APPLICATION OF A MODELLING METHOD FOR KNOWLEDGE FLOW ANALYSIS IN AN EDUCATIONAL IT ECOSYSTEM

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KEYWORDS

IT Ecosystem, e-learning, educational ecosystem, knowledge flow, modelling methods

ABSTRACT

A knowledge flow is invisible but plays an important role during the learning process within an educational information technology (IT) ecosystem. Learning objects within IT are the major medium that enables knowledge to process between teacher and learner. By modelling technology as an ecosystem, the developer of an educational system can indentify factors that may impact the learning process more successfully. The aim of this paper is to present an application of a modelling method for knowledge flow analysis in an educational IT ecosystem. We suggest a technology ecosystem model to represent the dynamic nature of technological impact on the educational process. The synergy between e-learning, t-learning and m-learning tools applied to the knowledge flow analysis in an educational IT ecosystem.

INTRODUCTION

Modern societies have dramatically changed as a result of technological changes such as the development of information technology systems (Baartman L.K.J. et.al., 2007). The synergy between electronic learning – e-learning, television learning – t-learning and mobile learning – m-learning tools allow learners to learn anywhere, anytime, on any device (Kapenieks A., 2009). The development of an ubiquitous learning environment needs to address several challenges in the design and development of educational IT. The main characteristic of an educational system is its organization which is controlled by information and fuelled by some form of energy. Other qualities are that they are selective and operate within certain limits and are self-regulating (Skyttner, 2005). Educational IT ecosystem principles can be used to provide ubiquitous learning environment for knowledge development in the context of life-long learning. A knowledge flow is invisible but plays an important role during learning process within the educational information technology (IT) ecosystem. As mentioned earlier, knowledge is dynamic – it goes through human brains for knowing, invention, propagation, fusion, generalization, and problem solving (Zhuge H., 2006). Learning objects within IT are the major medium that enables knowledge to process between teacher and learner. By modelling technology as an ecosystem, a developer of an educational system can indentify factors that may impact learning process more successfully. The aim of this paper is to present application of modelling method for knowledge flow analysis in educational IT ecosystem. We propose the technology ecosystem model for representing the dynamic nature of technological impact on educational process.

KNOWLEDGE FLOW WITHIN AN EDUCATIONAL IT ECOSYSTEM

The information technology (IT) ecosystem approach for educational purposes comes from the digital ecosystem paradigm. The digital ecosystem paradigm captures the existing main principles from nature. A natural ecosystem is a biological community of interacting organisms in their physical environment (Uden L., Damiani E., 2007). The digital ecosystem is a self-organizing and adaptive digital infrastructure that supports organizations or communities in colaboration, creation of knowledge and sharing (Uden L., Damiani E., 2007).
The educational IT ecosystem is an adaptive digital infrastructure that supports the continuous learning process in an organization (Stale G., Majors I., 2009). A digital infrastructure consists of digital components that can be software components, applications, services, knowledge, business processes and models, training modules, a contractual framework and law (Uden L., Damiani E., 2007). Knowledge flows are the methods through which knowledge is available and the ways that knowledge moves throughout an organization.

RELATED WORK

Related work in the field of knowledge flow analysis in an educational IT ecosystem consists of 4 main categories:

- methods of knowledge flow analysis;
- approaches for IT "ecosystem" development;
- methods for knowledge flow modelling;
- methods for providing a digital e-learning ecosystem paradigm.

The main approaches and methods of the related work are shown in the figure 1.

The first category includes research work closer to the subject of this paper. The results of related work reflects (Amritesh, Sarkar R., 2009) (Kim S. et.al., 2003) analysis as a method of knowledge management in organization. Knowledge flow can be defined as the transfering of the knowledge creation, its distribution and reuse from a person within a group - called knowledge sender- to the next person, called knowledge receiver (Kim S., et.al., 2003). It must also have a specific direction of transfer and specific knowledge content. Knowledge content is shared among participants in a collaborative system and analysis is used as a method of graphical representation and the decision making process.

The second category consists of methods for knowledge flow analysis in the context of knowledge management systems (Lillenhagen F., Krogstie J., 2008), (Zhuge H., 2006). Results of research work reflect an active knowledge modelling solution to enable effective e-business, enterprise design and development and lifecycle management. This approach offers the opportunity for people with different competences and skills to exploit the most recent advances in IT (Lillenhagen F., Krogstie J., 2008).

The third category incorporates related work for providing methods for analysing digital infrastructure including e-learning (Long P., et.al., 2008), (Zhang D. et.al., 2008), Su J.M., 2004). Related work proposes an ubiquitous digital ecosystem model including infrastructure using different pedagogical theories to meet the specific needs of the learner.

The fourth category includes approaches for e-learning ecosystem development (Uden L., Damiani E., 2007), (Chang V., Guelt Ch., 2007), (Stale G., Majors I., 2009), (Wurzinger G., Chang V., Guelt Ch., 2009), (Amritesh Sarkar R., 2009), (Ficheman I.K., Lopes R.D., 2009. This category reflect methodologies for the development of e-learning which meets the needs and abilities of the learner more precisely.

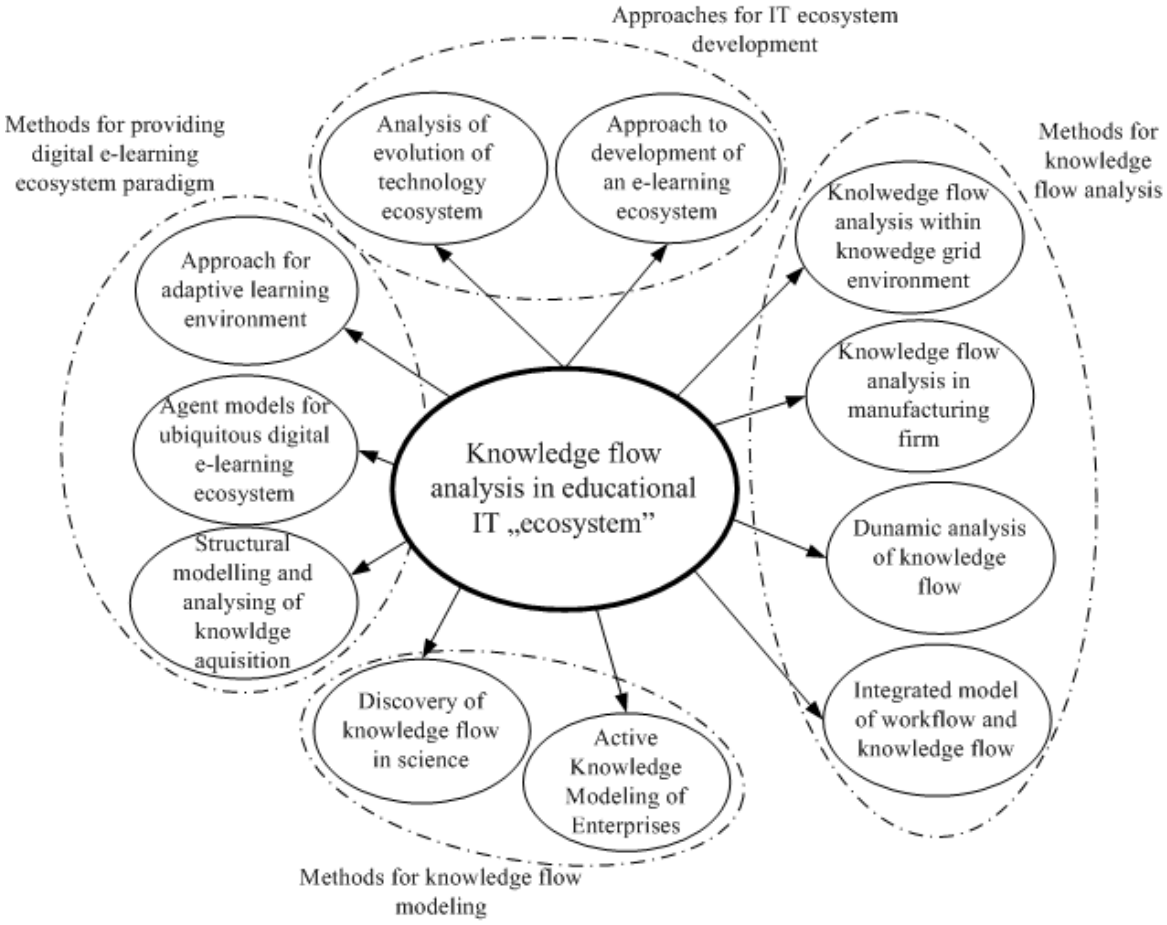

Figure 1. Main issues of related work in knowledge analysis in educational IT ecosystem field.

COMPETENCE DEVELOPMENT WITHIN AN EDUCATIONAL IT "ECOSYSTEM"

Learners need to be flexible and adaptive if they are to function well in complex and global societies of the modern world. To support the needs of these new learners, education is changing its focus from one of transmitting isolated knowledge and skills to one of acquiring complex competences, guiding learners in developing skills for learning and finding information from the diverse range of sources available in society. In short, education is increasingly becoming learner-centred and competence-based.

A common notion of most descriptions of competence is that it consists of connected pieces of knowledge, skills and behaviours that can be used to solve a problem adequately (Baartman L.K.J. et.al., 2007).

Below is a brief description of the case studies from the projects carried out by the Riga Technical University Distance Education Study Centre from 2005 to 2009.

1) A project entitled *A Continuing Education Programme to strengthen the capacity of small and medium sized enterprises through ICT and knowledge management solutions*. The project goal was to promote human resource development by increasing the employability of individuals in the job market. The learning outcomes for participants were new skills in knowledge management field as well as self development and analytical skills as well as skills.

2) A project on *Training Academic Staff at Higher Education Institutions in e-learning applications*. The project objective was to share the created knowledge and skills of the DESC experts at RTU in course design in order to train the academic staff at a Latvian higher education institution in the newest e-learning applications and methods. The learning outcomes for participants were self-development, creativity and new skills in the application of e-learning solutions.

3) A project *Raising the qualification levels of the teaching staff at the Latvian National Police Academy by successfully implementing an ICT programme*. The programme provided a modern, positive e-studies environment with interactive multimedia simulations intended to encourage further training. The project used innovative multimedia e-studies solutions to facilitate learning access and generally raise the education level of the teaching staff. The learning outcomes for participants were communication skills, self-development and new skills in application of e-learning solutions.

4) A fourth project was *Training the teaching staff and professionals in the basics of e-course management*. The goal of the project was to develop human resources and to design a basic, continuing e-studies course to meet the needs of lecturers and professors in the regional higher education institutions of Vidzeme, Latgale, Zemgale and Kurzeme so that they could become competent in knowledge society technology and exploit its applications in research and class work as well as developing communication skills.

5) A project an *Innovative software to produce training games designed to develop knowledge society solutions (SPRIDITIS)*. The objective of the project was to develop an innovative e-learning approach to enhance organizational and individual skills and competencies for managing and participating in international research projects. More specifically, another outcome was to develop a training game that would support the training and development of skills or competencies necessary for successful participation in RTD projects within the European Research Area (ERA). The SPRIDITIS game can enhance: (i) communication skills which are particularly significant in the early stages of proposal preparation, (ii) decision making skills in the context of the development of the a project proposal, and (iii) skills and abilities to assess the potential benefits of a project in respect of the strategy of the organization.

6) A project on *Research into m-studies products and services – PUMPURS*. The purpose of the project was to research new mobile technologies for m-learning applications and to develop a model that would make this service feasible as a learning tool in Latvia. The results of this m-learning project can also have wider potential. They can appeal, for example to telecommunication industries interested in new product design and services to augment the area of m-learning applications. The use of the benefits of technology-enhanced learning, the learning process can become more flexible and alse can encourage more knowledge-based searches and, significantly, is able to support collaborative work. The end result was to raise the quality of learning and its impact on the larger social environment.

7) A project *Developing friendly and motivating knowledge society strategies in societies to promote the social integration of young people with special needs*. The project promoted the inclusion of socially at-risk young people with special needs and to attempt to integrate them successfully in the normal education system. It is also aimed at giving them confidence in their skills by providing them with a programme that would prepare them to participate in the knowledge society. RTU designed the programme and e-course combined with an off-line game tailored to meet the needs of the target group. RTU used the experience of organizations involved in this area such as Social Integration Centre of Jurmala, Riga Technical University and Liepajas Academy of Pedagogy to achieve the specific aims.

8) An eighth project was *The Development of a programme for training engineers to design CAD (computer aided design) models.* The aim of the project was to make an online training programme to upgrade the qualification and skills of construction designers such as mechanics, electricians, metal workers and designers who specialize in prefabricated structure and manufacturers to upgrade their qualifications and skills.

The training programme was developed as an e-course which aimed to increase the qualifications of operatives in applied engineering, construction design and to raise professional standards and to give Latvian products a competitive edge.

9) A project entitled *Enhanced Learning Unlimited (ELU)*: The ELU Project was supported by the European Union under the Sixth Framework Programme for Research and Technological Development. The vision of the ELU is to increase learning opportunities at home, in the office and at school via interactive digital TV (iDTV). The objective of the ELU is to investigate ways of increasing the use of television for learning activities through adapting and enhancing methods used for e-learning using a PC. The ELU intends to define the future of t-learning (learning via iDTV) as an alternative to e-learning (learning using a PC).

The reasons for using different kind of technologies in the educational projects were the following: to a) advance the learning of fundamental concepts and principles; b) provide an innovative learning environment through multimedia; c) demonstrate the application of theory to practice; d) incorporate IT technologies to identify the needs of users and match them to appropriate learning curricula to suit their needs and interests.

The projects outlined above were evaluated according to the competences defined in the TENcompetence project, and in line with the criteria defined by the EU 6th Framework competence profile. There are 5 meta-competences within the competence model (Hernandez-Leo D. et.al, 2009) namely:

- communication;
- self-development;
- creativity;
- analysis;
- problem solving.

Each competence can be reached at different levels (level 1 – conceptual, level 2 – comprehension and level 3 – application). Table 1 shows the results of the evaluation of interviews made with a group of experts who evaluated individual changes in competences within each project. Figure 2 represents the average competence level achieved by using each of the 3 educational technologies.

Table 1: Ten competences in life-long learning

COMPETENES Project Number. (development level)	Communication	Self-development	Creativity	Analysis	Problem-solving
1)	3	3	2	3	3
2)	3	3	2	1	2
3)	3	3	3	2	2
4)	3	3	3	2	3
5)	3	3	3	3	3
6)	2	3	2	2	2
7)	3	2	3	3	3
8)	2	3	3	3	2
9)	1	2	3	3	3

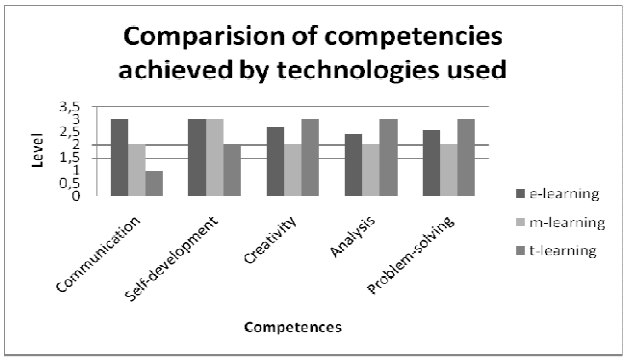

Figure 2. Competency level depending on application of educational technology in 9 educational development projects.

The Enterprise Knowledge Development (EKD) method serves as a tool for analysing knowledge flow and processes in an educational IT ecosystem. The EKD model is shown in Figure 3 and Figure 4. It shows goals (G) for providing knowledge flow, processes (P), rules (R), concepts (C) and actors (A).

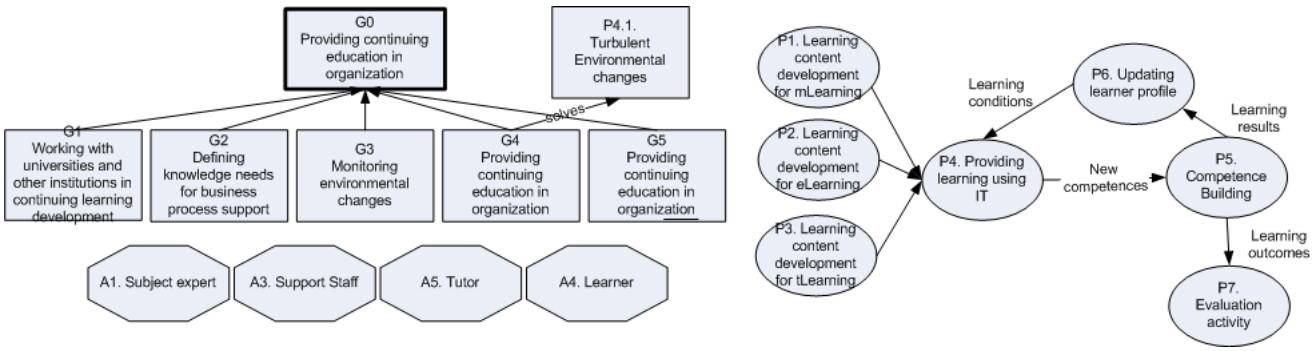

Figure 3. Goal, actor and process model for competence development.

Figure 4. Concept and rule models for competence development.

CONCLUSIONS

The studies undertaken demonstrated specific findings concerning the use of the specific modelling method namely.

The competence development is determined by the synergy between the technologies, learning conditions and the learning profile of each individual.

The use of advanced learning technologies improves competence development. The major improvement is related to self-development, followed by creativity, communication, problem-solving, and analysis.

The t-learning, m-learning, and e-learning technologies demonstrate the positive influence of competency development. We observed that e-learning has the strongest impact, followed by t-learning and m-learning. This corresponds with the global technological development level/experience of the three technologies.

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BIOGRAPHY

Ginta Stale is a lecturer in the faculty of Engineering Sciences at the Vidzeme University College Latvia and project manager at Riga Technical university Distance Education Study centre; she has MSc and Engineer degree in Computer Systems and experience in e-study program and course development for national and international students of IT.
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