

Innovative learning stories for teachers based on latest IT technologies

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Abstract— This paper deals with new ways of teaching and learning with major support of new technologies and software solutions in primary and secondary schools. Children are keen to use new technology, mobile devices, and internet applications. They use it more for out of school activities. School has to explore the potential of new technologies and offer curricula in attractive way. Connection between traditional and on-line content should be found, linking existing educational objects into IP world is necessary. Teachers are facing new challenges how to teach in a new setting different generation of pupils. This paper brings review of some tools and presents selected learning scenarios which should help to do so. Paper also presents project iTEC funded by European Commission which helps to solve some of the problems that teachers are facing. The research project wants to identify trends for future classroom, recognize best practices and test them in 1000 classrooms throughout the Europe.

I. INTRODUCTION

Fast development in field of computers, networking and mobile technologies has already begun to transform the way how schools teach and learn. ICT is no longer fear for some teachers and they do understand the need to implement at least some software and hardware gadgets into teaching. For example social networks could offer excellent tools for communication and content sharing. Latest mobile phones and tablet PCs offers high computing power which enables delivery of the multimedia content like videos in HD. Search engines allow finding answer on many questions in seconds. Libraries in schools do scan and recognize text in books into on-line databases as reading and searching in traditional way seems to be very obsolete for pupils.

These changes require to identify and select proper scenarios for teaching and to select right tools in order to improve educational process. Question how to attract pupils to study and to prepare them well for life is worldwide issue. Leaders in field of education across European countries have recognized the real need for change in curriculum with the development of ICT. There is a broad wish to extend and exploit the potential for knowledge dissemination, more effective learning and the development of efficient education services in support of reform goals at affordable cost. Some proponents argue that reforms using ICT are intended to ensure equal access to educational opportunities and quality education appears in many ways to be dependent on the effective deployment of ICT.

Areas where change is needed in order to achieve a transformation of education include goals and objectives, content and its sources, evaluation and assessment, structure of learning activities and interaction between participants. Also there is need to redefine job descriptions and working habits and awareness of parents and society.

ICT has the potential to create new, open learning environments, play an instrumental role in shifting the emphasis from a teacher-centered to a collaborative, learner-centered environment. The real need is to enhance the role of students from passively receiving information to being actively involved in their own learning. This involvement should help to address new roles which teachers need to play in preparing students for an emerging knowledge-based and technology-driven society. ICT could also support long-distance exchange and interaction between geographically spread groups of teachers and their students.

II. EU PROJECTS FOR EDUCATION EVOLVEMENT

During last few years European Union has funded and presented a lot of projects in the field of primary and secondary education. Authors had an opportunity to be involved into two very interesting ones which are shortly presented below.

A. Project eMapps.com

First project named eMapps.com (Motivating Active Participation of Primary Schoolchildren in Digital Online Technologies for Creative Opportunities through Multimedia) brought idea of gaming into schools and created real application [1].

The main objectives of eMapps.com were to build communities of creative, networking children in the New EU Member States (NMS), generating their own cultural content and communicating with peer groups in other countries and to contribute to the growth of a community of teachers who are aware of the potential for change through 'schools without walls' and who exchange knowledge and experience through communication with counterparts in other NMS countries.

Project has developed adaptable interactive tool (primarily games played on a mobile platform) with which delivered learning objectives and which helped to integrate the use of ICT in the delivery of the school curriculum. Project also targeted goal to establish processes and facilities for teachers and children to access relevant digital content available through a variety of sources while playing the eMapps.com games - and to

make the multilingual and multicultural local content created during the games suitable for sharing and repurposing for use in the wider eLearning context of schools and children in NMS.

One of the most interesting ideas of the eMapps.com project was to create a child's living map of Europe, based on geography, history and heritage, accessible through mobile devices, which can be continuously expanded as an important and rich content resource for schools in NMS and elsewhere [1].

B. Project iTEC

iTEC (Innovative Technologies for an Engaging Classroom) is a four year, large-scale project that takes an informed look at the potential classroom of the future. The key aim is to develop engaging stories for learning in the future classroom that can be validated in a large-scale pilot and be subsequently taken to scale [2].

Starting in September 2010, iTEC will bring together policy makers, researchers, technology suppliers, other technology-enhanced learning experts and innovative teachers in order to design and build scalable learning and teaching stories for the future classroom with recognition of the realities of pace of the educational reform process. Rigorous testing of these future classroom scenarios in large-scale pilots will then be carried out in order to significantly increase the possibility that innovation can be mainstreamed and taken to scale when the project ends.

iTEC, therefore, will explore a vision of the future where schools will remain the key location for learning and assessment as part of a wider network of physical and virtual learning locations. In doing so, the project recognises that the learning process will increasingly engage with other stakeholders including parents and cultural and business sector members and draw in adult and informal learning. iTEC also begins with a clear understanding that the starting point for change is current teaching practice and that educational policy making in the real world must be understood as the context for this change. The project will not only examine how innovative technologies can be deployed but also the underlying change processes that are required in order for innovative teaching and learning practices to be mainstreamed and taken to scale.

iTEC objectives are [2]:

1. To develop and refine a range of teaching and learning stories that include new approaches to assessment, (developed by project partners and teachers themselves) for the future classroom in order to engage teachers and pupils together with other stakeholders contributing to pupils' learning and growth.
2. To develop decision support criteria (technological, pedagogical and policy-related) that facilitates the selection of stories that can be mainstreamed and taken to scale.
3. To develop specific teaching and learning activities, also involving new approaches to assessment, based on the scenarios and test these in a pre-pilot phase with a focus group of teachers, with a view to determining which of these have the potential to be mainstreamed in a number of countries.

4. To carry out large-scale pilots in up to 1,000 classrooms in at least 12 countries exploring both the integration of technologies and how these impact on teaching and learning practices and the engagement of a wider group of stakeholders outside the school.
5. To research the skills and competences needed by teachers in the classroom of the future and to equip teachers and ICT co-ordinators, both within and beyond the project, with the pedagogical knowledge and skills needed to implement project stories.
6. To evaluate the extent to which the iTEC stories have been successful in supporting collaboration, individualisation, creativity and expressiveness and identify those with maximum potential to have a transformative effect on the design of the future classroom. Also to identify the underlying change processes necessary to bring about this transformation.
7. To widely disseminate project results and ensure they can be taken to scale by implementing a mainstreaming strategy that includes the formation of a new high-level body at European level to ensure that iTEC stories and work in the large-scale pilots contribute to the educational reform process.

III. PROJECT iTEC LEARNING STORIES

Project iTEC consortium partners under the leadership of European Schoolnet (consortium of Ministries of Education) have created several stories [3] how education should be modified in order to implement new technology and techniques into classes. Three of nine created scenarios for the first project cycle were presented to teachers in Slovakia in order to gather feedback and to evaluate feasibility in such scenario implementation. Full texts of these three scenarios will now follow. All the stories were distributed by the partners and tested in their countries.

A. Recognizing Informal Learning

Students document and reflect on their informal learning that occurs outside of school. They upload this onto a portfolio and share their learning with teachers and parents where appropriate.

Ms Fierro recognises that Paulo, like several of the students in the class, does a lot of work outside of school but is less interested in the formal curriculum. As a result the school has created a space for students to share their out-of-school experiences as part of their formal school curriculum, which offers students the opportunity to get formal credits for their out-of-school activities where appropriate. Paulo collects and documents evidence about the skills and knowledge he gains when involved with his hobby, skateboarding. He places all the evidence he collects onto his online portfolio. This is provided by the school, but accessible from anywhere that has an internet connection. He collects evidence in a range of formats including scans of the designs he has created for skate logos and skate clothing, photos of the different stages of him building a ramp, and a video of other skaters using his ramp at a competition. He captures this evidence using a range of different tools, including his mobile camera, a

friend's video camera, uploaded computer created designs, and paper drawings which he has scanned in at school.



Figure 1. Recognizing Informal Learning Story

Once a term Paulo and the rest of the school have the opportunity to present their collected evidence at a 'show and tell' gallery that happens in school. Paulo can also present his work to an individual teacher if he feels uncomfortable sharing it with a wider audience, but he is happy to share it with other students. Teachers from different subject areas view the students' work and decide if they can use the evidence to support formal assessment. Ms Fierro teaches design and technology and decides that she can use Paulo's evidence to support his accreditation in this subject, particularly in the areas of 'use of materials and their construction'.

Paulo's online portfolio has a 'school' and 'public' setting which means he is able to share selected parts of his work with anyone in the school, or with a wider audience. He is asked if he wants to share his work with his parents using the share settings on his portfolio but he declines.

B. Reacting to Student Feedback

Building on the range of digital resources that already exist, teachers have access to a Learning Management System (LMS) in which students can record responses based on understanding and progress using a student response system. With this information they can adapt their teaching style appropriately.

As a newly qualified teacher, Mr Kowalski uses a range of digital resources to increase the amount and quality of support he gives to his learners so to provide more tailored formative responses to his students' progress. Mr Kowalski is encouraged to investigate his students' understanding by monitoring their progress through an interactive response system which is used throughout the school. Mr Kowalski asks a mixture of open and closed questions throughout the lesson, and depending upon the student's responses (which are returned as a mixture of numerical votes and free text responses,) he changes his pedagogic approach to make sure he revisits areas that students are challenged by and quickly builds upon areas where they have good understanding. Seeing two students respond with detailed written responses, he asks them to

sit with four students who struggled with a previous question to act as peer mentors, whilst he revisits some work with another group of students.

The student response system is linked to the school's LMS which ties student's responses to other data, giving Mr Kowalski and other teachers a better insight into students' progress and development. By using this more detailed understanding of his students, Mr Kowalski alters the students' groups and the activities he sets them.

In order to provide greater structure for his students' learning, Mr Kowalski uses this more detailed understanding of his students' interest and knowledge and accesses an education 'app store' to find appropriate resources for different students. Accessing the 'app store' from his laptop, Mr Kowalski adds specific resources to the names of different students that he thinks will benefit from a particular resource. By doing this, specific resources are linked to a 'graduated lesson plan' that



Figure 2. Reacting to Student Feedback Story

allows his students to access further resources, linked to their progress and concerns, which are captured by the interactive response system. The four students who were struggling with some key concepts have access to a video of an older learner explaining a key issue, whilst two students who demonstrated a good understanding access a set of challenges that ask them to plan an applied project.

Mr Kowalski continues to monitor the students' work through the LMS, the interactive response system and by talking with students as they continue with their work. Towards the end of the lesson, Mr Kowalski asks each group to rate the resources that they have used which add to the overall ratings of each resource in the 'app store'. By observing these ratings and by using all of the monitoring opportunities available, Mr Kowalski develops a deeper insight into the progress of each student, which informs his use of the graduated lesson plan for future lessons.

C. Outdoor Study Projects

The students go out to explore the school grounds tasked with a problem or challenge. They have to either capture authentic data, or explore how concepts can be applied in the real world.

Ms. Rossi, a science teacher, has been liaising with the geography teacher and they have noticed that their students need to develop a more in depth understanding of the local natural environment and wildlife. Ms. Rossi has also noticed that although her class works well as individuals, they would benefit from more group learning. She decides to get the group to work collaboratively on a problem based activity to do with nature and the local environment. When deciding on a specific activity for the class she liaises with the geography teacher to ensure the chosen activity could also support learning in geography. She sets her class the challenge of finding out why the population of ladybirds has decreased in the school grounds over the last year.

Carmen, a student, goes outside with her group to collect real data to help the class's investigation. Each group member has a different role and a different instrument to capture authentic data. Carmen uses her mobile phone to capture images of the areas where most ladybirds live, whilst others in the group record the temperature and survey habitats. Ms. Rossi lets the students work together in groups so she can take the role of observer and coach. This helps her understand what skills the students need to practice. She notes down what skills the students need to develop to help her design future learning activities. She realizes the group need more training on using instruments without disturbing wildlife, and also how to set specific group goals.

After gathering a series of photos Carmen comes back to class with her group and they share their data and findings with each other. They get some specific support from Ms Rossi on how to use a software package to draw conclusions from the group's numerical data. Having drawn their conclusions, the group choose to create a short film from their photos and data to share their findings with other students in the class. They work together using laptops and a web tool to create a short digital film explaining what they found. Carmen and another student upload their photos while the rest of the group writes a script to present their findings. They each record a part of the presentation script and use the automatic editing software on the web tool to create the film. This film is posted on the school's learning platform for the class to view for homework, and also for students in a geography



Figure 3. Outdoor Study Projects Scenario

class, who are doing similar work, to comment on. The group also decides to post it on the public area of the learning platform so they can show their parents/carers when they get home.

IV. FIRST CYCLE FEEDBACKS COLLECTED IN SLOVAKIA

Presented three stories were evaluated by two experienced teachers at Secondary grammar school in Spisska Nova Ves, Slovakia. School was selected randomly, feedback does not represent general idea in Slovakia but teachers provided very valuable comments. Some notes based on face-to-face meeting is presented below.

A. Recognizing Informal Learning

Presented story was very attractive for teachers and following comments were collected:

- selection of the presented activity should be consulted with teacher first,
- some definitions of what is expected are needed, sure creativity is required from student mostly
- motivation (marks) to do the task should be interesting for them,
- online portfolio for such sharing is missing at the school, but any internet platform should be accepted,
- some older teachers (in general) probably will not accept such way of presentation due to their lack of modern technology skills,
- although this story is targeting students who do not like formal learning, teachers expect that the most active ones will be medium and better students,
- teacher will need to find the key how to encourage shame students to present their out of school activities,
- motivation is that students are encouraged to use technology they like – teacher will see how they are able to present it using “their generation” language/technology,
- both teachers see the problem also in sharing students outputs with other teachers at the school – how to motivate other teachers to find time for seeing the portfolio if many students attend such a presentation,
- subjective marking scheme – if teacher does not like the presented activity (e.g. graphitti) marking could be a problem (presented subject could hide the work of the student),
- for some teachers it could be motivating to participate in such way of teaching – not only because some of the student activities are interesting, but also they will see many new technologies at work,
- presentation of activities which are close to presenters (students) should help to evolve presentations skills – e.g. not focused on what to present, but how to present it in an attractive way.

B. *Reacting to Student Feedback*

Presented story was welcomed by teachers (probably it is more attractive for teachers than for students) and following comments were collected:

- Learning Management Systems as tools are very welcomed by teachers and they see them as great tools not only for students but also for themselves,
- problem that was presented by teachers immediately after reading the story could be summarized as “missing LMS installation in school” and “missing administrator” for such tool – rest of the discussion is presenting story as we have such tool and unlimited sources for usage of that tool,
- LMS will be probably attractive only for good/active students. We were not able to find motivation factor for “lazy” students to “wake up” and use offered source of content for study (even from Application store),
- Feedback from students – great! For teacher who is interested in quality of offered curricula this will definitively help. But it will require a lot of time to spend with feedbacks and with finding of attractive and user-adapted learning sources.
- Time is the weakest point in this story. Teachers like when provided “tools” save their time. Here it will need a lot of time resources in the adaptation phase, but later it will be great storage of learning objects.
- The software solution for voting should be the only possible way for feedbacks. There are insufficient funds for such hardware solutions at most of the schools in Slovakia.
- Due to the school reform (which is in progress recently) in Slovakia some subjects do miss officially approved books – LMS with digital content should be great for students in meantime.
- App store – great idea! We miss such a repository in Slovakia. No matter if content will be for free or not – learning objects are difficult to find for many teachers. What about of exchange of student created learning materials by students? Motivation?

C. *Outdoor Study Projects*

Last presented story teachers commented as great idea with high potential to be interesting for students. But there were some comments presented:

- How big the groups should be? If small – good for the results, good for the involvement of every member. But more teachers have to go out with the group during activity (given by law) – missing teachers.
- Typical school hour has only 45 minutes in Slovakia – too short time period to go out and do something.
- Teachers are skeptical that this can be done during normal subject hours – a lot of formal learning has to be done during normal classes – it is defined by national curriculum plan. This activity should be only as part of after school activities.

- Students for sure will like such learning – it is new for them, they’re out of class, they can work with technology.
- Outdoor activities will be limited only to school surrounding – more teachers are required to monitor children at given type of lessons.
- School needs to buy some technology (video cameras, cameras, microphones, GPS, sensors ...) in order to implement this story. Multiple same type devices are needed – problem for many primary schools.
- If multiple groups are outside for an outdoor activity – every group should have a different task. To work on the same topic is demotivating for the groups.
- Overall feeling from story is very good, but implementation is possible only as part of after school activities.

V. SOFTWARE TOOLS AVAILABLE FOR TEACHERS

Important part for implementation of new teaching practices is to have proper tools in hands. In our case it is software for communication, sharing, presentation, evaluation and marking. Many applications already exist but still most of the teachers are not familiar how to use them in teaching. Following part of this article will shortly present just few of them as for inspiration.

A. *Web Applications*

There are a lot of web services available on market providing content sharing and collaboration. The most known services are provided by Google, Microsoft or large software players. For example, Google during last years presented many interesting web-based applications like Google Docs for creating, editing and sharing of various documents for public or defined group. Also collaboration and versioning is helpful for students with same tasks, creating common document. Google Sites allows simple creation of webpages for schools projects, wikis for bigger content libraries. No matter how information are analyzed by Google, for teacher usage of this tools help to collaborate with student groups using simple user interface and wide sharing capabilities. Most of the applications are available as free service.

B. *Learning Management Systems / Course Management Systems*

As teaching is complex process it involves also content sharing, testing and marking. For this reason Learning Management Systems (LMS) and Course Management Systems (CMS) were developed. One of the well-known CMS/LMS is Moodle [4]. Moodle has several features considered typical of an e-learning platform. Some typical features of Moodle are [5]:

- Assignment submission,
- Discussion forum,
- Files download,
- Marking,
- Moodle instant messages,
- Online calendar,

- Online news and announcement (College and course level),
- Online quiz,
- Wiki.

Some other well-known LMS/CMS are Chamilo, Haiku, ILIAS, Blackboard, Open LMS, etc. Most of these solutions are available as freeware.

C. Testing tools

One of the most time consuming tasks for teacher is verification of real student knowledge and skills. Recently market offers wide variety of tools for testing which allows to test student in real time and to show final score. Moodle could do this task, almost every LMS/CMS. But these systems do not offer generation of new tasks based on pre-defined mathematic formulas and are not able to display personalized recommended step by step solution. This is solved by application named GENEXIS [6]. It provides functionality to create, update and spread the latest educational content developed by the governmental services through Internet. It allows creating unlimited amount of training options on any subject as well as gives opportunity to monitor student's progress throughout the study process.

Major difference between GENEXIS and other systems as Moodle is content editor that allows teachers to create exercise templates. Based on these templates GENEXIS generates multiple variations of one exercise. This way each student can receive an individual exercise for homework or test or else can train on one exercise template several times as new exercise variation is generated each time. When student completes the task system evaluates the result and shows the solution process enabling student to "learn-by-doing". GENEXIS is licensed on per-school license [7].

D. Social Networks

Services like Twitter and Facebook completely changed life of millions of people all around the world. Sharing instantly what is on my mind to tens of hundred several times a day from everywhere using even mobile devices made a small revolution in life of pupils. These services have potential to be used also for educational purposes. It requires that teacher will prepare interesting tasks for pupils together with methodology aiming educational goals of given subject.

CONCLUSION

This paper presents some ideas related to share best practices of teachers with application of the new information technology developments. Several EU funded projects in last years were trying to define new methods and methodology which will lead to better educated young generation. As society and customs are changing school needs to be flexible to reflect it in proper way. Three presented stories are result of EU project iTEC which is now in its first phase.

Paper also presents some comments of teachers who are skilled and have years of experience in Slovak educational system. These teachers believe that in future more and more learning will occur outside traditional class rooms. Some schools are moving online to 'virtual school', building on-line community of students, staff and parents. Everything is possible thanks to simple access to Internet at home or at work. Due to this fact students can work on projects either from school or home, can be creative, communicative and innovative. It is important to foresee future ways with support of the latest hardware and software solutions.

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