doesn't allow the use of objects, to be placed inside the educational modules repeatedly; or the use of materials, created by lecturers and students, to remain in a programme, so that in the course of time a student loses access to them.
- it is not possible to organise a comfortable educational space for active co-operation between students working on team solutions to educational tasks.

All the above mentioned lead to the final conclusion concerning the necessity of re-designing the e-learning environment in order to satisfy the following requirements for active learning:

1. to implement active learning tools and methods;
2. to maintain learning activities like communication, discussions, team-working;
3. to support both collaborative and co-operative learning;
4. to support the lecturer's role as an active participant and co-ordinator, rather than as promoter;
5. to allow students to create valuable cooperative, collaborative and individual products, which later can be used by students in their professional carriers.

## 4   Application Tendencies of Modern IT in Teaching

When analysing applications of IT for teaching purposes, it is possible to select a number of influencing facts. In our opinion, the most important of them are the increased amount of information related to the permanent development of technologies and entrepreneurial activity, and the mass introduction in teaching the technologies on the basis of the Internet, including Web 2.0. The first factor causes changes in knowledge of the specialisation, and determines the main requirements of the environment for teaching, the rapid transmission of knowledge and abilities of the students. The

second factor allows an increase of the creative potential of students, provides joint creation and use of information resources and collaboration and expansion of functional possibilities for teaching. Contemporary students want teaching in the form of an active dialogue and to be in a position to have an impact on the course of events, that is, they want to be competent participants in a teaching process, the authors and reviewers, as a student-centered model foresees it.

Following the O'Reilly [7] definition, Web 2.0 is the technology for designing systems which, through network co-operation continue to develop as more people use them. The main feature of Web 2.0 is to attract the users to create knowledge by introducing home page content and to use the principle of frequent verification. In the base variant of Web 2.0, every person could easily create and spread *content* in the World Wide Web. It could include records in weblog, pass video through YouTube, place pictures in Flickr, help in the creation of content in wiki, and also create Myspace type social networks. Thus, contrary to Web 1.0, which makes service to a vertical «Teacher-Student» relationship, the Web 2.0 technology is characterised by development of horizontal connections and works on the basis of social relations.

The key components of Web 2.0 are easy-to-use instruments and general or social relationship systems having the expected results. One of the most interesting results of the use of Web 2.0 is the phenomenon which is often named *'Collective Intelligence'*, describing the situation when the potential influence of information between the users of WWW grows very quickly. It is very important, that this index increases with the increase in the number of persons actively contacting each other through WWW, that provides people with possibility of joint search, creation and the exchange of information. The research of McKinsey [8], Forrester [9] and other authors in the area of the use of Web 2.0 technology in industry, shows recently growing active interest in *Collective Intelligence*. Researchers point out that for effective creation of new decisions and knowledge it is necessary to aggregate the possibilities for users of the input of information, methods of joint activity, and also modern technologies of collection and processing of information (wiki, weblogs, widgets, mashups etc.)

## 5   Concept of e-Environment in LIS

As a result of research, the main conceptual requirements were formalised for the developed environment of e-learning with the use of modern approaches and information technologies. It is necessary to provide the e-environment having the following basic functionality:

- permanent development of educational materials, with the possibility of their modernisation by authors and teachers and by students. Traditional electronic courses serve only as base information sources;
- generalisation of existing knowledge and the creation of new knowledge – students create materials themselves and communicate with other students through technologies, enabling the distributed creation of materials and division of responsibility in the process of forming and the use of resources;
- use in the process of teaching large sections of the aggregated information sources which includes in itself all possible formats of files and methods of their transmission;

- the study of materials takes place at any time and at any place: all information sources can be used not only by computers but also by mobile telephones, MP3 players etc.

Development of these new possibilities for e-learning environment will be based upon the instruments of Web 2.0 technology, such, as weblogs, wiki, podcasts and other.

Articles written on weblog technology form an analogy of the classical concept of scientific theses and create electronic home pages of a persons or organisations on which the collection of information is made on a concrete topic or topics, including regular updates of this information. Information can be written down in a weblog by a proprietor. It can be re-written from other weblogs. The readers of a weblog can also supply information, make comments on themes and discuss different questions. Automatic creation of templates is thus possible for theses published in a weblog, using information from the pages of wiki and personal notes associated with them. A weblog can be integrated with other weblogs. The results of continuing experiments, current results of work and newly synthesised ideas, can be written down in a weblog.

It is possible to select the different forms of weblogs for the teaching of LIS, firstly as a means of communication between students concerning organisation of the course, the performance of tests and home tasks, and the support of different student initiatives, secondly, for additional discussion of course themes, conducted by a teacher and the encouragement of students to make independent analyses of the information received. In such weblogs, teachers will formulate questions and tasks for students, and also give references on additional materials and resources for the topic. Thirdly, for the students, using weblog on a research theme can become the method for bringing in comates and teachers to make comments, and to criticise and correct the method of preparation.

The addition of the use of weblogs for teaching LIS can be a forum – a traditional asynchronous mechanism of communication. A forum can be related to any theme, document, person, or weblog. A forum provides bilateral connections and enables comments both on the theme and the comments of other users.

For the personal base of knowledge modern technology of wiki is appropriate. Wiki is a home page which is filled with information from a group of people and can be used as a mean of accumulating knowledge on the certain topic in the process of collective work. The basis of wiki is represented by a graph, where knots are noted by keywords and vocabulary entries associated with them. Personal wiki can be integrated with other wiki's, for example in Wikipedia and other encyclopaedias.

In teaching LIS, the use of wiki is assumed for the joint performance of laboratory exercises and course projects, and also for group discussions having a possibility to give references on additional materials. Upon completion of every block of the course themes, students apply the acquired knowledge in practice and by wiki resources to collect new ideas, descriptions of interesting decisions etc. relating to this block of themes. In the future, they can be taken into account in a new modification of the course or to create independent educational content themselves.

To provide the course with a great number of aggregated information sources, it is possible to use podcasts. Podcasts are programs of subscription on a receipt of digital audio or video recordings, which can be delivered to personal computers, mobile telephones or MP3/MP4-players.

Podcasts will be used in the teaching of LIS for distribution among students by audio and video recordings including courses or comments on a study programme. Creation of podcasts is also planned by students themselves, summarising the results of their research in LIS course.

## 6   Conclusion

Recent developments in information technologies and telecommunications facilitate the development of new training and educational methods and tools, as described above. This provides possibilities for organising educational processes not only in the traditional way, but also by means of active learning, combining IT technologies with modern pedagogical approaches. This is of special importance for LIS teaching, where IT is the main subject of the course. The presented concept of Web 2.0 based e-teaching environment opens new horizons active teaching, providing student with wider education possibilities in enhancing their professional skills and abilities. By using Web 2.0-based LIS e-learning environment, both lecturers and students are able to create individual centres of teaching and researches on the different themes of LIS. Moreover, the designed e-environment will provide opportunities to form student personal portfolio achievements in studies and research, by submitting them in an electronic form for discussion and debriefing with co- students and lecturers.

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