Implementation of Advanced Technologies in Ontology-based E-learning Model

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Abstract. Paper discusses how advanced technologies like educational software and Web 2.0 tools could be successfully integrated in e-learning in order to create and deliver high quality e-learning content using ontology-based model. We propose here a possible solution for implementation of advanced technologies in this model and how different social tools and educational software could be used in ontology as RLOs. We describe advantages of the solution and how set requirements for effective e-learning are satisfied by the suggested model for integration of new technologies.

Keywords: ontology, educational software, game-based learning, Web2.0

1 Introduction

Basic problem of advanced learning is to guarantee that students will be able to apply acquired skills and knowledge in practice. For this reason modern e-learning should integrate new technologies in different learning activities and this way to achieve highly interactive and social-oriented education. In the same time learning should be flexible, attractive and adaptive to the specific needs of learners.

Ontology-based e-learning model seems to be the most flexible and adaptive to the preferred learning style and previous educational background of students [11].

Main task of this research is to explore and offer how new technologies like gamebased learning and social tools could be successfully integrated in ontology-based elearning model in order to provide high level of interactivity and quality of learning.

2 Models for effective and interactive online learning and trends in advanced forms of e-learning

In this paper we use a model of online learning [1] describing 2 basic types of interaction in e-learning: interaction among participations in education and interaction with learning content e.g. independent study or structured learning resources. This model illustrates required elements of knowledge/content interface that should be provided and supported like search and retrieval of information, simulations, games and virtual labs and capabilities for communication

and collaboration. The second model we apply in order to define requirements for high quality learning is the model for effective learning proposed by Anderson in [4]. It described basic phases of design and implementation of effective education.

The paper focuses on research of existing learning theories that will support flexible, attractive and adaptable forms of education. We analyzed several theories (Behaviourism, Cognitive, Constructivist, Activity-based, Socially situated learning) [2]. We use provided comparative analysis of these theories based on their basic characteristics, advantages, disadvantages and potential for their application in elearning. We selected the most appropriate one for our flexible, adaptable and effective education. Selected theory should satisfy the requirements for effective and interactive e-learning process set by the models. Based on these criteria we choose Constructivist learning theory and Socially situated learning as the most appropriated ones. Constructivist provides opportunities for gaining experience during the learning which is one of the basic criteria for effective learning[4]. Socially situated learning allows and supports high level of interactivity both among the participant in education and with learning content. Another advantage of Social tools is that they are common used and well accepted by the users. For this reason we combined both theories and we selected to use Social-constructivist learning theory described by Vygotsky [3]. The selected Social-constructivism learning theory combines advantages of both learning theories and allows users to gain experience using capabilities of social tools. Social-constructivist learning theory allows students to gain experience during the education by social interactions. Our next task is to choose the most appropriate model for this learning theory and to implement it in the design and development of the learning. For this purpose we used methodological approach offered in [2]: to review learning theories, to identify their common characteristics, to build a model using these characteristics and to map learning theories to the model. Using this methodology we select the most appropriate model for this type of education. It is used for Conversational framework developed by Laurillard [10] and is described in details in [2]. It is represented by 3 pairs of elements: Individual – Social, Reflection – Non-reflection, and Information – Experience.

Selected model allows users to receive individualized learning which is very important factor for a successful education. It should be based on the specific educational needs of the learner and it should be appropriate for preferred learning style and previous educational experience of the student. In the same time learning is organized in social learning environment where users could communicate and collaborate using Web 2.0 tools. Another advantage of this type of education is capability of social tools for reflection of students experience and impressions during the education in blogs, wikis, forums, etc. In this social learning environment information could be shared and exchanged by users and learners could find out the most appropriate learning content based on the rates and comments of other students. This way they have access to the most interesting and related to their interests resources as well as they can share information.

The selected model satisfies the requirement for effective learning represented in [4]. It emphasis on the importance of interaction with the learning content and collaboration and communication between participants in education which is critical for effective learning through support of information exchange and

options for reflection. Necessary variety of learning activities supports social and individual learning as well as option for gaining experience. Combination of all available components of the model allows acquired knowledge and skills to gain personal meaning for the student and at the end of education learners should be able to apply them in real life which is one of the most important impacts of education [4]. Ontology-based model of e-learning illustrated on Fig.1 represents basic elements of successful e-learning described in details in [11]. Learning environment should provide different components that support effective learning process. Next levels of content complexity and flexibility in the model are structuring and organization of learning content. In this model learning content is organized as ontology in a given domain and main concepts are linked with relations among them as well as reasoning rules and axioms. Integration of Learning 2.0 technologies [9] in learning process allows students to use and create socially constructed learning content. In the same time applying the model we can use flexibility, adaptability and reusability of learning resources that this model supports. At implementation level we will create learning environment using capabilities of Learning 2.0 and edutainment as basic components of the learning system. Edutainment represented by simulators, educational software and serious games provides and supports capabilities of gaining experience[12]. This way the concept of Constructivist theory for gaining experience with authentic real life problem and situations will be achieved [13]. This way tasks set by selected conversational framework model and chosen learning theory will be executed. For ontology representation we can use Multimedia Web Ontology Language (MOWL) using the advantaged of Web Ontology Language (OWL) and multimedia used in the last level of complexity of the model.- content asset In the same time the selected language supports some option for reasoning. On the next level of content complexity we have to create RLOs using definition of L'Allier [5] for LO. Smaller part of learning content used both in e-learning and knowledge management is information object. Here we have to define different concepts related to the topic as well as principles and procedure for the selected domain of science. For this purpose we can apply learning sequenced defined by Gagne [6] in order to use different concepts, principles and procedure of the target domain. Last element of flexible and adaptive e-learning is content asset where we use multimedia for learning content representation [7, 8]. Learning environment uses ontology for content organization. Concepts of ontology are represented by LO with related information for each concept. Information objects are used by RLO for procedures description and each information object contains content assets with multimedia elements. In design of learning environment we use the concept of its representation as combination of Web 2.0 tools and edutainment. For ontology development we can use MOWL. Information for each ontology concept is represented by RLOs containing social tools and educational software. In each LO use can use IO for principles and procedures description for gaining high order experience [12]. This information is represented by multimedia content assets.

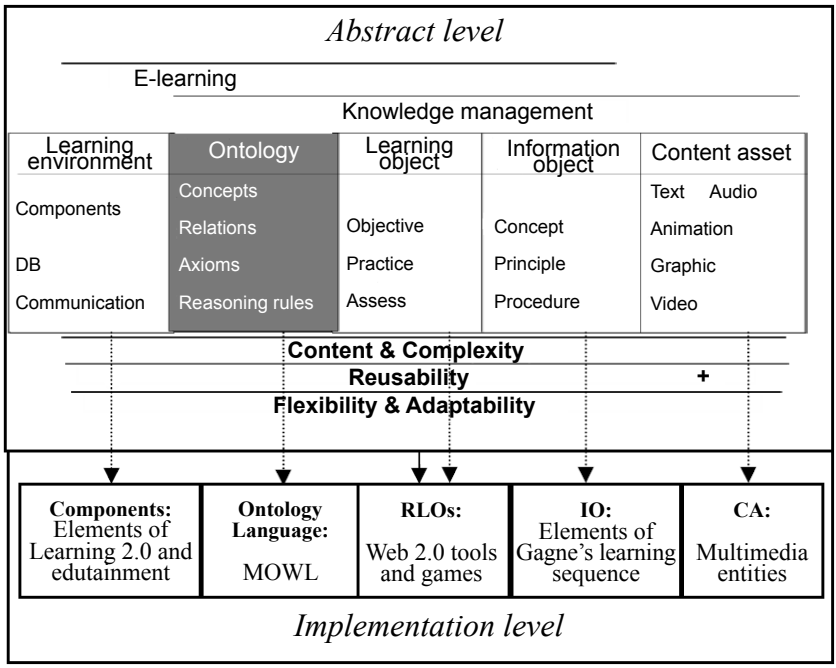

Fig. 1. Ontology-based e-learning model.

3 Application of advanced technologies in ontology-based e-learning model

Based on different models and learning theories discussed in previous sections we suggest an ontology-based e-learning model integrating advanced technologies like Web 2.0 tools and educational software. Concepts of ontology are linked by relations and each concept has a LO that contains information about it. Usually standard type of resources like pdf, doc and ppt files, is enhanced by different social tools like blogs, wikis, etc. in order to provide high quality education. They are integrated in ontology as RLOs and allow learners to share their own experience, comments and ideas about the concept. We can add different types of educational software, serious games and simulations as RLOs in the ontological structure.

Thus designed and developed e-learning allows students to gain experience in social learning environment, to share and exchange information using Web 2.0 tools, to choose individualized learning resources according to their specific educational needs and to use advantages of educational software for experience gaining and sharing with other participants in education. This knowledge and learning content becomes social constructed. Students not only share and exchange information about learning content, but they create learning resources using Web 2.0 technologies. They comment, rate, recommend and develop learning content. This way they become active participants in learning process not only passive consumers of e-learning resources. Advantages of proposed solution is that flexibility and adaptability of ontology-based models are used.

In the same time development of learning content as small part of information e.g. RLOs, information objects, and content assets allows high level of reusability. On the other hand we use enhanced capabilities of advanced technologies like Web 2.0 tools and educational software like simulations and serious games. Integration of described tools as RLOs allows advantages of ontology to be applied and to develop highly interactive multimedia e-learning content in order to create high effective and high quality e-learning using learning sequence defined by Gagne. The requirements for effective learning defined by model described in [4] as well as the model of online learning represented in [1] are satisfied by the solution offered. Some assumptions of Social-constructivist learning theory for gaining experience in social environment by users' interactions are applied.

4 Conclusion and future research plans

In this paper we set requirement for successful high interactive and effective education represented by the models of Ally and Anderson. We analyzed existing resources describing different e-learning theories and selected the most appropriate one according to set of criteria for effective and interactive learning represented by the models. We choose appropriate for the selected theory model and we described how the new technologies could be integrated in ontology-based e-learning model. At the end we outlined the advantages of proposed solution. Our future research plans will be focus on investigation on methods and tools for shared development and editing of ontologies, capabilities for mobile delivery of learning content organized as ontology structure and application of wireless technologies in social software and game-based learning.

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References

1. Anderson, T., TOWARD A THEORY OF ONLINE LEARNING, InTheory and Practice of Online Learning, Anderson, T. and Elloumi, F. (eds.), Athabasca University, (2004)
2. Conole, G., et al. Mapping pedagogy and tools for effective learning design, Computers & Education 43, 17–33 (2004)
3. Vygotsky, L. (1978). Mind in Society. London: Harvard University Press
4. Ally, M., FOUNDATIONS OF EDUCATIONAL THEORY FOR ONLINE LEARNING, In Theory and Practice of Online Learning, Anderson, T. and Elloumi, F. (eds.), Athabasca
5. L'Allier, James J. (1997) Frame of Reference: NETg's Map to the Products, Their Structure and Core Beliefs. NetG., http://www.netg.com/research/whitepapers/frameref.asp
6. Gagne, R. M., The conditions of learning (2nd ed.). New York: Holt, Rinehart and Winston
7. Newby, T., Stepich, D., Lehman, J., & Russell, J., Instructional technology for teaching and learning (2nd ed.). Upper Saddle River, NJ: Merrill (2000)

8. Yordanova, K., Interactive multimedia course for teachers education in e-learning concept and its possible application in vocation training and educational process, In International Review on Computers and Software, July, ISSN1828-6003,Vol. 2N. 4, pp. 415-420 (2007)
9. Yordanova, K, Application of CSCL capabilities in virtual communities, Open PhD Workshop on Technology-Enhanced Learning and Semantics, Software and Services, 03 September, Varna, Bulgaria, (2008)
10. Laurillard, D., Rethinking University Teaching: A Framework for the Effective Use of Educational Technology. Routledge, London, (1993)
11. Yordanova, K., Learning Systems as Ontology-based Learning Object Repository, International Conference CompSysTech'10, 17-18, June, (2010)
12. Antonova, A., Todorova, K., Serious games and Virtual Worlds for high level learning experience, S3T, September 11-12, 2010, Varna, Bulgaria (2010) (accepted)
13. Jonassen, D. Designing constructivist learning environments. In C. M. Reigeluth (Ed.), Instructional theories and models (2nd ed.) (pp. 1-21). Mahwah, NJ: Erlbaum. (1998)