ABOUT CREATING REUSABLE LEARNING OBJECTS IN WEB-BASED LEARNING ENVIRONMENT

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The increasing amount of learning materials available through the Internet and the growing need for developing attractive and compelling educational resources put their quality on the backstage. The paper is focused on the necessity of invention new learning approaches that allow educators and universities to download available content and adding desired information in order to develop courses. A concept of creating reusable learning objects is proposed.

Keywords: Learning object, Reusability, Interoperability

1. ANALYSIS OF CURRENT SITUATION AND NEED FOR A CHANGE

The increasing amount of learning materials available through the Internet and the growing need for developing attractive and compelling educational resources put their quality on the backstage. At present most of the accessible instructional content is pedagogically poor, consisting of sequenced text based materials and exercises which are highly interrelated. Furthermore, their subject and topic range are limited. Consequently, a problem of a need for new teaching and learning approaches that allow educators and universities to download available content and use it in order to develop their own courses is becoming more actual in the recent years. It will be unable to fulfill this with currently proposed learning materials on the web. Michael Feldstein suggested the idea that the courses could be created in learning objects that could be custom-assembled into new courses according to the curriculum [1]. In that way the potential of learning objects could be fully exploit to radically transform the manner in which learning material is produced, stored, manipulated and experienced.

The implementation of reusing learning content has not been so popular yet because the content should be open, i.e. freely accessible. Here arises a question about respecting and rewarding intellectual property rights, which is within the competence of the European Commission. To be realized the exchange and reuse of learning objects they should be written according to the recommended elearning standards represented in the SCORM, IMS and IEEE documents [2]. It will be simple and effective if content sharing is to become widespread.

2. TOWARDS A CONCEPT OF THE REUSABLE LEARNING OBJECT

2.1. Nature of reusable learning objects

According to IEEE a learning object (LO) is "any entity, digital or non-digital, that may be used for learning, education or training" [3]. In our research we will take the view that a learning object is a small digital piece of learning material usually consists of only one type of data (text, graphic, mathematical expression, media file and so on), which is fully independent, has clearly defined objectives and has the potential to be reused in different contexts.

Learning objects become reusable when they are both accessible and transferable. Accessible means that objects are available in digital form, stored in online databases and described by metadata that allow users to assess the usefulness of the object. A transferable means that objects are independent of the learning context for which they were originally developed. Reusable learning objects (RLO) could be used in different curriculum, by different groups of learners and in any learning environment. These issues of interoperability and reusability are essential to the sustainability.

There is no standard for the size of a RLO but it is crucial in achieving success in its reusability. Larger ones are typically harder to reuse, and those who reuse smaller learning objects have less work to do.

2.2. About creating reusable learning objects

The process of teaching is more than presenting some content to the students. For any digital information to become a LO it should have a clear defined learning goal. To realize this goal the learning content should be presented in an appropriate form and should be wrapped in a user friendly interface. While form and interface provide a structure of a learning object, reusability gives added value to it. A LO can benefit itself of the flexibility and scalability offered by information and communication technology only if the object in itself is designed for reuse by many developers in different learning contexts. However there is still a serious problem regarding LOs - its greatest influence of instructional design theories.

Content is traditionally created from the point of its use. Since use is context and instructional dependent, content aimed for a particular use is generally incorrect for other purposes. Here appears the reusable learning object approach - a new way of content creation and its educational use. The LO could be truly reusable when it fulfils a high level of abstraction. This abstraction gives independence from use and full functionality, enabling LO to join other ones in order to build up desired learning resource. A self-standing RLO in itself can be understood and shared among users but cannot form a learning resource (LR) which is complete learning item, included the whole information required to meet predefined educational goal. For that purpose several of them have to be aggregated. How many they will be, how they are related, and for what purposes will be determined depends on the educators' objectives. The mutual relations between learning resources, learning objects, learning environments and curriculum library (used as a database) are shown on Fig. 1.

A LO should include only one or few related notion. It is better to think in advance how many notions about a topic can stand on theirs own and can be reused in different contexts. If a LO consists of more then one notion, one of these should be the main and the others should be derived from it or be dependent on it.

In addition it is required a more effective way of describing educational materials in order to successfully combine learning components in appropriate way. In most e-Learning researches and developments it is assumed that web content is labeled using standardized metadata. Such metadata is meant to add information that search engines and other Internet technologies can use to more accurately understand the content and retrieve and/or manipulate it for the user. There has been a considerable

international effort to develop metadata standards and tools that will allow interoperability on information [3]. The hope is that learning materials can be obtained from variety databases according to the description of designed LO.
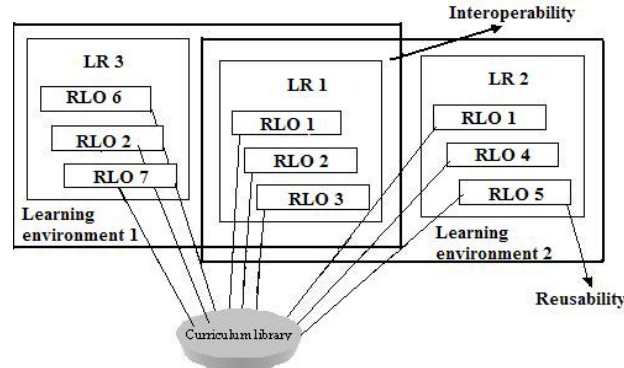

Fig.1 - Relations between learning resources, learning objects, learning environment and curriculum library

3. IMPLEMENTATION OF THE REUSABLE LEARNING OBJECT CONCEPT

3.1. Developing reusable learning objects

In our previous work [4] we have developed LRs based on existing MS Word documents. These educational materials were built in one piece and theirs core was highly interrelated, which acquired to use them only as a whole unit. They couldn't be used on theirs own regarding the fact that these many connections would remain broken and consistency of the presentation would be destroyed. Furthermore, the already created LRs were large enough to concern small clearly defined educational objective. They also didn't have embedded descriptions, so they couldn't be found, retrieved and reused outside the Class Server learning environment. In order to reuse LOs in different LRs with a different objective they would have to fulfill the reusability and interoperability requirements.

Having in mind the presentation above and analysing reusability requirements, now we are developing LRs grounded in Computer Networks and based on RLOs. The scheme illustrated in Figure 2 depicts structure and organization of learning materials in this course. It represents a hierarchy links between course, learning resources and learning objects. Here learning objects are independent units that are created according to the reusability and interoperability requirements and they can be custom assembled in order to form learning resource for a predefined educational objective.

In Figure 3 are depicted a part of shared resource and included RLO named Framing. Each LR is associated with built-in properties which incorporate aspects that allow pedagogical decisions to be made including prerequisites, level of detail, technical level and other according to IMS Learning Resource Standard [2]. Such information allows users to understand deeply the intention of the LOs and their relationships with other ones and their relative position in the structure of knowledge domain. In Figure 4 the built-in properties of the LO named Framing are shown. The description of the educational objectives is based on the Bloom's taxonomy –

knowledge, comprehension, application, analysis, synthesis and evaluation. In MS Class Server some describing attributes are pre-determined choices and others are manually entered according to teachers view. We find out that some enhancements to these descriptors are required.
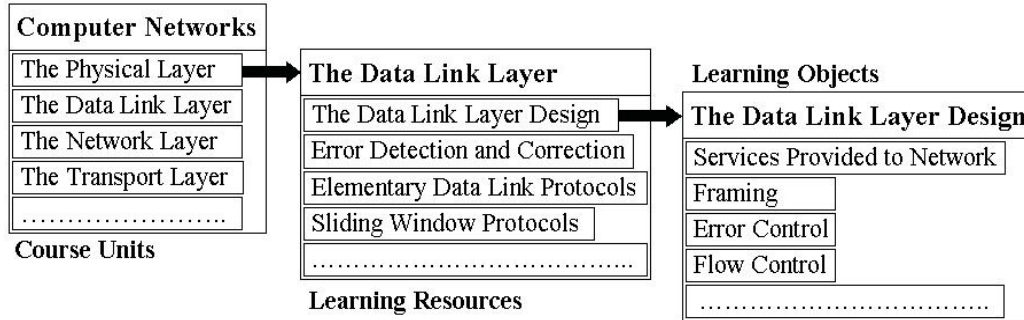

Fig. 2 - Structure and organization of learning materials

According to us the LRs are made by using a common model, applicable to all kinds of learning theories and materials. Its basic components are as follows:

- clearly defined educational objectives;
- schedule – short content description;
- key words – facilitated searching;
- presentation – learning content made by aggregation of learning objects;
- examples of studied topic;
- self testing – tasks and tests that allow students to estimate their progress;
- assignments - tasks or tests that allow educators to estimate students' progress;
- associated learning materials – additional references;
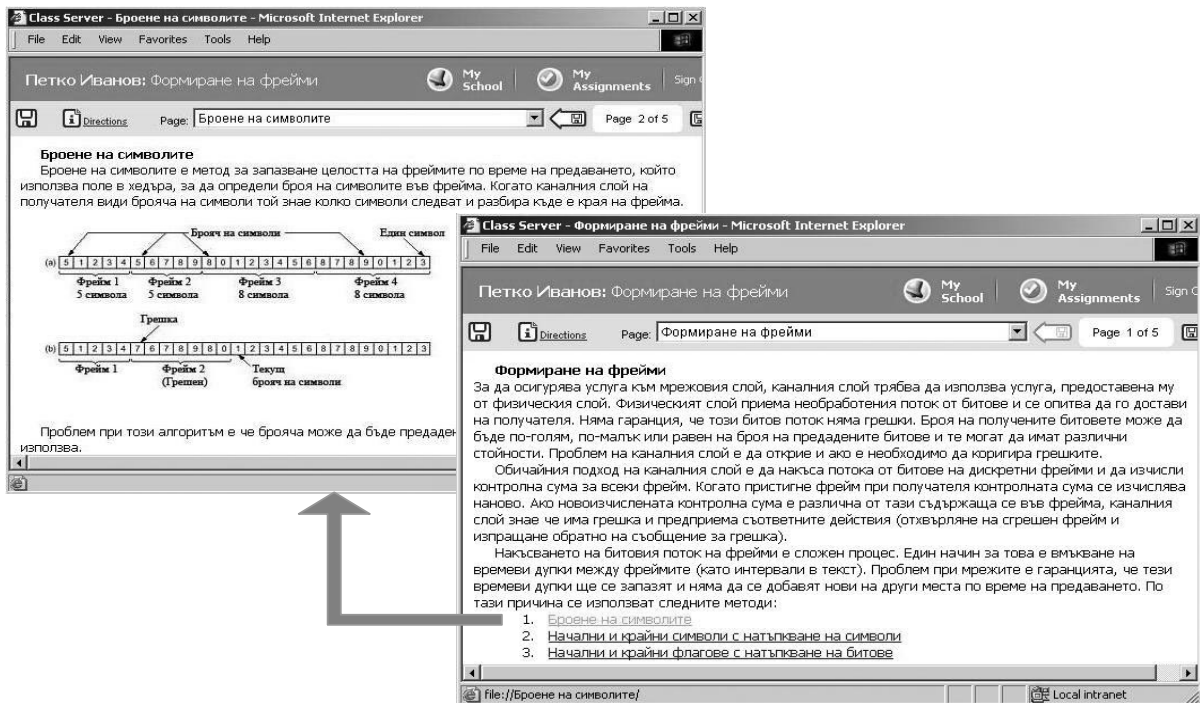- related www links.

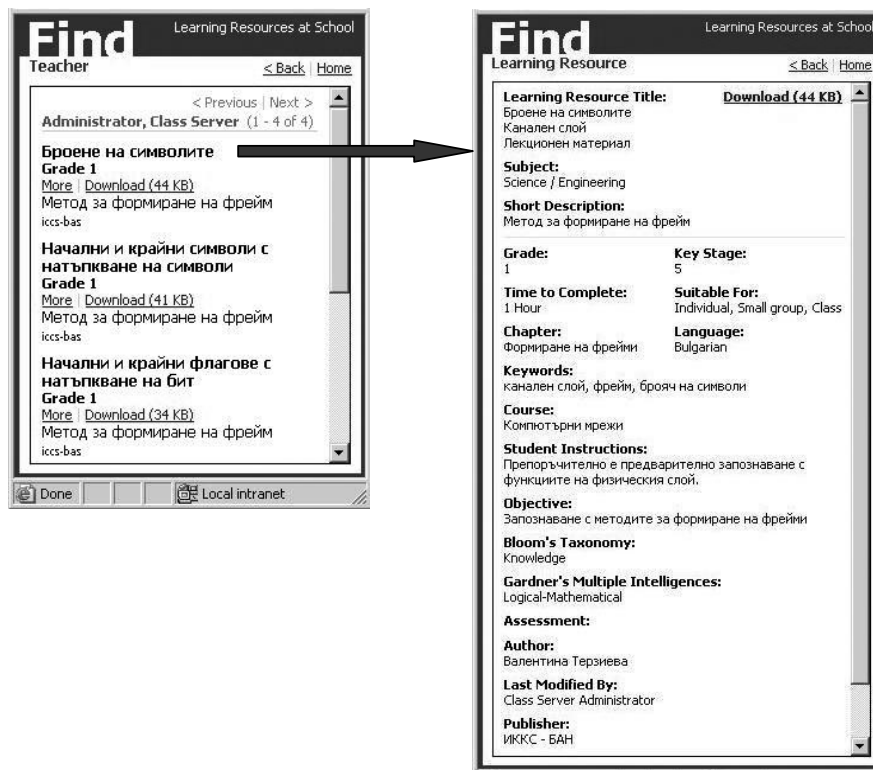Fig. 3 –Learning Object named Framing depicted in Fig. 2

Fig. 4 – The built-in properties of the Learning Object named Framing

The created LOs are saved in the curriculum library which is a web site or shared folder created and maintained by the Class Server system. There is option allowing specifically selected LRs to be found in the university's curriculum. This option facilitates retrieving and reusing learning materials.

All these learning materials are intended to be used for PhD education in our institute. As the doctoral education is very specific, it needs a suitable approach to be supported in e-Learning. Usually the PhD-students don't have one and the same research topic despite being in the same scientific area. Obviously, they have to attend some common course, but each of them will need additional lessons concern his specific research topic. From the educator's point of view, it will be a facilitation and time saving if they can find almost appropriate learning objects on web or in their own repository, and then adapt (if needed), and use them for different PhD-students.

In our learning resources there exist different types of LOs such as:

- Instructional objects - standard explanatory text, covering a specific topic;
- Individual activities - additional readings, an activity and questions or tests;
- Collaborative activities - these require students to engage in a collective task;
- Assignments - an assignment at the end of each unit and course assignment;

3.2. Advantages and disadvantages of implementing reusable learning objects

RLOs represent an alternative approach to content presentation - the modular approach - that is the learning content has been divided into quite small components. A composition of several of them forms a learning resource. Here are summarized the main advantages and disadvantages of this approach from our point of view.

Pros:
- easy content upgrading – by proper educational content fragmentation into smaller pieces – LOs, different parts can be maintained and updated separately;
- flexibility – the growth quantity of a standards-based LOs available in public repositories, increases the choice and allows more flexibility for designers;
- pedagogy – LOs fit well into many Instructional design theories. For any specific type of learning objects instructional templates could be created;
- user's facilities – as standards take hold, the learning object approach allows students to find and use appropriate LOs despite their learning environment;
- cost saving – there is no sense to spend great amount of time and money producing multiple versions of similar learning objects when single versions of the same objects could be shared at a much lower cost per university. If a suitable learning object can be found, a new one does not need to be created.

Cons:
- redesigning cost – changing to this approach from the old one involves additional cost of transforming existing content to RLOs;
- flexibility restrictions – using standards-based LOs limits the learner to content that is accessible depends on maintained interoperability;
- pedagogical restrictions – limitations of available RLOs could narrow pedagogical approaches, especially when it concerns discursive material.

4. CONCLUSION AND FUTURE WORK

It is evident that reusable learning objects are the most meaningful and effective way of creating content for web-based learning. The concept of reuse is appealing to many educators but there still has been a lack of its practical implementation when designers try to integrate available learning objects into resource intended for their particular educational content. The reusable learning objects approach provides a high degree of flexibility of creating learning resources and allows a wide variety of educational purposes.

This paper has attempted to begin the process of developing reusable learning objects. Although, Microsoft Class Server is not exactly intended for this purpose, it is quite appropriate for our goals, because it allows learning resources to be built combining learning objects according to the curriculum. The further work will be concentrated on the enhancement of the available learning resources grounded in Computer Networks and developing a new ones, which are intended to PhD education in our institute.

5. REFERENCES

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