Planning “Logistics information systems” course content and its promotion through Baltic regional competence network

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Abstract: - The paper is focused on modeling of content of the course “Logistics information system” according to the cognitive domain of Bloom’s taxonomy model. Authors introduce their empirical study on improving the course content to achieve better education quality in accordance with overall trends of harmonization of the higher education system. The benefits of ShowRoom developed within Baltic regional competence network are described in the paper considering Showrooms as a course module aimed at improving students’ competences and highlighting the actuality of technology transfer. The paper could be considered as the experience sharing with colleagues developing curricula in Logistics and Information Technology.

Key-Words: - logistics information systems, course content, modeling, simulation, Bloom’s taxonomy, Showroom, technology transfer

1 Introduction
Nowadays the academic society is involved in the process of forming a totally new educational system which however, has still not a clear form. Common trends related to application of information and telecommunication technologies within plenty of academic papers on different aspects of education as well as promotion of modular courses show a perspective of creating virtual universities where students can pick up different courses supplied by globally spread educational institutions in order to meet their educational goals. In this context, harmonization of educational system according some common standards has a high priority in every higher school. This will allow achieving both enhancement of existing educational processes and settling a basis for new developments in educational space.

Enhancements of curriculum and course contents modeling are regular functions of academics. However, now actual is a systematization of this process according to some general models, as for example Bloom’s taxonomy model of learning which is popularized among plenty of educational issues.

The topicality of above mentioned in a field of engineering studies formed a goal of the current paper as sharing academic experience in “Logistics Information System” (LIS) course content’s planning, modeling and evaluation according Bloom’s taxonomy. This is an obligatory course within “Information technology” Master curriculum in the faculty of Computer science and information technologies at Riga Technical University. The rest of the paper is structured as follows. First, a brief introduction into the course is presented. Then, the empirical experience of authors’ findings on improving course content up to Blooms taxonomy is summarized. The actuality of Showroom is explained then as students’ competences developing center which introduce them new trends and developments of ICT and allow testing new systems by this promoting students’ interest on technology transfer concept. Finally, discussions are about current challenges which academic stuff can face with during the process of course enhancement.

2 Logistics Information System
The course of LIS was developed for the post graduate students by the Department of Modelling and Simulation in 1998. 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) [1]. It is aimed at providing students with high level knowledge, skills and competences in Logistics Information Systems through the integration of theory and practice. The course focuses on the variety of IT applications to logistics management, for instance, simulation of logistic systems. Almost 90% of LIS students are
employed either in private companies or in government institutions which makes them to be in extremely high demanded for qualitative teaching processes.

The course is structured in several modules. Starting with a course overview, it then focuses on first module on analysis of information technologies applied in logistics. Along with theoretical block, students are invited to improve their practical skills performing several labs, namely “GPS and GIS in object monitoring”, “Cargo Tracking Systems”, and “RFID in Logistics” [2]. The next module is aimed at exploring a 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 put on the functionality of the system for supporting related logistics functions. Along with lecturer’s (and invited industrial partners as well) presentations, students make their own research work. This task is performed as team-work and is aimed at both enhancing students’ professional competence and their group working skills.

Evaluation process is a critical challenge for every academic course. Since 2009 a portfolio assessment evaluation system is implemented within the course. It consists of following components, which may have differential weights which can be easily up-dated by the lecturer before the course is started: (1) an on-line test with N questions which covers the block of Logistics IT (interim assessment 1, lower order questions), (2) written essays on N’ questions in the context of block LIS (interim assessment 2, high order questions), (3) team-work and research presentations.

LIS operates with a variety of teaching method, starting from traditional lectures, and then debriefing, discussions, and 5-minute activities [3], [4]. The Logistics Information System block is organized using workshops, seminars and team-projects. Labs are used to facilitate the exploration and illumination of difficult concepts. In fact, information technologies within LIS are not only the subject of the course, but rather a part of didactical tool aimed at demonstrating the power of IT in logistics. The possibility to learn information technologies and systems by applying them in studies allows students (1) to understand the main principles of IT in Logistics, and (2) to evaluate the variety of its applications for different solutions. This, according to Bloom’s taxonomy of educational objectives, can be explained as student growth through development of their intellectual skills and abilities.

3 Modeling Course Content
3.1 Course content planning
Information technology as well as any ICT related subject is rapidly and fast developing field which requires a total control over the course subject and almost incessant revision it up to new trends. Being an interdisciplinary course, the content of “Logistics information System” is updated continuously toward actualities in both fields, i.e. logistics and information technologies.

![Fig.1. LIS course revisions chronology](image)

A revision of the course content and course structure re-planning is usually done at three planning levels (see Fig.1.). Strategic revision is performed either to develop a new course or to update it up to new Master curriculum’s goals. During this a description of the course is analyzed and course goals are updated to satisfy both Master Curriculum and industry requirements over the horizon of 3-4 years. For example, the latest decision of strategic planning of the course is related to including Showroom-based activities within course. The benefits of this decision will be considered in part IV.

Tactical revision is done once in 2-3 years. It analyzes course outcomes, teaching methods and tools. It results also in defining potential improvements needed to be implemented into course content. As illustration, the result of every tactical revision of LIS course is a decision on developing and implementation of new labs.

Operational revision is conducted frequently right before the course is run. It allows analyzing course activities, its duration, as well as evaluating the assessment system. Also, decisions within this stage are partly based on student evaluation of the course (see [3]).

If summarize either curriculum or course content development and enhancement, it consists of several main steps. Model of course development is clearly presented in [5] by five steps: (1) translate course
goals into measurable student outcomes; (2) determine levels of expertise required to achieve outcomes; (3) select both curriculum and classroom assessment techniques; (4) choose and implement instructional methods (course activities); (5) conduct assessment and evaluate - are outcomes realized.

However this simply looking process is performed under a variety of requirements and restrictions, and usually should be done in a short time. Due to this a methodic help is needed to achieve the best quality in course development. However the main issue is not related to the lack of methodology, as in fact there a wide scope of literature on the subject of curriculum development. The challenge is focused in elaboration of a framework which (1) allows planning, evaluating and enhancing course content under a time limitation, (2) respects and follows pedagogical and educational aspects, (3) is intelligible for any academic personal despite their specialization and research field.

This is more actual for technical studies where academic stuff involved into the teaching process has mostly empirical pedagogical skills. Forced to enhance curriculum quality they adopt engineering related methods and approaches into the process of curriculum development. Illustratively, DMAIC and QFD methodologies of Total Quality Management are applied to developing Master and Bachelor Curriculums [6, 7].

3.2 Course content modeling and evaluation

Although the paper refers to the Bloom’s taxonomy, the extended model of its cognitive domain presented by Anderson and Krathwohl [8] are applied now into LIS course content evaluation. The novelty of Anderson is that they changed the name for each level from a noun to a verb, by this made this model adoptable into teaching process among academics.

As the Fig. 2 shows, the LIS course outcomes are first structured according six Bloom’s model’s objectives, however expected outcomes may cover more than one objective, as for example an outcome “to understand, interpret and use professional terminology” summarizes key words from three levels of Bloom’s knowledge model, i.e. remembering, understanding, and applying. Evaluation of activities could be done as referring to the related outcome, which is already evaluated in the light of Bloom’s model (as it is done in Fig.3). However, essential for course evaluation is to weight course activities separately from outcomes, using same Bloom’s model. Similar approach of course’s outcomes and activities evaluation is presented in [9].

Fig.2. Evaluation of LIS by Bloom’s model

Within current paper application of Bloom’s taxonomy is demonstrated for evaluation of course outcomes and teaching activities, although authors are working also on developing and evaluation of final examination papers and questionnaires in light of Bloom’s taxonomy [10].

Fig.3. Course development model

Within current paper it is proposed to express both evaluations numerically by using a grade scale [0..2]: 0 – activity (outcome) is not related to objective, 1 – activity (outcome) represents an objective partly, 2 – activity (outcome) is related to...
objective strongly. To evaluate both outcomes and activities, a matrix is used (as example, see Table 1).

Table 1. LIS course’s evaluation results

<table>
<thead>
<tr>
<th>Activity</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity 1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Activity 2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Activity 3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Activity 4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Activity 5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Activity 6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Activity 7</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Activity 8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>%</td>
<td>12</td>
<td>12</td>
<td>20</td>
<td>16</td>
<td>24</td>
<td>16</td>
</tr>
</tbody>
</table>

Evaluation of teaching activities is performed by academics involved into course teaching. Table 1 present a matrix which are formed by 8 activities (or respectively 6 outcomes) mentioned in Fig.3 and 6 Bloom’s objectives (i.e. 1 – knowledge, 2 – comprehension, 3 – application, 4 – analysis, 5 – synthesis, 6 – evaluation). It is also recommended to perform outcomes evaluation by external colleague or industry partner, by this ensuring (1) external assessment of course content and (2) critical comments on course improving.

The results of both objectives and activities evaluation are then compared to find a gap of Bloom’s model’s objectives (see Fig.4).

![Fig.4. Comparing results](image)

As the chart shows there is some difference between outcomes and teaching activities evaluations, however it is not critical. Though, presented results are achieved through iterative process on outcomes and activities analysis. The conclusion of chart analysis is either the course content is improved after the provisioning (one can say harmonized) or not. Idealized, the difference between outcome Oi and activity Ai within one objective is approaching zero value, |Oi-Ai|→0, ∀ i∈[1..6]. In this case a full harmonization between outcomes and objectives is obtained (one can say that course content is harmonized according to Bloom’s model). However, there are at least two challenges that the authors faced with. First one is related to the necessity of using etalon distribution for Bloom’s objectives, which in its turn can vary depending on academic year the course is operated at. Within current page authors empirically evaluated “etalon” distribution based on own perception and academic experience, also addressing to some papers on the same matter, as for example [10]. The second challenge refers to estimation of allowed discrepancy Δi between outcome and activity for each objective of Bloom’s model. During paper developing, it is assumed to be within 5%.

4 Technology Transfer

As it was mentioned above, the development of students’ competencies and skills are essential goal of each academic program and a particular course itself. The most essential is promoting among students an interest related to the technology transfer from academic fields to business environment.

The recent strategic decision within LIS course is addressed on including a module of technology transfer in the course content. The tactical decisions within this goal are the following: (1) attendance of RTU Showroom; (2) redesign student research in a way that it will results in “team-work product” developing during the course and presented at the virtual showroom of RTU showroom. This will allow promoting so called product oriented learning activity among students.

4.1 ShowRoom at RTU

Showroom at RTU aims to promote Latvian ICT based research & development, creating a link between product’s or idea’s author and industry SMEs representative. Showroom’s main target audience is RTU students (whereas the majority of master study programme students are SME’s representatives from ICT sector); young researchers from ICT sector; university academics staff.

The majority of showroom’s products is going to be demonstrated as software, developed by RTU researchers in the frame of different international and local projects. Besides software demonstrators, there is going to be other kinds of materials available, such as video clips recorded in technological parks of other BONITA partners [11]; several physical exhibits, mobile IT solutions (i.e. mobile applications on different kinds of mobile devices – mobile phones, PDAs, smart phones); video translation of events through a web cam; informative materials and booklets in a paper form.
as well as in electronic form (PPT presentations, video records, PDFs, other multimedia). So, depending on the exhibit type visitors of the showroom will be able to: (1) study demonstrative materials (both multimedia and hard copies), (2) work interactively with different kinds of software (mobile/web-based), (3) experiment with physical exhibits.

Therefore showroom at RTU is planned to be a place for demonstration of existing products and solutions as well as creation of new products’ and solutions’ ideas. The results of several RTU research projects in IT area are going to be demonstrated at the RTU showroom. The most interesting of them are open multi agent methodology for intelligent tutoring systems development, autonomous robotic system which is driven by knowledge-based intelligent and adaptive control system, intelligent supporting system for adaptive tutoring and knowledge assessment, and learner psychophysiological model based adaptive tutoring system [11].

4.2 Virtual Showroom
Showroom at RTU is planned to be a place where young or experienced researchers can demonstrate and promote their own ideas or developed solutions. Therefore one of the stands is going to be equipped with all necessary equipment to create “ShowRoom visitors’ idea or product demonstration”. Developed demonstration is to be placed in BONITA virtual showroom.

Virtual showroom at RTU is planned to be organized as web portal. Web-based approach gives many advantages like 24/7 access to all exhibits and ability to target wider audience of potential users. Such web portal should include information (both interactive and demo) on all exhibits in the real showroom including ideas, products and solutions. Visitors of the web portal should be able to access and watch demonstrations and technical specification of the interested exhibits. Web portal should provide video translations of various events (workshops, seminars etc.) organized in showrooms, both in Riga and at showrooms of other BONITA partners.

Web portal is to be organized in following main sections:

- **Existing products section** includes presentations (multimedia materials, software trials & demonstrators, prototypes etc.) of the real showroom’s exhibits.
- **Required ideas and solutions (requests) section** is intended to be a place where users can provide information on topical research problems and needed solutions.

4.3 Students research work
To promote result oriented learning, students’ research work in 2011 is redesigned in the context of Showrooms concept. This means that regular reports on the defined topics are replaced now by an interactive framework elaboration on the course subject performed during the course which could be then presented at the virtual showroom. At the moment it includes the elaboration of the content for the predefined framework according some requirements and formatting notes (see Fig.5), however in the long term perspective tool for collaborative work should be used.

**Fig.5. Students’ research-work product (in Latvian)**

Figure 5 shows framework interface. Rows indicate ICT systems used to support logistics functions indicated in columns. During semester, students fulfill the content of the framework by adding (1) description of technologies, (2) logistics functions, and (3) short annotation about application of current technology within certain function. All descriptions should be provided by illustrative and video aids. As the result, at the end of the course “the end product” is developed which can be used then by students for academic or business purposes.
4 Conclusion
There is a variety of case studies on developing curricula and course content, however application of generalized framework for course content enhancement should be performed under some educational instructions to achieve the best quality of educational processes. The last requirement can be a challenge for academics in engineering fields addressing them to the methodology on evaluation and modeling course content according to some learning model. The presented empirical study focuses on evaluation of LIS course’s content in accordance to Bloom’s cognitive learning model. It is easy to use, and is aimed at enhancement of the course content; however it is actually only an initial point for future research on this matter.

An actuality of harmonizing course is critical for new members of the European Society in the context of Bologna declaration which asks also for more effective engagement of the labour sector representatives (business employers, professional associations, trade unions) to education process. Therefore, the technology transfer center and Showroom concept developing and its engagement into course content are important activities which will promote students’ interest on developing and application of new technologies in business and industry, as well as facilitate elaboration between business/industry and academic environment.

Acknowledgment
The presented activity is funded partly by the project "Support of FP7 ICT STREP project “Simulation highway” proposal development” supported by European Regional Development Fund (Nr. 2010/0191/2DP/2.1.1.2.0/10/APIA/VIAA/001) and partly financed by the European Union (European Regional Development Fund) within the Baltic Sea Region Programme 2007-2013 project BONITA (Baltic Organisation and Network of Innovation Transfer Associations).

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