

# From a “Flap of a Butterfly Wing” to the “Wind of Change”

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## Abstract

The paper deals with a specific case of the authors' experience in combining new technologies with innovative pedagogical approaches inspired by the Papert's constructionist ideas. During the *Audio-Visual and Information Technologies in Education (ATIVE)* course in the e-learning Master of Science program, the students and teachers started joint research on a topic “We'll meet again in 10 years” with emphasis on the future of education. The main goal of the course leaders (the first four authors) was to put in action different approaches for effective learning. The constructionist idea for creating a meaningful product (containing something new) was implemented by means of ICT social networks where all intermediate products were shared and discussed.

The paper presents the activities and the first results of the *School-of-the-Future* learners' team (the last four authors) - studying recent research, writing analytical reports on the current situation, designing and conducting questionnaires and video interviews with students of different ages, processing them and presenting the results).

The overall experience within the *School-of-the-Future* project made the course leaders optimistic of the potential of *collective intelligence* when harnessed in the development of a school model based on the lessons learned by the older generations and the dreams of the younger ones.

The work described is still in progress. Even if we think of the first steps being made as a “flap of butterfly wings” we surely wouldn't like to cause an educational tornado. But we could hope for a “wind of change” at least...

## Keywords

School of the future, ICT-enhanced skills, Teacher training, Team work, Work on a project

## Introduction

*If you do not design the future someone or something else will design it for you.*

Edward de Bono

Nowadays the dynamic changes in economics, technology, political and social relationships have a crucial impact on the process of education. We shall focus on three aspects of these changes. The first one refers to the **requirements of the society** concerning the *products* of education. The business needs young people with good working-in-a-team and working-on-a-project skills. The company leaders are interested in workers with well-developed information- and presentation skills. They expect that schools and universities will provide them with such employees. At the same time the creativity-based society we are striving for puts emphasis on developing the creativeness of young people. In 2009 (The European year of creativity and innovations) the Institute for Prospective Technological Studies at the European Commission's Joint Research Centre started a large research project to identify if and how the educational institutions in different European countries contribute to the development of creativity. It focuses on the identification and development of gifted students, on the interdisciplinarity of education, on the application of ICTs in education, etc. The idea of lifelong learning has also matured and many European projects direct their efforts to its realization. The best way education can meet such expectations has been summarized by Seymour Papert (1999): *The choice we must make for ourselves, for our children, for our countries and for our planet is to acquire the skills needed to participate with understanding in the construction of what is new OR be resigned to a life of dependency.*

The second aspect of recent changes in the educational process is associated with **the educational environment**. The revolution in ICTs influences the infrastructure of schools and universities. Most learners have access to various electronic devices and to the Internet. Furthermore, research centers and technology oriented companies developed different types of educational software and Internet applications supporting lifelong learning, communities of practices, etc. Technology environments and tools for social networks cross the boundaries of personal life and enter school life.

The third aspect of recent changes in education is related to the **development of innovative pedagogical approaches** in accordance with society expectations for high-school- and university graduates. The approach appearing to be the most relevant with these expectations is *constructionism* (Papert, 1999) referring to everything that has to do with learning by making, with experiencing the construction of a meaningful product which could be presented and shared with others.

Some fundamental ideas of constructionism in action as experienced by the authors are presented further in the paper.

## The Context

The research under consideration has been carried out in the frames of *Audio-Visual- and Information Technologies in Education (AVITE)* - a compulsory course for pre-service and in-service teachers at the Faculty of Mathematics and Informatics at the University of Sofia *St. Kl. Ohridski*. Since the AVITE course is a crossing point of technology and pedagogy it is natural that it has been dynamically changed in the last five years. The sessions (both lectures and the hands-on activities) are lead by a team of teacher educators striving to implement the best practices in integrating ICT in education as identified within recent European projects in the field.

## The Actors

There were thirteen trainees in the course considered in the paper - six students in the e-learning MSc program and seven Bachelor students at the Faculty of Mathematics and Informatics, all working in parallel with their study.

The team of the course leaders was formed by the first four authors (further called *the educators*). In recent years, they have been involved in a number of national and European projects (IDWBL, TENCompetence, WebLabs, UNITE, ShareTEC, I\*Teach, InnoMath) and their ambition has been to effectively merge different aspects of the educational process – technological infrastructure, pedagogical innovations, and creativity support. During this period, various aspects of the AVITE course (in which more than one thousand in-service and pre-service Bulgarian teachers have participated) have been used as a *live laboratory* in which the innovative teaching strategies based on the constructionist ideas are demonstrated at a meta level [Sendova et al, 2009a, 2009b, Stefanova et al, 2009a, 2009b].

## The Approach

The educators' approach is based on a specific *I\*Teach* (Innovative Teacher) methodology in which the notion of *ICT-enhanced skills* has been defined as a *synergy between the technical and the soft skills* expected to be transferable skills in the Life Long Learning society. Putting the emphasis on the development of *ICT-enhanced skills* has been addressed in the frames of Leonardo da Vinci *I\*Teach* project (<http://i-teach.fmi.uni-sofia.bg>). The *I\*Teach* methodology (Stefanova et al., 2007b) is based on active learning methods, viz. the student is in the centre of the learning process, the teacher is a guide and a partner in project work based on didactic scenarios encouraging the creative thinking of students.

Let us note that the soft skills expected to be developed during the project include team work (planning, task distribution, communication skills, conflict solving), information skills (searching for and selecting relevant information, critical thinking), presentation skills (selecting the most appropriate tools for a specific task, written and oral presentation of the project products). Furthermore, the project output is expected to be finalized ("put on the table") and sharable with others.

## The Process

The general time-line of the course is presented in (Table 1) but the duration of each phase depends on the specific audience and the course duration.

As a rule the course starts with introduction of the participants followed by brainstorming on a specific theme chosen by the educators on the basis of a preliminary analysis of the students' profile.

This time the opening introduction of the participants was provoked by the following questions: *Are you an expert? In what? Why? Who was your teacher? What makes a great teacher?* Apart from the general amusement caused by the fact that hardly anyone considered himself/herself an expert the educators were impressed with some opinions concerning the features of the "good teacher" and the "good school".

- *My school was not what it should be, because the pupils were not challenged.*
- *The IT teacher of my son has no prestige because "she is not willing to develop herself; she is just reading from the text book and does not encourage the more enthusiastic pupils to share their knowledge with her and their peers."*
- *After a spelling mistake a teacher in English apologized to her students. "Don't worry, this is just a word, and you corrected it. As for us, we don't know so many things you could teach us..."*

Table 1. The phases in the course delivery and their objectives

Phase	Course Delivery Mode	Objective
Presentation of the participants	face-to-face	To capture the participants interests so as to address them later in the course
Brainstorming / lateral thinking on a specific theme	face-to-face	To define topics of possible projects to work on
Forming teams around the project topics being formulated as subthemes	face-to-face	To start building (to enhance) team work skills
Planning the work on the project	face-to-face	To start building (to enhance) skills for working on a project
Short (5 minutes) presentation of the developed plan	face-to-face	To enhance presentation skills
Working on a specific project in a team	distance	To develop ICT-enhanced skills (with emphasis on information skills, working-on-a-project skills, working-in-a-team skills)
Presentation of the work done and the projects' results	face-to-face	To enhance presentation-, evaluation- and self-evaluation skills

These observations were a starting point of a heated discussion about the role of the teacher in contemporary school. The participants shared the understanding that children are a great resource of ideas to be used by teachers.

Finalizing the participants' presentations and the discussions around the questions, the educators proposed the following formulation of the general theme: *We'll meet again in 10 years.*

The next session started with brainstorming (Figure 1) - *what sub-themes do participants associate with "meeting in ten years"?*



Figure 1. The brainstorming

Here are the first topics that came to mind:

- *Alumni reunion*
- *The dreams (now) and the realities (in 10 years)*
- *Today's students as future teachers*
- *The future school vs. the school of the future (pessimistic vs. optimistic visions)*
- *The most fruitful decade in our life*
- *The challenges we are ready to face*

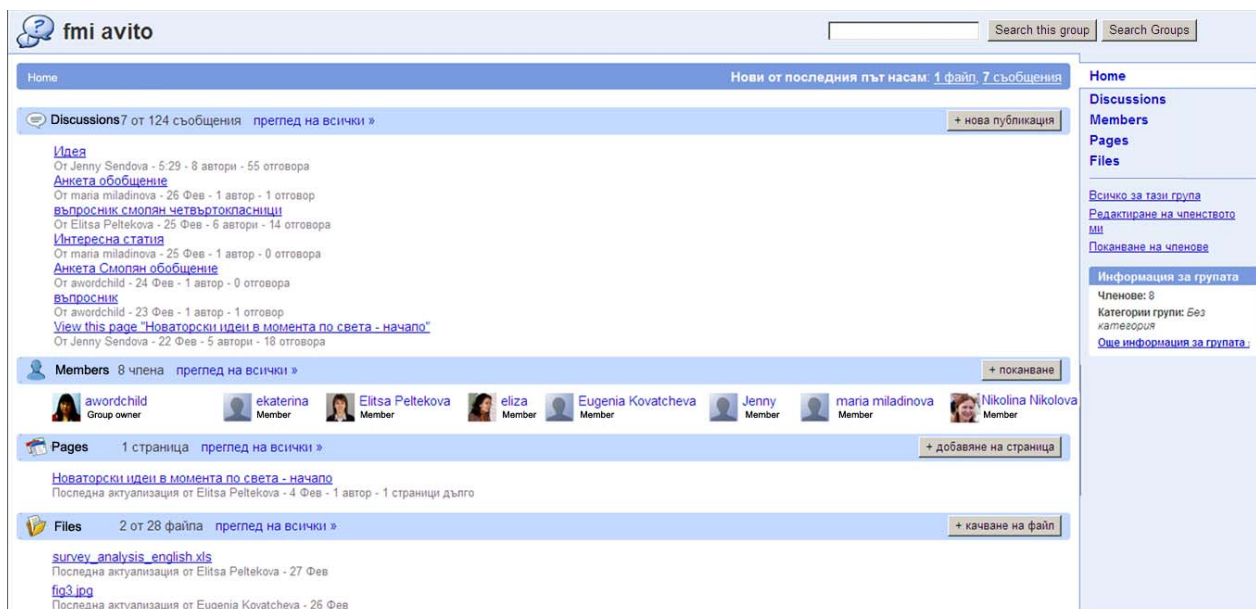
Afterwards the participants clustered around the sub-themes and formed project teams accordingly. One of the groups (the last four authors) focused on the *School of the Future* and it is its work to be discussed below.

## The Project Itself

### The Organization

Given their extensive experience in using network tools the educators were happy to see that the *School of the Future* team organized its work by forming a Google group, **fmi avito**, and invited them to join in -

The first activity of **fmi avito** was to make a plan, to distribute the roles and the tasks among its members. The latter found the group tool to be very convenient for staying in touch and collecting new information in a single shared place. The social group **fmi avito** is being used by the educators and trainees to share new ideas, documents, and to work collaboratively on common tasks (Figure 2).



The screenshot displays the Google Groups interface for the 'fmi avito' group. At the top, there is a search bar and a 'Search this group' button. Below the search bar, the group name 'fmi avito' is prominently displayed. The main content area is divided into several sections: 'Discussions' with 7 items, 'Members' with 8 members, 'Pages' with 1 page, and 'Files' with 2 files. The 'Discussions' section lists various topics such as 'Идея', 'Анкета обобщение', and 'Интересна статия'. The 'Members' section shows profile pictures and names of group members, including the group owner 'awordchild' and several other members. The 'Pages' section shows a page titled 'Новаторски идеи в момента по света - начало'. The 'Files' section shows files like 'survey\_analysis\_english.xls' and 'fig3.jpg'. On the right side, there is a sidebar with navigation links and group information, including the number of members (8) and the group category (Без категория).

Figure 2. The homepage with the main activities and participants of the **fmi avito** Google group

When appropriate the educators would establish connection between experts in the field and the members of the *School of the Future* team. First, the trainees received in their “e-mail box” a link to the works of a well-known educator, Rachel Cohen from France, who is the initiator of the international literacy project *Mini web, Multilingue, Maxi Apprentissages* (MMM). The goals of MMM are in full harmony with the educational principles adopted by the learners’ group and their vision about early education – *to enhance cognitive, social and technical skills from an early age, in order to allow children to communicate, to exchange, to have access to information, to construct their own knowledge, and to establish educational strategies allowing teachers to give a new power to their students: autonomous access to sources of information, construction of knowledge through distant cooperation and sharing* (<http://www.mmm-ec.org>).

Next, the trainees were stimulated to work collaboratively on an international study on a similar topic - *future of learning together*. They expressed their enthusiasm and satisfaction from such

interaction with experts on international level which turned their project work into a component of genuine research.

The next milestone of the project was to design a questionnaire and conduct interviews with students.

### The Questionnaire

The questionnaire on the *School of the Future* was proposed by the team leader but its final version was a product of joint efforts. The questionnaire consisted of seven questions focusing on three basic themes – what subjects should be taught in the school of the future, what should the teachers be like and what would the classrooms look like according to their expectations. Each of the topics included up to three questions with an open answer. The students were expected to provide up to three suggestions best matching their vision of the *School of the Future*. As for the classroom, it could have been drawn or described verbally.

The educators' team approved the questionnaire and helped the trainees to collect data from 12-graders (18-19-year-old students) - 30 questionnaires were filled in by these students one day later.

Several days later the learners continued to collect data from twenty one 4-graders (10-year-old pupils) and from 10 students having just graduated (25-38 years old).

### The Interview

To arrange an interview with high-school students involves a lot of preparation and administrative authorisation. Thus, the educators were involved in providing permission from parents and assisting the *School of the Future* team in conducting the interview with four 7-graders (14-year-old students).

## The Feedback

The most valuable part of the *School of the Future* project was its authenticity – the team was genuinely involved in presenting a vision of the school reflecting the opinions and the dreams of a variety of people – younger and older pupils, teachers, parents, researchers, and participants in educational experiments in the recent past. Thus, the final presentation and the discussion of the project were just a milestone (almost a side effect) of real research – this was the general feeling of the team.

What follows are some representative examples of the feedback provided by the participants in the team survey.

### The Classroom of the Future

„Please, draw, paint or describe how you imagine classroom of the future” - this was the interview task that provoked the greatest varieties of suggestions – two examples are given in Figure 3.

As expected, technologies are present and the environment is stimulating – there are flowers and curtains (in the drawings of the younger students) and a non-conventional arrangement with a lot of corners providing facilities for working on your own and in a group (the 12-graders). Options for on-line communication with experts in the field of study are also envisaged.

It is interesting to note that although the prevailing answers to the question *What will not be present in the classroom of the future?* were of the kind: *the black/white board*, there were boards in their pictures. Another frequent answer (especially among the older students) to the same question was *separate desks*. This could be related to the wish of the students to work in teams (including their teachers and experts in different fields). These students' expectations are

in accordance with researchers' expectations (Leis Miriam 2010) for globalization of education. A Common understanding of many researchers and pupils is also that *there will be no textbooks*.



Figure 3. "A Classroom of the Future" according to a 12-grader (left) and a 4-grader (right)

Although most of the younger students imagined the future classrooms rather conventionally (with desks in the usual type of rooms) there were still some who would prefer an open-air classroom. Some non-traditional elements in the imaginary classroom suggested by representatives of all age groups show that they would like the classroom of the future to be cosy.

There was even a counter-question asked by a 12-grader: *Are you sure that the classroom will exist?* This question is in full harmony with some researchers' expectations that the future classes will not be limited in terms of age, distance, etc. With wider use of technologies in education the notion of the classroom will be changed dramatically and will be far from the traditional today's understanding. The main conclusion of the research was that the older the students – the braver their visions of the *School of the Future*, probably reflecting their awareness of how much the changes depend on them.

### The Future School Subjects

According to the interviewed pupils (of all ages) the basic subjects in the school of the future (Figure 4) would still be mathematics and languages - a strong indicator of the general perception of the importance of these subjects in students' future education and careers.

As for some new subjects in the *School of the Future* most of the students in the senior classes shared their wish to study ecology and how to behave in society. The fact that these suggestions ignore reality of such subjects already being included in the school curriculum shows the irrelevance of the way they are being taught.

Such correspondence mismatch among existing school subjects and the expectations of the 12- and 4-graders was also observed in the case of Person&Society (studied in Grade 4) and World&Personality (studied in Grade 12. These subjects were mentioned as unnecessary in the school of the future. At the same time a subject expected to provide knowledge about how to live in contemporary society was included in most of the wish lists of subjects in the *School of the Future*.

The teams of both educators and trainees expected that technology would constitute a much greater part of the students' vision for the school of the future. It seems, however, that students do not necessarily link the acquisition of knowledge and skills with modern and future technology

development, although they tend to acknowledge the increasing presence of ICT in their learning environment. Apparently students perceive their interaction with both classmates and teachers as being more important than the use of traditional or technological means to achieve it.

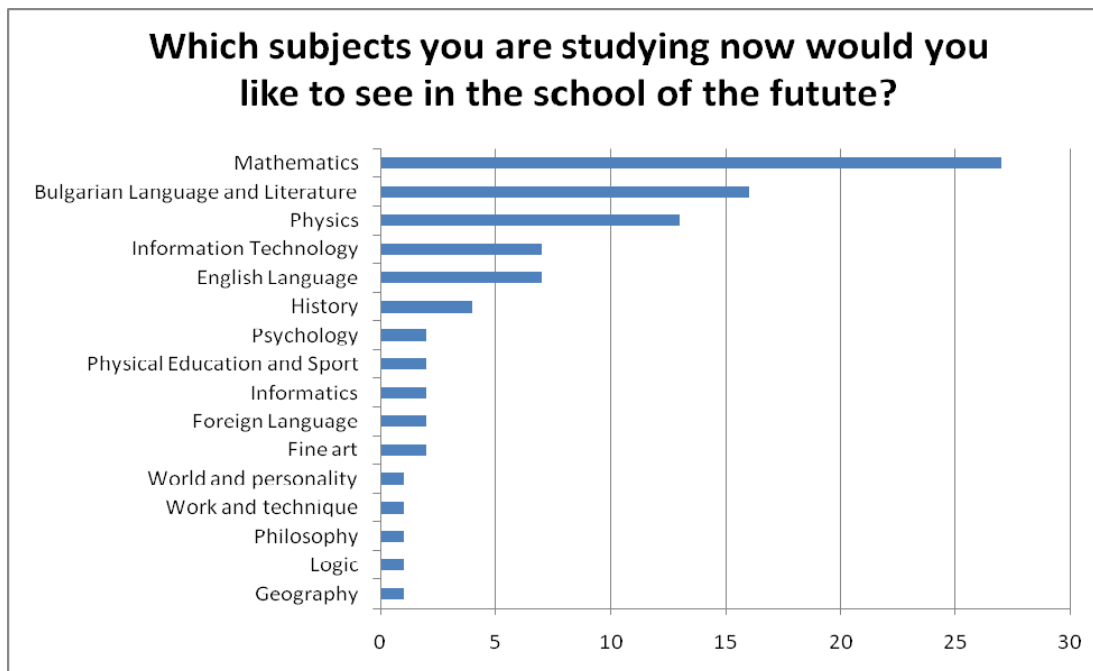


Figure 4. The subjects in the School of the Future

### The Teachers of the Future

There is a serious overlap in the expectations (wishes) of the four and twelve graders in the answers to *What should the teachers of the future be?*. The most frequent answers were:

- motivated”, „keen on their work”
- correct and fair
- thinking out of the box
- provoking students to think”
- encouraging all students
- fun, witty
- with good social skills
- kind, good, considerate

The respondents aged 25 – 38 think that the most important features the teachers should possess are: knowledge in the area of the subject taught, ability to communicate with students, being good psychologists and the ability to provoke the interest of the pupils.

### Conclusion

The *butterfly effect* is a metaphor often used to demonstrate that insignificant changes in the initial conditions could cause dramatic effects, e.g. a flap of the wings of a butterfly in NY could cause a tornado in Tokyo. While the butterfly does not "cause" the tornado in the sense of providing the energy for the tornado, it does "cause" it in the sense that the flap of its wings is an essential part of the initial conditions resulting in a tornado, and without that flap that particular tornado would not have existed.



We made some modest steps towards constructing a model of the *School of the Future* in the frames of a teacher education course. The overall experience of the School-of-the-Future research team made us optimistic of what is possible to achieve when harnessing *collective intelligence* (Cornu, 2006) in the development of a model of education based on the experience of the older generations and the dreams and visions of the younger ones. The work described is still in progress but it gives an idea of how knowledge construction and sharing could be promoted not just as a primary goal in teacher education, but also as a good practice the teachers-to-be could apply in their future work.

Even if we think of the first steps being made as a “flap of butterfly wings” we surely wouldn’t like to cause an educational tornado. But we could hope for a “wind of change” at least...

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