

# ICT-enhanced Teacher training for Lifelong Competence Development

"The greatest value of e-learning is in its ability to bring people to people not just people to content." (Stacey, 2003)

**Krassen Stefanov**, *krassen@fmi.uni-sofia.bg*

Faculty of Mathematics and Informatics, St. Kliment Ohridski University of Sofia  
5, James Bourchier Blvd  
1164 Sofia, Bulgaria

**Irina Naskinova**, *irinanaskinova@yahoo.com*

Faculty of Mathematics and Informatics, St. Kliment Ohridski University of Sofia  
5, James Bourchier Blvd  
1164 Sofia, Bulgaria

**Roumen Nikolov**, *roumen@fmi.uni-sofia.bg*

Faculty of Mathematics and Informatics, St. Kliment Ohridski University of Sofia  
5, James Bourchier Blvd  
1164 Sofia, Bulgaria

## Abstract

In this paper we are giving an example of how Information and Communication Technologies (ICT) can enhance the process of Teacher training, and how this can be used for Lifelong Competence Development of teachers. We show how one particular methodology for teaching and training soft skills can be further enhanced by the use of ICT. We show how the use of Learning Design centred software platform for lifelong competence development can enhance the in-service training of teachers.

## Keywords

life-long learning, active learning methods, competence development, Learning Design, ICT-enhanced Teacher training

## Introduction

Although there has been a great deal of research in the field of lifelong learning in recent decades, and substantial research and development on learning technologies in a variety of fields, the cross-section between the two is an unexplored territory (Koper, 2004) – this is a compelling conclusion about the current state of educational software. The specific requirements that come from the field of lifelong learning are not sufficiently reflected in today's leading learning technologies.

One of the basic requirements for an ICT tool supporting lifelong learning is to be able to search for appropriate learning facilities and to plan adequate learning paths to these and other facilities. Such an ICT tool should serve as a learning broker between lifelong learners and learning providers to identify the most appropriate opportunities during the learning lifetime.

The development of a technical and organisational infrastructure for lifelong competence development is the purpose of a EU-funded Integrated IST-TEL project : TENCompetence. The

infrastructure will use open-source, standards-based, sustainable and innovative software technology. With this freely available software infrastructure the European Union aims to boost the European ambitions of the Knowledge Society, by providing all European citizens and other organisations easy access to facilities that enable the lifelong development of competences and expertise in the various occupations and fields of knowledge. The purpose of the development of the TENCompetence Integrated System is to provide a software framework for the effective and efficient support of users who create, store, use and exchange knowledge resources, learning activities, units of learning, competence development programmes and networks for lifelong competence development. The main TENCompetence components are Network of Learning, Competence Development Programs, Unit of Learning and Knowledge Resources.

Competence development programs (CDP) in formal training, as well as in individual flexible training offers, apply contemporary social-constructivist principles of learning, based on the use of knowledge resources in the context of learning activities. The main characteristics of CDP are the use of flexible, modular learning paths based on reusable and shared learning objects, orientation to achieving well known certification, strong emphasis on all accreditation issues, and usage of new forms for collecting evidences of prior learning and competence achievements like e-Portfolios.

Lifelong competence development is indispensable for the knowledge-based economy. A number of surveys in the domain of the labour market identify as crucial and essential for this new economy the ICT-based competences and the so-called “soft skills”. These competences can be considered to be essential for every citizen and worker, and in this respect we can speak about **ICT-enhanced competences**.

In this paper we describe one experiment that tries to show how TENCompetence approach and software infrastructure can be used for the implementation of an innovative and complex training methodology, developed in the frames of the Leonardo project “The Innovative Teacher” (I\*Teach, 2006). For this reason specific CDP for ICT-enhanced competences will be developed, using the TENCompetence software framework, aiming to implement practical methodology, targeted at day-to-day utilization by the teacher trainers and teachers of four identified ICT-enhanced competences in their work (I\*Teach Methodological Handbook, 2007).

### **Competence development programme**

The Competence development program is aimed at providing teacher trainers, pre-service and in-service teachers with integrated online collaborative software environment for attaining the ability to teach ICT-enhanced competences. ICT-enhanced competences (Stefanova & all, 2007) are *soft skills* related to:

- information
- presentation
- working on a project
- working in a team,

which are interweaved in a natural way with the acquisition of ICT competences.

Our main goal is to adapt the training methodologies and curricula developed in I\*Teach Project, which are mainly based on the face-to-face approach, for the use within the integrated online software infrastructure developed by the TENCompetence project. In order to achieve this goal, we are using the Learning Design specification and all related software tools, and thus we design and develop all the training resources and activities in electronic form, ready to be used and re-used through the TENCompetence software infrastructure. As a result, we developed new Competence Development Program, implemented as a part of the TENCompetence software infrastructure, for training ICT teachers how to use and utilize the I\*Teach methodology.

The Competence development program is based on scenarios, involving the learners in activities, related to the real world situations. A lot of research on the learning processes back up the position that learning does not result solely from the provision of knowledge, but from the engagement of the learner in activities into the learning environment (Koper, 2001). One of the major contributions of IMS LD (2003) is that it guides the education providers to start not with the content, but rather with learning activities and the achievement of learning objectives. IMS LD (2003) recognises that learning happens when learners cooperate to solve problems in social and real life project-related situations. However we should point out that the IMS LD (2003) has not been so far fully implemented in a single integrated authoring and learning software environment so far.

The TENCompetence project is based on the use of the Learning Design specification (see IMS LD, 2003) for the formal description of the learning process. The methodology used in the TENCompetence project for developing formal and informal learning activities and units of learning can be described using the following three steps:

- Step one: Description of narrative scenarios of the instruction play, in which the learners will be involved.
- Step two: Development of UML activity diagrams and discussion of the learning flows
- Step three: Formal description of the learning scenarios in units of learning according to the IMS LD specification, including packaging the necessary learning objects, methods and resources in a single reusable and machine readable unit of learning, and aggregating the units of learning into different individual learning paths, according to the individual competence assessment, positioning, preferences, learning style and choice of activities.

Below we provide a detailed description of the development of a Competence Development program for in-service teachers in teaching ICT-enhanced competences, by specifying first the narrative scenarios and giving the corresponding UML diagrams, and next - by giving the detailed IMS LD description of the teaching process by stressing on the learning activities to be performed.

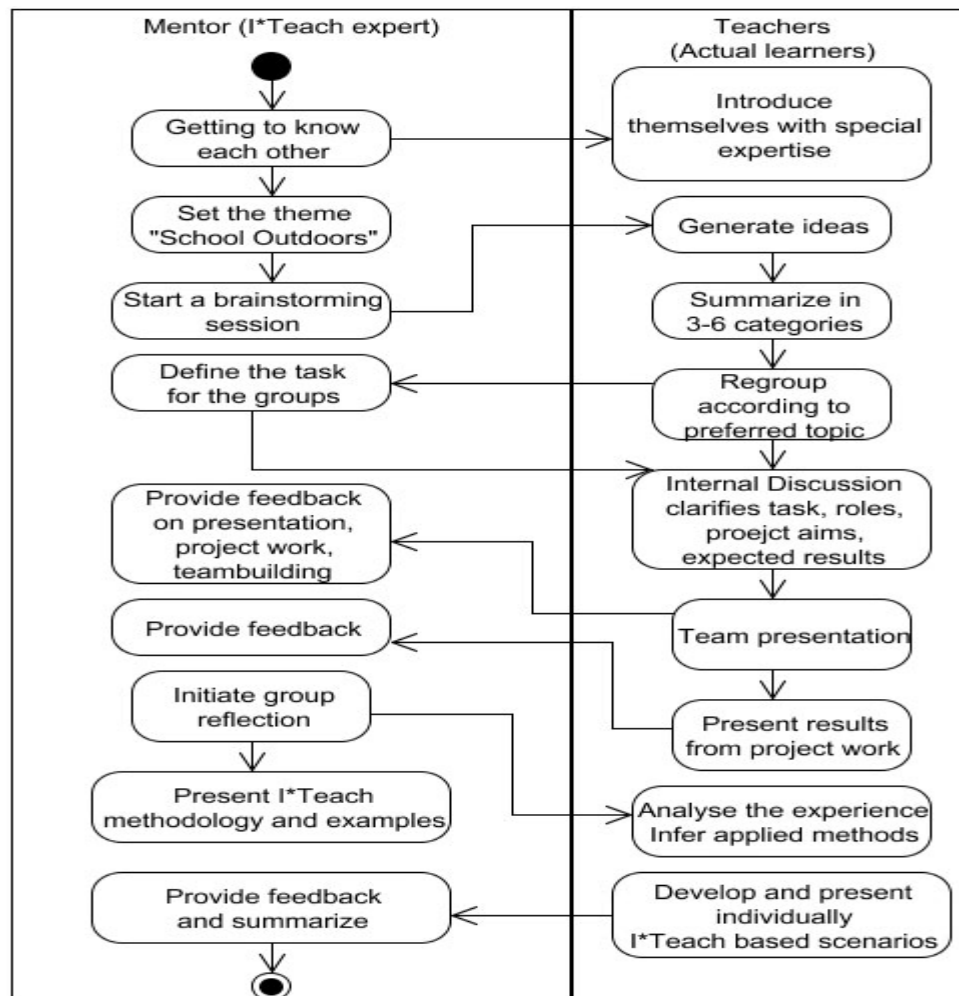
## **Narrative Scenarios descriptions and UML Diagrams**

The learning process starts with some short face-to-face meetings that aim to give the main idea of the I\*Teach methodology, to introduce the software environment (TENCompetence set of tools for knowledge sharing, social communications, individual learning and competence development), and to present the time schedule and main actors in the learning process. After that all teachers continue with their learning in their own authentic environment. They have access to the TENCompetence integrated software framework, and through this framework they are able to learn and work co-operatively with their colleagues, having constant connection with their trainers. They use and share all the available knowledge resources for finding useful examples and case studies, for sharing the results of their work with other teachers and with their mentors, as well as to work co-operatively in a team on a project.

There are three main roles involved: **learners** (individual ICT teachers), **mentors** (experts giving help and support to teachers in respect to the I\*Teach methodology) and **moderators** (experts giving help to teachers with respect to TENCompetence framework and other software tools). The learning activities are actively supported by the knowledge resources repository. The repository collects scenarios and tasks (reusable learning resources), which are the main building blocks, used by teachers in their practical activities.

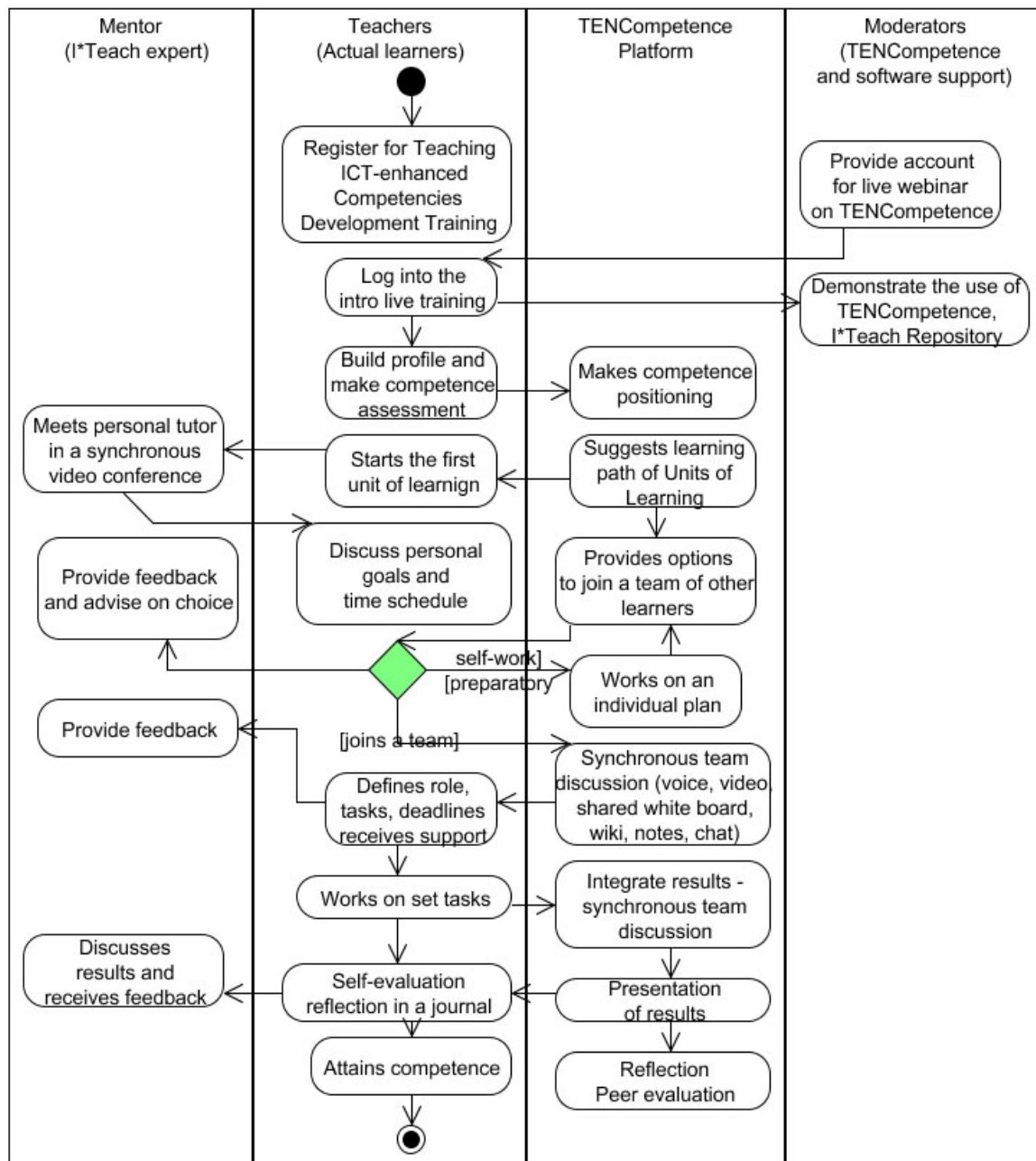
The learning process is composed according to the following schedule:

1. A face-to-face session (two days) aiming to:
  - a) present the main ideas of the I\*Teach methodology (four hours);
  - b) present the knowledge repository, main repository objects, and how to work with the repository (four hours);
  - c) present the TENCompetence framework and client, and short training how to use it (four hours).



**Figure 1.** Example of a Face-to-face Session – Introduction to I\*Teach Methodology

2. Individual work in authentic environment using the TENCompetence framework that aims to:
  - a) identify the teacher's competence level and to define the needed learning path;
  - b) follow all required Units of Learning in relation with the individual learning path;
  - c) participate in all planned group activities and team work;
  - d) use the knowledge repository for inspiration based on some previous developed learning materials, to share results and jointly work on a project with other teachers, to store the final products in a repository;
  - e) perform evaluation of their individual results as well as the results of the other teachers.



**Figure 2.** Example of learning process supported by the TENCompetence Platform and tools

3. Final face-to-face session (two days) that aims at:

- presenting the main results having been achieved by the teachers;
- discussing the strong and the weak points of the methodology and the repository;
- discussing the strong and the weak points of the TENCompetence framework;
- discussing the plans for the further pilots with teachers that act as trainers in an authentic environment, aiming to train pupils and/or lifelong trainees.

Each individual learner is following her/his learning path as generated by the TENCompetence system. The learners use all the collaborative learning components (for sharing products and documents, for looking for help and orientation, as well as for performing the planned group activities) and most of the individualised learning components (for reading, writing, assessment, personal navigation) of the system. Each stage/phase is completed by completing a task or list of tasks. By passing along the set of milestones the school teachers are building up a set of ICT-

enhanced skills naturally interweaved with the predetermined teaching objectives. As a result, the teachers obtain the envisaged new competences.

## Learning Design

In this chapter we will show how the competence development program is implemented by the use of units of learning. A unit of learning is the smallest unit, that incorporates some semantic and pragmatic whole, and provides learning events for learners, that satisfy one or more interrelated learning objectives.

The essence of the IMS LD (2003) specification is a model which can describe many different behaviorist, cognitive and social constructivist approaches for learning. This conceptual model is based on the metaphor of a *theater* and aims to describe an “instructional play”, in which learners are directed to work in teams in order to accomplish some educational objectives. It provides a formal XML schema for description of active learning scenarios. The XML manifest describes a unit of learning, where people act in different roles in the teaching-learning process. The manifest is machine readable and interpretable. It can be easily played in an IMS LD (2003) compatible framework, that could be stored in repositories, retrieved, modified and reused. This approach separates the learning objects, learning objectives and services from the educational method which is applied. The educational method is designed to meet the learning objectives, which specify the desired outcome of the learning play.

### Example of learning objectives definition according to IMS LD

```
<imsld:learning-objectives>
  <imsld:title>Learning objectives</imsld:title>
  <!--To be able to design and perform learning scenarios in the context of their subjects
  according to the actives methods described in I*Teach methodology-->
  <imsld:item identifier="item-26" identifierref="resource-2ec" isvisible="true">
    <imsld:title>Learning objectives</imsld:title>
  </imsld:item>
</imsld:learning-objectives>
```

In a unit of learning, a person gets a **role** in the teaching-learning process, typically a **learner** or a **staff** role. In this role he or she works towards achieving certain **learning objectives**. The person performs more or less structured **learning and/or support activities** within an **environment**, that is composed of learning objects and services envisaged to be used during the performance of the activities. The **learning and support activities** are the pivotal objects in the learning design. They provide a scheme for guided engagement of the learners for the attainment of educational goals. All activities are nested in different **environments** which consist of the appropriate **learning objects and services** to be used during the performance of the activities.

### Example of activities definition according to IMS LD

```
<imsld:activities>
  <imsld:learning-activity identifier="Getting-to-know-each-other" isvisible="true">
    <imsld:title>Getting-to-know-each-other panel</imsld:title>
    <imsld:environment-ref ref="env-f1e346ca-e0b8-2c32-5a94-36783536febb" />
    <imsld:activity-description>
      <imsld:title>Getting to know each other</imsld:title>
      <imsld:item identifier="item-4af7" identifierref="resource-05" isvisible="true">
        <imsld:title>Scenario</imsld:title>
      </imsld:item>
    </imsld:activity-description>
  </imsld:learning-activity>
</imsld:activities>
```

The **method** is a description of the “instructional play”, which makes a unit of learning a single semantic and pragmatic entity in a specific context bound toward the accomplishment of a learning objective. The method consists of one or more concurrent plays. A **play** consists of one or more sequential acts. An **act** is related to one or more concurrent role-parts. Each **role-part** associates every role with one activity or activity structure in a specific environment.

#### Example of method, play, act, role-part definition according to IMS LD

```
<imsld:method>
  <imsld:play identifier="play-7" isvisible="true">
    <imsld:title>Session 1</imsld:title>
    <imsld:act identifier="act-cdb">
      <imsld:title>Getting-to-know-each-other panel</imsld:title>
      <imsld:role-part identifier="rolepart-Learner">
        <imsld:title>Role Part - Teacher Trainee</imsld:title>
        <imsld:role-ref ref="role-Learner" />
        <imsld:learning-activity-ref ref="Getting-to-know-each-other" />
      </imsld:role-part>
      <imsld:role-part identifier="rolepart-Mentor">
        <imsld:title>Role Part - Mentors</imsld:title>
        <imsld:role-ref ref="role-Mentor" />
        <imsld:learning-activity-ref ref="Facilitation" />
      </imsld:role-part>
    </imsld:act>
    ...
  </imsld:play>
</imsld:method>
```

At the level B specific properties and conditions are added in order to allow the learning designer to control the learning activity flow. The properties provide personalization, since they contain information about the progress of the learner and they are being kept in the learner profiles. The conditions can be used to specify different learning paths depending on the results of an individual learner.

The level C adds notification. A notification is based on the outcome of an event in the runtime system. A notification can make certain activities visible and can provide them to a user. This level incorporates a higher level of learning flow control.

The units of learning, that have been developed for each specific sub-competence (skill) included in the Teaching ICT-enhanced Competences Program, are the main building blocks for the specification of different individual learning paths. Each such learning path is formed depending on the results from the competence assessment for the learner, as well as from the positioning of the learner’s competences assessed within the CDP being followed. The learner can choose between different possible learning tracks. In addition, the learning paths can be negotiated within a team of learners that are targeting similar learning objectives. When a team has a common negotiated goal, each individual team player will be assigned with his or her specific objectives. The peer teaching and peer review is strongly encouraged in combination with the opportunity to share individual experiences. In such a way the TENCompetence framework provides a social constructivist environment, in which learners not only share learning objects, resources and knowledge, but they also share successful learning tracks

(learning experience). The best learning tracks will be recorded and provided for future use of newcomers.

The teachers, after becoming experienced users of the framework, might advance and use the TENCompetence platform as a learning design authoring tool as well. TENCompetence and I\*Teach methodology are completely complementary, because both are based on the principles of learning in teams and problem-solving in the frames of real world projects.

Another challenge for the teacher training pilot and the application of some active learning methods is the identified need of designing some new type of evaluation scenarios. IMS QTI (2006) Specification does not thoroughly describe the new forms of evaluations, such as peer review, 360 degree evaluation, e-portfolio assessment and self-evaluation (Schoonenboom & all, 2007). These forms of evaluation require development of new learning designs that combine the IMS LD and QTI specifications. In addition - the implementation of multi-agent based software for competence assessment would be also required (Miao & all, 2007).

## **Conclusion**

We believe that the described above approach would be very appropriate for the in-service teacher training. The teacher trainers would face the challenge to be able to demonstrate some of the ICT-enhanced competences. The Bulgarian teachers, after becoming experienced users of the framework, might advance to using the TENCompetence as a learning design authoring tool as well. TENCompetence and I\*Teach methodology are completely complementary, because both are based on the principles of learning in teams from problem-solving project-based experiences, related to the real world.

The implementation of the I\*Teach methodology using the TENCompetence online collaborative learning environment provides some rich opportunities for validating the TENCompetence infrastructure. The validation will be based on the following assumptions:

- 1) There has been identified an urgent need for development of new ICT-enhanced competences for teachers (Nikolov, 2007);
- 2) The teacher training pilot would require definition, development and management of a complex recursive set of competences.
- 3) The competences that the teacher should obtain are very dynamic since they should follow the requirements of the evolving educational reform and the fast development of ICT. In this respect the competences definitions for the domain should be changed as well. This will let us test the TENCompetence infrastructure functionality dedicated to management of competences;
- 4) The training will be based on some flexible and learner-centred educational models and they should be incorporated into an authentic e-learning environment which is adaptive to the needs and abilities of the trainees. In this respect some features of the Web 2.0 schools should be incorporated into this environment as well.
- 5) The training pilot will be oriented towards building a strong community of practices and learning networks. The social interaction and group work is the main instrument in the training of the new enhanced ICT competences. This means that TENCompetence framework, upgraded with some functionality of Web 2.0 learning environments, would be very suitable for meeting the training needs in the domain.

During next three years, Bulgarian ministry of education is going to implement a massive educational reform that aims to improve the use of ICT in schools. There are several programmes funded by the government dedicated for training and re-training of in-service teachers. These programs would provide a great opportunity to apply and further improve the described approach based on the use of the TENCompetence platform for the implementation of the I\*Teach methodology and training resources.



## Acknowledgement

The work on this paper has been partly sponsored by the TENCompetence Integrated Project that is funded by the European Commission's 6th Framework Programme, priority IST/Technology Enhanced Learning. Contract 027087 ([www.tencompetence.org](http://www.tencompetence.org))

## References:

- I\*Teach Methodological Handbook (2006) "Innovative teacher" Leonardo project, <http://i-teach.fmi.uni-sofia.bg/>
- I\*Teach Project (2006) "Innovative teacher" Leonardo project, <http://i-teach.fmi.uni-sofia.bg/>
- IMS LD (2003). IMS Learning Design Specification. Retrieved February 12, 2007, from <http://www.imsglobal.org/learningdesign/>
- IMS QTI (2006) Question and Test Interoperability Specification, Retrieved February 12, 2007, from <http://www.imsglobal.org/question/index.html>
- Jonassen, D.H., Mayes, T. & McAleese, R. (1993). "A manifesto for a constructivist approach to technology in higher education" in Duffy, T., Lowyck, J. & Jonassen, D. (eds), Design environments for constructivist learning, Springer Verlag.
- Koper, Rob, (2001) "Modeling units of study from a pedagogical perspective: the pedagogical meta-model behind EML", <http://hdl.handle.net/1820/36>
- Koper, Rob (2004) *Editorial: Technology and Lifelong learning*, British Journal of Educational Technology, Vol. 35 Issue 6, Page 675, November 2004.
- Miao, Y., Tattersall, C., Schoonenboom, J., Stefanov, K., & Aleksieva-Petrova, A. (2007). *Using open technical e-learning specifications and service-orientation to support new forms of e-assessment*, in *Proceedings of the TENCompetence Open Workshop on Service Oriented Approaches and Lifelong Competence Development Infrastructures, Manchester GMEX, 11th – 12th January 2007*.
- Nikolov, R. (2007), *Towards Web 2.0 Schools: Rethinking the Teachers Professional Development* (paper submitted for IMICT2007)
- Rasku-Puttonen, H., Eteläpelto, A., Arvaja, M. & Häkkinen, P. (2003). "Is successful scaffolding an illusion? – Shifting patterns of responsibility and control in teacher-student interaction during a long-term learning project". *Instructional Science*, Vol. 31 (6), pp 377-393.
- Schoonenboom, J., Tattersall, C., Miao, Y., Stefanov, K., & Aleksieva-Petrova, A. (2006). *The role of competence assessment in the different stages of competence development*, in H.H. Adelsberger, Kinshuk, J.M. Pawlowski and D. Sampson (Eds.), *International Handbook on Information Technologies for Education and Training*, 2nd Edition, Springer, in preparation, to be published November 2007, available at: <http://hdl.handle.net/1820/871>
- Stacey, Paul. (2003). "People to People not just People to Content - Learning Environments for Active and Alive Content", <http://www.bctechnology.com/statics/pstacey-feb1403.html>
- Vygotsky, L.S. (1978). *Mind in Society*. Cambridge, MA: Harvard University Press.
- Stefanova E., Sendova J., Nikolova I., Nikolova N. (2007) When I\*Teach means I\*learn – implementing a new methodology for building up ICT-enhanced skills (paper submitted for IMICT2007)
- Wood, D., Bruner, J. & Ross, G. (1976). "The role of tutoring in problem solving". *Journal of child psychology and psychiatry*, Vol. 17, pp 89-100.

## Biographies



**Krassen Stefanov** is an Associate Professor at Faculty of Mathematics and Informatics at St. Kliment Ohridski University of Sofia and the Director of the University Computer Center. He has reach experience as Teacher Trainer and in doing research in Technology-Enhanced Learning field. He is main responsible for the Bulgarian national ICT school Olympiad. He is expert in Bulgarian Ministry of Education for implementing ICT in schools.



**Irina Naskinova** is an MSc student at the University of Sofia, but also has experience as software engineer and in teaching in MSc programmes level. She is participating in the TENCompetence project and is responsible for the training of Bulgarian ICT teachers. Recently she was approved for inclusion of the Top Talent PhD program sponsored by the Dutch government.



**Roumen Nikolov** is the Vice-Dean of Faculty of Mathematics and Informatics, and the Director of Centre of Information Society Technologies, Sofia University. He works in the area of e-Learning, e-Work, Software Technologies, Knowledge Management and Innovation and Entrepreneurship. He has been involved in more than 30 projects in the area of ICT in Education.

### Copyright Statement

This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs2.5 License. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/2.5/> or send a letter to Creative Commons, 559 Nathan Abbott Way, Stanford, California 94305, USA.