Development of an electronic course based on the i*teach methodology with the use of the ims learning design standard

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DEVELOPMENT OF AN ELECTRONIC COURSE BASED ON THE I*TEACH METHODOLOGY WITH THE USE OF THE IMS LEARNING DESIGN STANDARD

"I hear and I forget
I see and I remember
I do and I understand." (Confucius)

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The paper is a demonstration of the use of active methods of learning and IMS Learning design (IMS LD) specification for the development of portable and reusable electronic course. It demonstrates 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. The paper shows how units of learning developed according to the IMS LD specification can integrate the contemporary active methods of learning in a web-based learning platform for project-based and problem-based team learning.

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

1 INTRODUCTION

The era of electronic publishing has offered vast opportunities for self-managed learning. The rapid development of electronic media offers learners much more convenient access to essentially unlimited sources of information. Learners become active agents in the process of learning and not passive recipients of knowledge from others. Access to needed knowledge will be faster, easier, more comprehensive, and hopefully much more economical.

Learning through the Internet offers an entirely new horizon with virtually unlimited boundary. Never before in mankind's history has learning been made so convenient, flexible, dynamic, exciting and challenging.

Although difficult and time consuming, active learning has many benefits. Carefully planned, structured, directed activities lead students to discover concepts and develop competences. Abstract concepts become meaningful, transferable, and retained because they are attached to an activity performance. The activities lead to concepts; the students construct the meaning. Learner-centered environments and active learning theory formed the basis upon which the author explored the use of technology for the development of a course for teacher training in ICT-enhanced competences.

2 METHODOLOGY

The ancient philosophers have passed onto us the wisdom of active learning. The current research in the constructivist and active learning perspective was developed in the 1970s. This view is rooted mainly in the works of Bruner (1985), Piaget (1952), Vygotsky (1978) and Papert (1980), and has its foundations in cognitive learning psychology. These educational theorists, often cited as the foundation of these "active" lessons, reveal that active learning involves much more than providing hands-on activity, encouraging class participation, or having students move around the room. Active learning is constructivist or discovery learning, which moves from experience to learning and not the other way around. Constructivist learning is inductive. Constructivist learning dictates that the concept follows the action rather than precedes it. The activity leads to the concepts; the concepts do not lead to the activity.

Ken, Jones (1993) suggests that active learning means participating in events which are facilitated rather than taught, and in which participants are given power. He points out that such training involves people's behaviour, as distinct from simply their capacity to remember, and that instruction and testing should, therefore, concentrate on behaviour. Teaching uses drama, role play simulation, exercises and games.

Essentially, in active learning, the standard classroom procedure is turned upside down – no lectures, no demonstrations, and no presentations. From the beginning, students engage in activities through which they develop competences and acquire concepts.

Active learning is guided by four principles – learners construct their own meaning; new learning builds on prior knowledge; learning is enhanced by social interaction; and learning develops through "authentic" tasks – constructivist learning moves from experience to knowledge and not the other way around. In a constructivist classroom, the activities lead to the concepts; the students construct the meanings. (Cooperstein, S., Kocevar-Weidinger, E. (2003))

The success of action learning relies very much on learners being motivated to learn for themselves (O'Hara et al., 1997). Sandelands (1998) suggests that action learning is synergetically more effective in a set (group of colleagues who are comrades in adversity). Zuber-Skerritt (1995) claims that action learning encourages self-critical reflection and feedbacks from critical friends (i.e. fellow set members). The action learning approach always works with "sets" which encourage executives to discuss, share, pool their ambitions and

experiences, thus creating a Gestalt where group synergy benefit can be reaped (Peters and Smith, 1996).

The electronic course for teacher training in ICT-enhanced competences is based on the I*Teach (Innovative Teacher) project. This project provides practices in designing and developing meaningful and motivational authentic learning scenarios (projects, challenges, activities, assignments, and assessments).

Project-based learning

Project-based Learning (PBL) is a model of carefully designed learning activities that are long-term, interdisciplinary, student-centered, and integrated with real-world issues and practices. A project is an in-depth investigation of a topic worth learning. The goal of a project is to learn more about a topic rather than to seek the right answers to approach to learning that can help all students achieve. (I*Teach Methodology Handbook, 2006)

Problem-based learning

The Problem Based Learning is an individual or group activity which has a specific time span and a result, such as a product, presentation, research. It is characterized with a timeline, milestones, and other aspects of formative evaluation as the project proceeds.

Within the problem based learning, the group or individual is encouraging to follow a self-directed and independent learning.

There are several steps involved in applying the approach:

Presentation of a problem – providing a problem or issue usually encountered in everyday organizational life

Students' involvement in defining the specific problem topic - students select the content areas and nature of the projects that they do

Students' research - students explore the nature of the problem, analyse the issues, and use relevant theoretical frameworks to research possible solutions, dilemmas and conflictions

Reflection: There is considerable focus on students understanding what it is they are doing, why it is important, and how they will be assessed.

Student participation in assessment: students may help to set some of the goals over which they will be assessed and how they will be assessed over these goals.

(I*Teach Methodology Handbook, 2006)

A Model of Active Learning

The model of active learning, that the author has chosen to implement in the shareable units of learning is based on Dee Fink. L (1999). It is based on experience and dialogue. The model is illustrated in Figure 1: Active Learning Model.

This active learning model is based on reflection and experience. Reflection is enhanced by sharing one's thoughts with others (Dialogue with Others) or by journal keeping (Dialogue with Self). These are the two essential instruments used in the developed units of learning.

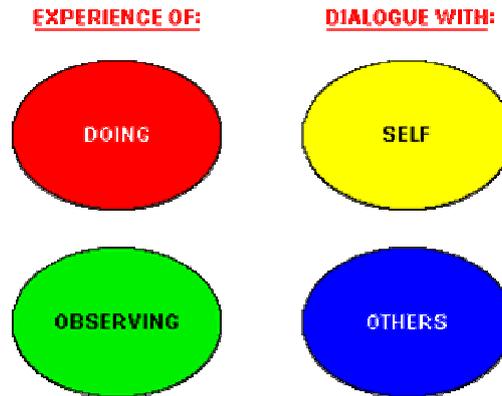There are also two main kinds of experience – "Observing" and "Doing".

FIGURE 1. Active Learning Model

Dialogue with Self

Dialogue with self is a reflection, based on individual work. Students ask themselves questions about the learning process, such as "What did I learn from the experience?", "How did I feel?", "How can I perform better?", "What was missing?", "What did I like and dislike?", "What is my contribution?", "How is this experience connected with my personal learning goals?" These questions address a wide variety of cognitive and emotional concerns. To promote reflection, a teacher can ask the students to keep a journal, or develop a learning portfolio. Other popular ways to motivate students to be reflective is to suggest creating and sharing a personal blog online.

Dialogue with Others

Dialogue with others comes in different forms. The essence of dialogue is to perform there a back-and-forth exchange. Listening to lecture is sometimes considered a "partial dialogue", but it is passive and does not engage students. A more dynamic and active dialogue occurs when the teacher creates small groups to discuss a topic. Students might be encouraged to seek experts in the field of research. This will enrich their knowledge from primary sources.

Dialogue with others can employ different technologies, such as live discussions, forums, synchronous chat discussions, email.

Observing

Observing occurs when a learner watches or listens what someone else is doing within the learning process. This might be watching how a teacher is writing a computer program and explaining each step, or using new software. Also observing takes place in natural sciences, where students watch the phenomenon they study, as in chemistry, physics or biology. There are two types of observation:

Direct – when the students observe the real action;

Vicarious – when the students observe a simulation.

Vicarious simulation may be reading stories of people or watching a film, or using software for simulation.

Direct observation is actually going and seeing what is happening in real-time.

DOING

Doing refers to the learning activity where the learner actually does something, designing software, writing a computer program, using a new tool. Doing is the most intensive and engaging part of active learning. Using simulation software is also a type of doing, known as vicarious "Doing". On the other hand, solving a real-time problem and using the actual instruments is direct "Doing".

Simulation of decision making processes, role playing and other techniques might be termed vicarious doing which teach students how to react in a real on the job situation.

COMPETENCE DEVELOPMENT PROGRAM

The concept of competence has many definitions. Within the TENCompetence project, competence is viewed as:
- a disposition of an actor;
- an attribute of an individual, team or organization;
- a situational adaptability;
- a latent attribute;
- a competence is identified and defined in a community of practice.

The Competence development program is aimed at providing teacher trainers, pre-service and in-service teachers with online collaborative environment for attaining the ability to teach ICT-enhanced competences. ICT-enhanced competences 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.

The competences are called "ICT-enhanced", because ICT improves these competences in three ways.

At first the acquisition of the competence is simplified by ICT, or quickened.

Second, the competence can be deepened by ICT. You can reach a higher level of proficiency.

In the third place ICT can broaden the competence. You can apply the competence on more and different cases. (I*Teach Methodology Handbook, 2006)

Application of ICT in acquiring competences can also been done in three ways.

In the first place ICT can simply be used as a tool. The competence itself has no connection with ICT.

Second, the competence itself, and the tasks to acquire that skill, require the use of ICT tools.

The third type of application is more complicated. ICT and its possibilities have emerged a new type of soft skills that would not exist without ICT. The teacher training program is centered on the following competence clusters:

- Teaching working on a project using ICT competences

The sub-competencies of teaching working on a project using ICT competences are shown in figure 2.
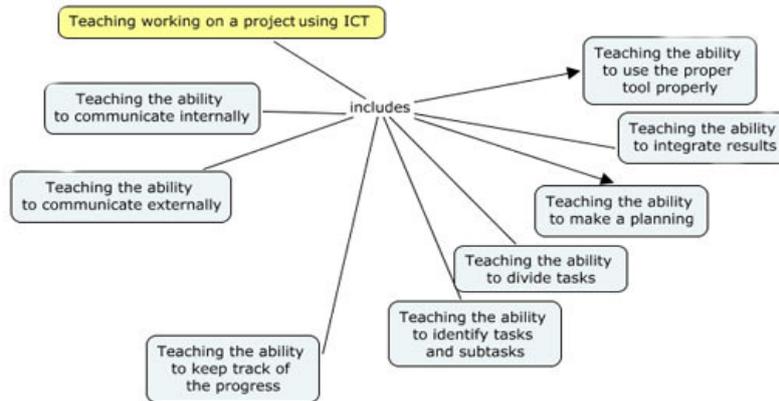
FIGURE 2. Teaching Working-on-a-Project Using ICT Competence

- Teaching working in a team using ICT competences. The sub-competencies of this competence are shown in figure 3.
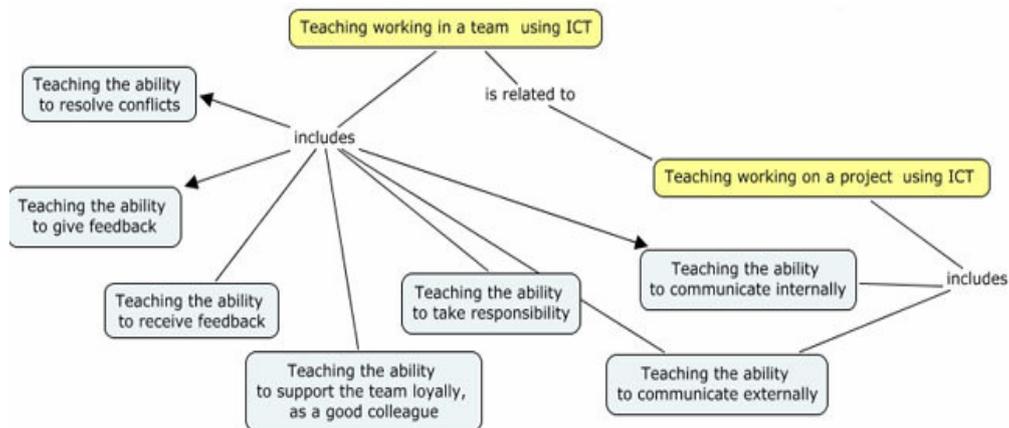
FIGURE 3. Teaching Working-in-a-Team Using ICT Competence

Development of an Electronic Course Based on the I*Teach Methodology…

- Teaching Information gathering and processing using ICT competences. The sub-competencies of this competence are shown in figure 4.
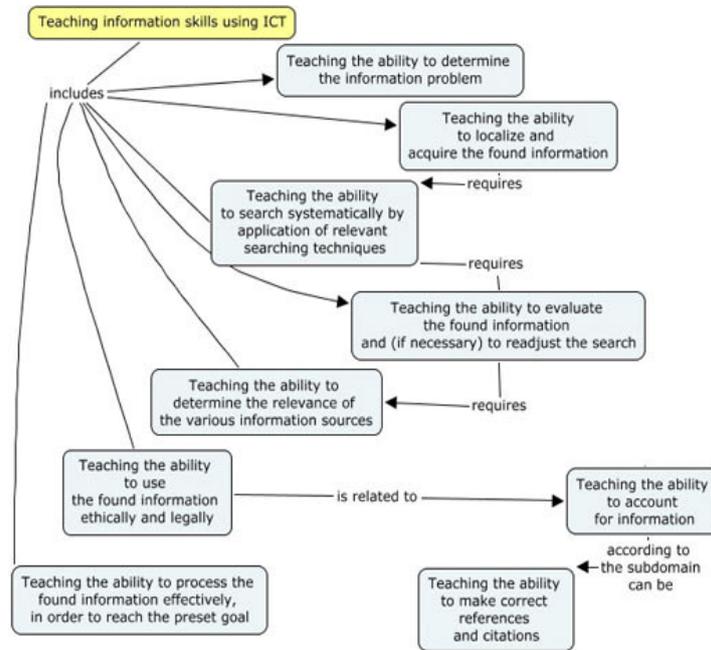
FIGURE 4. Teaching Information Gathering and Processing Competence
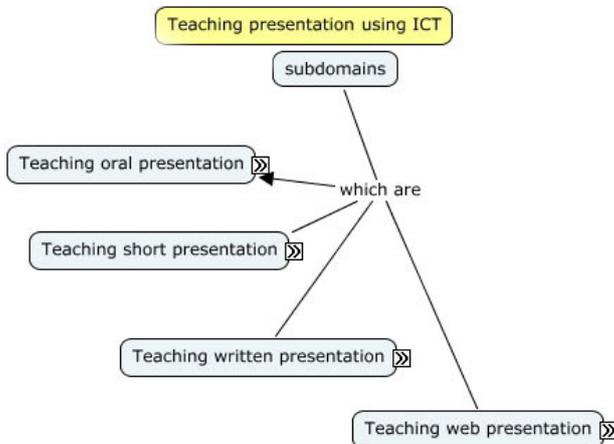
FIGURE 5. Sub-domains of Teaching ICT-enhanced Presentation Competencies

- Teaching ICT-enhanced Presentation Competences The sub-competencies of this competence are shown in figure 5.

The relations between the competencies are shown in figure 6.

FIGURE 6. Teaching ICT-enhanced Presentation Competencies

The Competence development program is based on scenarios, involving the learners in activities, related to the real world situations. The following figure illustrates the components of a learning activity.

3 RESULTS
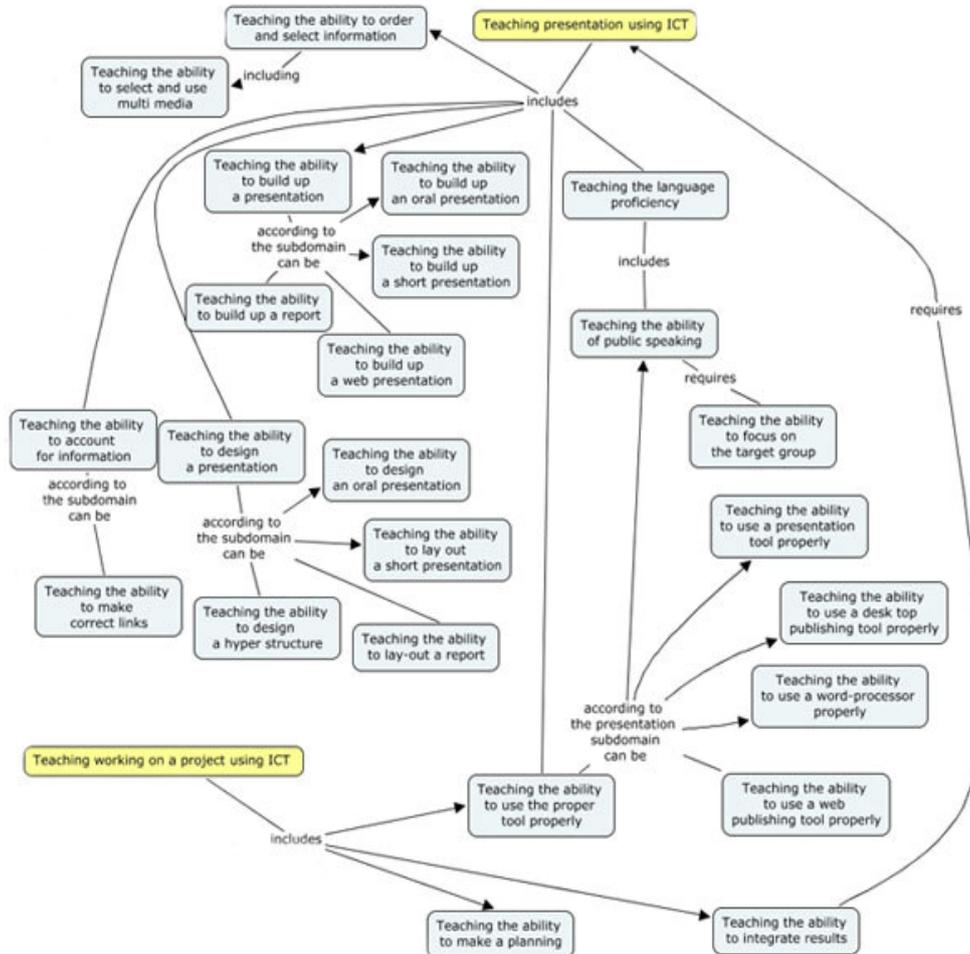USE OF IMS LEARNING DESIGN SPECIFICATION FOR THE DEVELOPMENT OF
THE ELECTRONIC COURSE

The core concept of the Learning Design Specification is a person getting a role in the teaching-learning process. The typical roles are a learner or a staff. Here, the person works for achievement of learning objectives, by following a path of more or less structured learning and support activities. All activities are executed within an environment. The environment consists of learning objects or services. The method contains the actual design of the teaching-learning process, determining which role gets certain activities. This can also be determined by notification.

Each method meets a learning objective – the desired outcome of the learning process. The method consists of one or more play(s). A play consists of one or more sequential act(s). An act is related to one or more concurrent role-part(s), each role-part associates exactly one role with one activity or activity-structure.

There are three levels of implementation of a method.

Level A includes learning objectives and prerequisites, roles, activities, environments, method specification.

A method at level B may contain conditions. The conditions are usually defined by Boolean expressions, which specify a property. A property can be grouped into property-groups. Properties can be of different types, representing respectively global versus local properties and personal versus role properties. Conditions can be If-Then-Else rules that further refine the visibility of activities and environment entities for persons and roles.

A method at level C uses a notification. A notification is triggered by expected results and can make a new activity visible for a role to perform. A notification can be created by one person and refer to another. Notification is also used for adaptive task setting designs, where the supply of a consequent activity may be dependent on the kind of outcome of previous activities.

Activities can be grouped into activity-structures. An activity structure creates a sequence of activities which depend on one another. Also an activity structure can contain a selection. If a sequence is presented to a role, the role has to complete each activity in order to access the next one. In a selection the role is given a choice from a number of activities in the set. An activity-structure can refer to another activity-structure or an external unit of learning. This enables elaborate structures to be defined if required.

Environments can contain two basic types:
- Located learning objects, which are of the following types: knowledge-objects, tool-objects, and test-objects.
- Generic services. A service relates to a concrete service facility available at runtime. Examples of a Service are discussion forums, chat rooms, monitoring tools, search facilities, etc. (IMS Learning Design Information Model, 2003)

IMS LD has not been so far fully implemented in a single integrated authoring and learning software environment.

The purpose of the development of the TENCompetence Integrated System is to provide software 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. The main TENCompetence components are Network of Learning, Competence Development Programs, Unit of Learning and Knowledge Resources.

The Competence development programs are based on units of learning. The Unit of learning is the smallest unit providing learning events for learners, satisfying one or more interrelated learning objectives. It is a semantic and pragmatic completely providing learning events for learners aimed towards the attainment of one or more interrelated learning objectives.

The essence of IMS LD specification is a model which can describe many different behaviorist, cognitive and social constructivist approaches to learning. This conceptual model draws from the metaphor of the theater to describe an "instructional play", in which learners are directed to work in teams to accomplish educational objectives.

The TENCompetence project addresses the development of innovative, standards-based methods and tools for:
– The creation, storage and use of formal and informal learning activities and units of learning.
– The exchange and quality rating of formal and informal learning activities and units of learning;
– The development of new assessment types and the ones included in the IMS QTI.

The TENCompetence tools and framework are used to provide online collaborative learning course on teaching ICT-enhanced competences, described above.

DEVELOPMENT OF UNITS OF LEARNING

The units of learning are developed in 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. Further, the necessary learning objects and the method are packed in a single reusable and machine readable unit of learning. Next, the units of learning are aggregated to develop different learning paths, according to the individual competence assessment, positioning, preferences, learning style and choice of activities.

In this and the Learning Design chapters it is provided an example of the described process of development of a Competence Development program for in-service teachers in teaching ICT-enhanced competencies.

NARRATIVE AND UML DIAGRAMS

The learning process takes place in an authentic environment. It starts with short face-to-face meetings aiming to give the main idea for the methodology of the I*Teach project, to present the software environment (TENCompetence framework, I*Teach knowledge repository and any additional software tools needed), and to present the time schedule and main actors in the learning process.

After that all teachers will continue with their learning in their own authentic environment. They will have access to the TENCompetence framework, and through this framework they will be able to learn and work co-operatively with their colleagues, and will have also constant connection with their trainers. They will use the I*Teach knowledge repository 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 or on a project.

There were only three main roles involved: teachers (actual learners in the environment), 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 teachers' curriculum is formed by several methodological handbooks, describing how the teacher has to teach enhanced ICT Competences. All teachers are involved in various
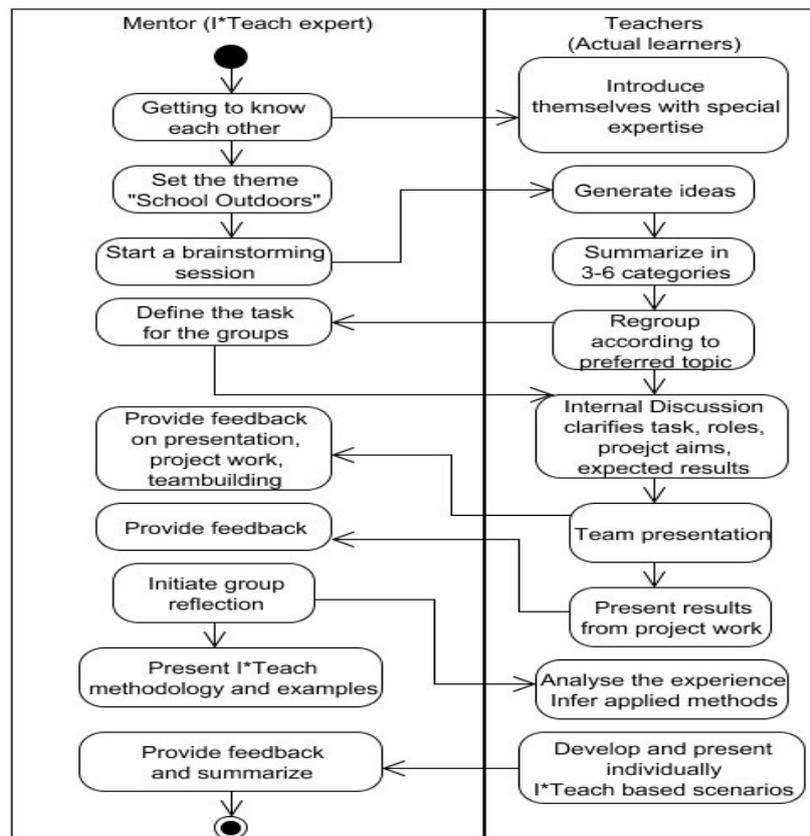

FIGURE 7. Example of a Face-to-face Session – Introduction to I*Teach Methodology

learning activities during the learning process. The learning process will be actively supported by the Knowledge resources repository. The repository collects scenarios and tasks (reusable learning resources), which will be main building blocks, used by teachers in their practical activities.

The learning process will follow the following schedule:

1. Face-to-face session (two days) aiming to:

- Present the main ideas of the I*Teach methodology (four hours)
- Present the knowledge repository, main repository objects, and how to work with the repository (four hours)
- Present the TENCompetence framework and client, and short training how to use it (four hours)

Example of UML diagram of face-to-face scenario is shown in figure 7.

2. Individual work in authentic environment using the TENCompetence framework aiming to:

- Identify the teacher's competence level and define the needed learning path
- Follow all the needed Units of Learning in relation with the individual learning path
- Participate in all the planned group activities and team work
- Use the knowledge repository for inspiration from previous developed learning materials, sharing results with other teachers, joint work on a project with other teachers, storing final products in a repository
- Perform evaluation of own results as well as results from other teachers

Example of UML diagram of individual work in authentic environment using the TENCompetence framework is shown in figure 8.

3. Final face-to-face session (two days) aiming to:

- Present the main results achieved by teachers
- Discuss the strong and weak points of the methodology and Repository
- Discuss the strong and weak points of the TENCompetence framework
- Discuss the plans for the further pilots with teachers acting as trainers in an authentic environment, aiming to train pupils and/or lifelong trainees

Each stage/phase is completed by accomplishing a task or list of tasks. The learner uses all the collaborative learning components (for sharing products and documents with others, for looking for help and orientation, as well as for performing the planned group activities) and most of the individualized learning components (reading, writing, assessment, personal navigation) from the system.

By passing along the set of milestones the school teachers build up a set of Enhanced ICT Competences naturally interweaved with predetermined teaching objectives. As a result, they obtain new competences.
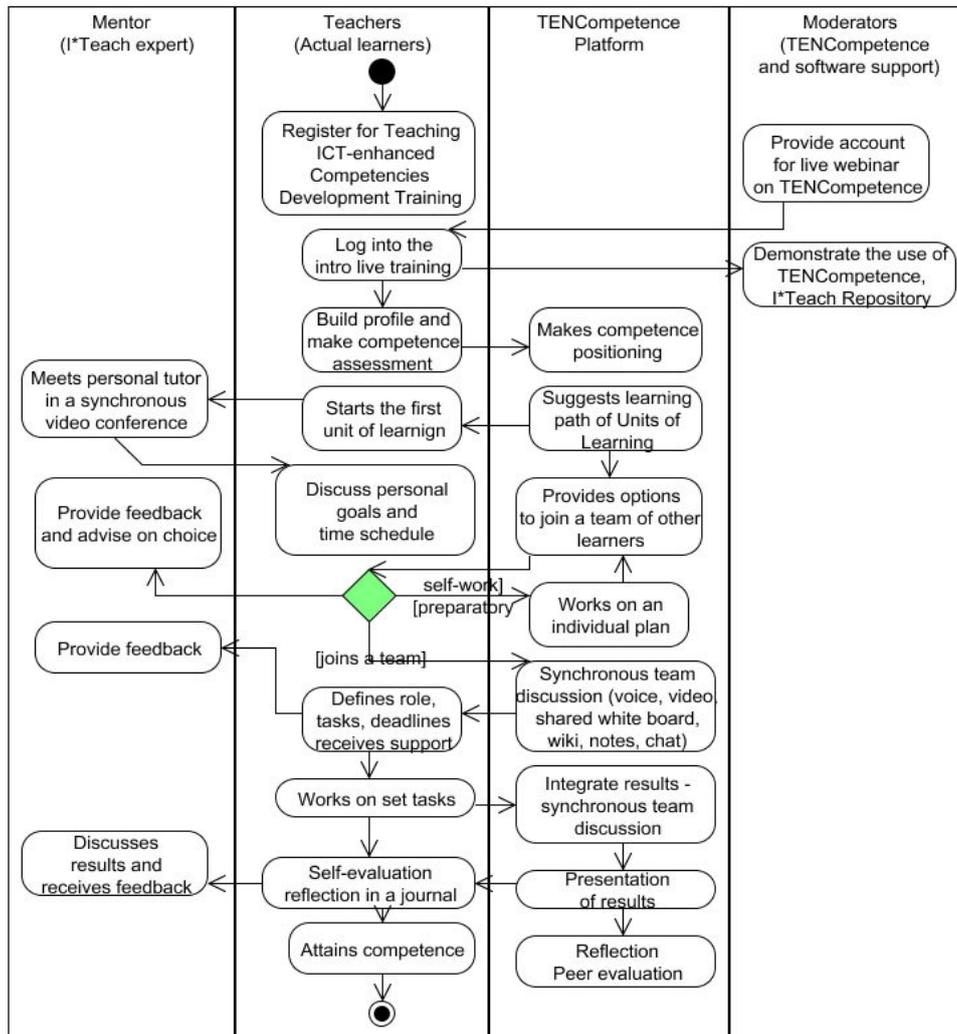
FIGURE 8. Example of TENCompetence Platform Learning

The IMS LD design specification 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 compatible framework, stored in repositories, retrieved, modified and reused. The approach separates learning objects, learning objectives and services from the educational method.

The educational method is designed to meet the learning objectives, which specify the desired outcome of the learning play. The XML scripting of the learning objectives is demonstrated in figure 9

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>

FIGURE 9. Example of learning objectives definition according to IMS LD

The method presupposes specification of the entry level for learners defined as prerequisites. The XML scripting of the prerequisites according to IMS LD is demonstrated in figure 10.

Example of prerequisitesdefinition according to IMS LD :
<imsld:prerequisites>
    <imsld:title>**Prerequisites**</imsld:title>
       <!--Prior knowledge and skills: language proficiency, teaching skills -->
       <imsld:item identifier="item-df5" identifierref="resource-48" isvisible="true">
       <imsld:title>**Prerequisites for "Teaching ICT-enhanced Competencies Development Training Program"**</imsld:title>
    </imsld:item>
   </imsld:prerequisites>

FIGURE 10. Example of prerequisites definition according to IMS LD

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/she works toward certain learning objectives by performing more or less structured learning and/or support activities within an environment, consisting of learning objects and services to be used during the performance of the activities. An example of role definition according to IMS LD is shown in figure 11.

Example of role definition according to IMS LD

```
<imsld:roles>
    <imsld:learner identifier="role-Learner" create-new="allowed" min-persons="1" max-
persons="20">
        <imsld:title>Learner</imsld:title><imsld:learner identifier="role-Learner">
         <imsld:title>Teacher</imsld:title>
         <imsld:information>
          <imsld:title>Teacher trainee</imsld:title>
          <imsld:item identifier="item-26" identifierref="resource-cac" isvisible="true" />
         </imsld:information>
        </imsld:learner>
    </imsld:roles>
```

FIGURE 11. Example of role definition according to IMS LD

The learning and support activities are the pivotal objects in the learning design. They provide a guided engagement of the learners for attainment of the educational goals. An example of the activities definition according to IMS LD is shown in figure 12.

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>
```

FIGURE 12. Example of activities definition according to IMS LD

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. An example of the environment definition according to IMS LD is shown in figure 13.

Example of environment definition according to IMS LD :
```
<imsld:environments>
     <imsld:environment identifier="env-f1e346ca-e0b8-2c32-5a94-36783536febb">
      <imsld:title>Getting-to-know-each-other panel</imsld:title>
      <imsld:service identifier="service-e91" isvisible="true">
       <imsld:conference conference-type="synchronous">
        <imsld:title>Face-to-Face Meeting</imsld:title>
        <imsld:participant role-ref="role-Learner" />
        <imsld:observer role-ref="role-Mentor" />
        <imsld:conference-manager role-ref="role-Moderators" />
        <imsld:moderator role-ref="role-Mentor" />
        <imsld:item identifier="item-b4" identifierref="resource-08" isvisible="true" />
       </imsld:conference>
      </imsld:service>
     </imsld:environment>
```

FIGURE 13. Example of environment definition according to IMS LD

The method is very description of the "instructional play", which makes a unit of learning semantic and pragmatic 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 one role with one activity or activity structure in a specific environment. An example of the method definition according to IMS LD is shown in figure 14.

The above examples provide view of the core components of learning design as specified by IMS LD. They constitute level A. Further, there are two other levels B and C.

At level B, properties and conditions are added which 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 are kept in learner profiles. Conditions can be used to specify different learning paths according to the results of an individual learner. An example of the properties definition according to IMS LD is shown in figure 15.

```
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>
```

FIGURE 14. Example of method, play, act, and role-part definition according to IMS LD

```
Example of properties definition according to IMS LD
<imsld:properties>
        <imsld:locrole-property identifier="prop-b40">
        <imsld:title>Self-evaluation</imsld:title>
        <imsld:role-ref ref="role-Learner" />
        <imsld:datatype datatype="file" />
    </imsld:locrole-property>
</imsld:properties>
```

FIGURE 15. Example of properties definition according to IMS LD

Level C adds notification. A notification is based on the outcome of fan event in the runtime system. Notification can make certain activities visible and provide them to the user. It is a higher level of learning flow control. An example of the notification property definition according to IMS LD is shown in figure 16.

```
Example of notification property definition according to IMS LD

<imsld:glob-property identifier="prop-b">
        <imsld:global-definition uri="email-0009">
          <imsld:title>E-mail</imsld:title>
          <imsld:datatype datatype="file" />
        </imsld:global-definition>
      </imsld:glob-property>
    </imsld:properties>
```

FIGURE 16. Example of notification property definition according to IMS LD

The units of learning developed for each sub competence from the Teaching ICT-enhanced Competencies Program are the building blocks for specification of different learning paths.

According to the competence assessment and positioning within the TENCompetence framework the learner can choose different learning tracks. Also the learning paths can be negotiated within a team of learners with similar learning objectives, within which working towards a common goal, each individual team player will achieve his/her own objectives. Peer teaching and peer review is encouraged as well as sharing one's experience. The TENCompetence framework aims to provide a social constructivist environment, in which learners not only share learning objects, resources and knowledge, but also successful learning tracks. The best learning tracks will be recorded and provided for future use of newcomers.

4   CONCLUSION

The article demonstrates how to include ICT in the classroom teaching environment and to focus on learner-centered teaching and learning strategies. This constructivist-based active learning environment also enables students to build their problem-solving and collaborative competences as well as their creative and critical thinking abilities in order to meet the rising demands of twenty-first century organizations. The research provides concrete applications for how to access student knowledge and implement active learning techniques in the classroom, using active learning methods applied in the Innovative Teacher (I*Teach) Project and developing shareable and reusable units of learning according to the IMS Learning Design Standards and TENCompetence framework.

However, although IMS-LD seems to provide a potential solution to developing reusable online courses, its practical use is hampered by a much too complex flow of production. The UML modeling and the translation of the activity diagram into the IMS-LD concepts of activities, activity-structures, and proprieties are out of reach of the typical staff in an educational context. Unless both the visual modeling of the learning activities and the generation of the compliant XML files can be integrated into the usual pedagogical design

practice of the teachers, the large-scale use of the specification will remain an unviable option for regular teachers.

While assumedly a technical and commercial challenge, the missing integrating product can easily be described: an IMS-LD compliant Learning Management System that would provide the course framework and set of tools, equipped with a visual learning activities design tool which would allow the teacher to sequence simply activities and type in instructions and resources references.

A natural and intuitive production process could then be implemented, ensuring that teachers' work and creativity are not at risk of being lost.

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