

GIVING TEACHERS A HAND(book) TO DEVELOP ICT-ENHANCED SKILLS

Teaching is the art of sharing.
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Shared web-based knowledge bases, enriched with the possibilities of discussing about their content and of proposing new one, seem to offer the opportunity to diffuse pedagogical innovation. To this aim, the knowledge base should enable teachers to put their own ideas at colleagues' disposal; and moreover, to improve their pedagogical knowledge by availing themselves of colleagues' proposals and suggestions. Thus, personal growth evolves in shared knowledge and vice-versa, facilitating the formation of a common educational line and the diffusion and reuse of valuable ideas, via the realisation of a learning community of teachers.

The *Innovative Teacher* (I*Teach) project (<http://i-teach.fmi.uni-sofia.bg>) of the EU Leonardo da Vinci Programme (http://ec.europa.eu/education/programmes/leonardo/leonardo_en.htm) is being developed accordingly. The work focuses on the teaching-learning of ICT-enhanced skills that is the set of behavioural and relational abilities influencing interaction with others. The projects' aims are to support teachers in devising, realising and sharing educational activities oriented to the learning of these skills.

In this paper, we outline the pedagogical framework followed and the methodological tools developed. Hints on the operative tools that are being produced to realise a web-based teachers' community working and learning on these ideas are also given. Some preliminary impressions based on the opinions of teachers who were involved in pilot trainings about the proposal conclude the paper.

Keywords: Technology-enhanced learning, ICT-enhanced skills, active learning, web-based teacher communities

1 INTRODUCTION

The diffusion of the ICT puts at schools' disposal a very powerful tool to diffuse and share, at international level, new educational ideas and practices. Thus, it helps to build a common approach to education, based on present pedagogical needs and apt to promote and sustain the forming of a teachers' community of practice on pedagogical innovation. A number of factors, however, make it difficult to realise this opportunity, in particular:

- In a number of school environments, the educational community is still dealing with the issue of the teachers' acceptance of ICT (Ma et al. 2005). To exploit the opportunities offered by the electronic network, thus, requires the development of both methodological and technical tools apt to support teachers and training actions apt to orient their activity.
- Computers started becoming widespread in schools in the 1980s with the diffusion of personal computers. However, we observe that, even when new technology tools are used, classroom practice still remains fundamentally unchanged (Watson 2001), thus proving that ideas need to be diffused more than products.
- Technology transfer is a central objective of the research on the educational uses of technology, since this process is critical in effectively bringing about innovations (Bottino et al. 1998). In recent years, considerable attention is being paid to the opportunities offered by communities of practices, where teachers can share experiences and ideas about the educational material and its use (Carr & Chambers 2006, Harris et al. 2003, Kristensen et al. 2003). This fact suggests the need of proposing efficient methods to establish and maintain such communities, by realising, via the electronic network, a continuous interaction between the scholastic and the research worlds.

These problems give evidence to the need of carefully devising and experimenting tools and methodologies, devoted to teachers, apt to transform the educational potential of the ICT into pedagogical innovation. ICT can be seen not only as a challenge but also as an opportunity to new instructional design. Of course, when thinking about a new instructional design we should focus on the skills we would like being developed.

With these ideas in mind the *Innovative Teacher* (I*Teach) project (<http://i-teach.fmi.uni-sofia.bg>) of the EU Leonardo da Vinci Programme was launched in October 2005 and will be concluded in October 2007. It involves partners of seven European countries (Bulgaria, Germany, Italy, Lithuania, The Netherlands, Poland, Romania). The coordinator of the project is the Sofia University *St. Kl. Ohridski*, Bulgaria.

The project focuses on the teaching-learning of a set of behavioural and relational abilities that influence interaction with others and that can be improved by the use of ICT. *I*Teach* aims at supporting teachers in devising, realising and sharing educational activities oriented to the learning of these skills. As for the pedagogical orientation, an active learning approach is adopted. To realise these ideas, the project puts at teachers' disposal methodological and technical tools that allow for an effective implementation of a web-based knowledge base, enriched with the possibilities of discussing its content, where users can interact, operatively discuss their ideas, and produce and share innovation on the basis of educational practices they devise and experiment. The outputs of the project include: a

handbook for teachers, a repository of scenarios and tasks, an off-line tool for scenarios and tasks development, and a number of virtual training centres. The handbook establishes the pedagogical orientation of the knowledge base and provides a support for realising educational ideas accordingly; the templates for scenarios and tasks constitute the methodological tools to communicate and share ideas; the repository represents the core of the knowledge base; the off-line tool supports the off-line production of scenarios and task to be imported into the repository, the virtual training centres put it at users' disposal and support interaction and sharing of ideas.

In the following, we focus on the pedagogical conception of the project. In particular, in Section 2 we briefly delineate the overall objective of the work, and the approach we followed to reach it. In the following three sections we illustrate the different phases of the work: in Section 3 we describe the method adopted to select the ICT-enhanced skills on which to focus on, and the learning view that guided our educational choices to develop them in students; in Section 4 we show the methodological tools in support of teachers when introducing ICT-enhanced skills in their schools; in Section 5 we give hints on the operative tools developed to realise such methodological choices. We conclude the work with some consideration on the preliminary results of our work (Section 6).

2 INTRODUCING THE CONCEPT OF ICT-ENHANCED SKILLS

Concerning the type of skills that pupils have to develop one can distinguish three categories. The first category consists of the subject-related skills. During math-class pupils learn how to solve quadratic equations. In chemistry they learn how to handle glassware and how to perform a titration. It is quite obvious that the responsibility for this kind of skills lies with the teacher of that course. Next category comprises the ICT-skills. During the last two, three decades ICT has conquered the world and has occupied an increasing place in every day life, at home, at work, in entertainment, in school. So in education attention has to be paid to working with ICT, and knowing the basic concepts. Most pupils learn in the schools how to work with file systems, with operating systems, and text editors. Schools organize these lessons, often given by a specially appointed ICT-teacher.

The third category consists of the so called *soft skills*. These are general skills, needed not only to complete successfully an educational career but also to become a good citizen of the modern society. Skills to consider in this respect are for instance information skills, presentation skills, working-in-a-team skills, and working-on-a-project skills. These skills are related to the needs of a society, in which the citizens are expected to learn life long, to develop continuously, and to invest in their own education. It is not always clear in the educational institutes who is teaching such skills (if at all). Even worse, we often witness inappropriate use of the ICT.

The area of the soft skills can benefit strongly from ICT, both in acquiring a specific skill and in executing that skill. ICT can make a task, related to a soft skill, easier or simpler or quicker to do. For example, writing a report in a team of pupils will be a tedious task without ICT. Using ICT can also deepen the skill. It offers the opportunity to perform on a higher level. A professional multimedia presentation with text, sound, images, movies, animations is often unthinkable without ICT. A skill can be performed broader by using ICT.

It can combine skills, or can force using them in a new area. You can practice collaboration skills in a classroom, but ICT offers the possibility to collaborate on a broader scale. International co-operation is within reach. This requires extra communication skills and language skills. It also has a strong multicultural dimension, required for the citizen in the modern society.

As ICT has such an impact on the essence of the soft skills a new terminology is introduced, the *ICT-enhanced skills* (IES).

A number of studies referring to the job market indicate that the *ICT-enhanced skills* are a crucial aspect for an active inclusion into the knowledge economy (Beard et al. 2007). In particular, it is generally recognised that IES are a key element of the ICT curriculum; thus, attention is devoted to the study of methods aimed at including them fruitfully in the technological preparation, at both basic and specialised level (Dettori et al. 2002, Howard 2005, Semoushin et al. 2003, Vo et al. 2006).

Profitable and proper use of ICT in acquiring those skills and fulfilling the skill related tasks does not come easy. It requires a sound and methodological approach.

In order to introduce IES in the teaching-learning of ICT at school level, in the project I*Teach we proceeded as follows:

- a preliminary phase, in which we selected a number of IES on which to focus on and the learning approach to suggest for their introduction;
- a methodological phase, aimed at analysing and proposing tools apt to support teachers, pertaining to an international context, in introducing IES in their school according to the learning approach selected in the preliminary phase;
- an operative phase, aimed at proposing and implementing tools apt to share, at international level, their work on IES.

Let us briefly describe these phases.

3 PRELIMINARY PHASE

3.1 Identifying ICT-enhanced skills to focus on

Skills to focus on during the project have been chosen starting from those generally identified as very important for the knowledge-based society (European Commission 2005).

The selection was carried out by means of a questionnaire through the project web site, e-mail and by direct contact (Dodero et al. 2006). Data was collected from about 600 educational researchers and teachers from all seven European countries participating in I*Teach. The questionnaire included a list of skills; the respondents had to assign a priority to them; moreover, for each skill, a subset of sub-skills occurring in it was indicated, and respondents to the questionnaire were asked to suggest the most important ones. In order to facilitate respondents, the questionnaire was written in English and then translated in the seven native languages.

The findings showed a common need throughout Europe for teaching and learning soft skills such as: working with information, presenting information, working on a project, working in a team (Table 1):

TABLE 1. IES taxonomy

Categories	Subskills involved
Information skills	to determine the information problem to determine the relevance of the various information sources to search by applying relevant techniques to localize and acquire the information found to evaluate the information found and readjust the search to process the information found so as to reach the preset goal to use the information found ethically and legally
Working on-a-project skills	to identify tasks and subtasks to make a plan to divide tasks to communicate internally to communicate externally to keep track of the progress to integrate results to use the proper tools properly
Working-in-a-team skills	to communicate internally to communicate externally to give feedback to receive feedback to resolve conflicts to support the team loyally, as a good colleague to take responsibility
Presentation skills	General to order and select information to master the language to make correct references and citations Written to build up a report to lay-out a report to make correct references and citations to use a word-processor properly Oral to build up an oral presentation to design an oral presentation to use a presentation tool properly Web-related to build up an web presentation to design a hyper structure to make correct references, citations, and links to use a web publishing tool properly to select and use multi media

3.2 The approach

In harmony with the constructive view of learning (Bruner 1966, Piaget 1976), the educational approach we follow is the one of active learning. The activities are student-centered, addressed by intentions and reflections; the tasks are authentic and the goals are concrete. To render the process efficient, moreover, the needs and the previous knowledge of the students have to be taken into account; they have to be motivated and supported in developing meaningful learning, to be encouraged in controlling their learning (Ausubel 1963, Novak 2002). Finally, we bare in mind that the active learning can fruitfully integrate individual with collaborative activities, thus including a socio-constructivist component (Vygotski 1978): knowledge develops as a social activity that produces meaning as assimilation of a negotiated version of the context. It was already observed, in fact, that social activities reinforce motivation, can render tasks more interesting and stimulating, and produce new, unexpected tasks that influence cognitive mechanisms (Dillenbourg 1999).

Of all the various methods of active learning we focus on the project-based- and problem-based learning. IES are developed by means of experiences and activities oriented towards the realisation of concrete goals during the execution of real tasks (Figure 1):

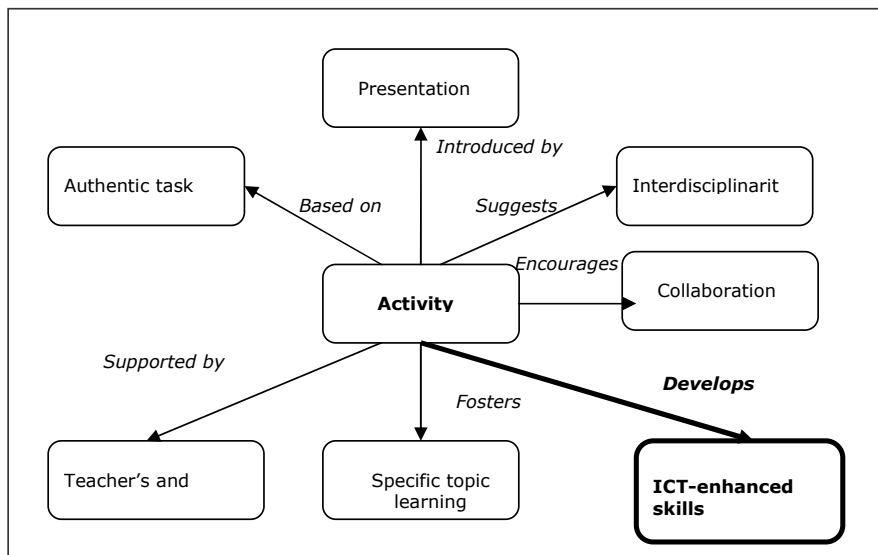


FIGURE 1. The main characteristics of an *I*Teach* activity

We briefly recall that in project-based learning students work collaboratively, for a sufficiently long period of time, on a relatively complex problem and produce some artefacts. The process involves the integration of preliminary knowledge with new one; in addition, it implies the development of skills to negotiate, to subdivide tasks, to compare opinions, to illustrate results, and so on, all being skills *enhancable* with ICT. At the end of the project, students have to present their work formally to a given audience.

The essence of problem-based learning is that it is a group approach encouraging self-directed and independent learning. The approach is based on providing a problem or issue usually encountered in everyday organizational life. The learners are expected to explore the nature of the problem, analyse the issues, and use relevant theoretical frameworks to research possible solutions, dilemmas and conflicts (I*Teach Methodological Handbook 2006).

In general, both project and problem-based learning present a number of advantages with respect to learning: the relevance of the activities, usually referred to the real world; the challenge proposed by a complex and authentic problem; the motivation; the interdisciplinary; the need of collaboration.

With respect to the traditional approach, active learning presents a number of advantages but putting it in practice is a complex problem that requires a lot of time and efforts by teachers. They have to design and organise activities that would gradually lead students to take control of their own learning, scaffold their work according to the educational context and balance between students' freedom and their own instructions.

4 METHODOLOGICAL PHASE

During this phase the fundamentals of the I*Teach methodology were established and the development of the supporting tools started. A bridge between the theoretical basis of the I*Teach and existing good educational practices was accomplished by educational scenarios.

4.1 Educational scenarios as a key concept of I*Teach

An I*Teach educational scenario is defined as a *composition of tasks in the context of an active learning environment leading the students to a general goal (producing a specific product) via a path (working/learning process) traced by milestones (intermediate objectives/stages of the product development). At each milestone pupils are expected to have finished a concrete stage of the product development and mastered a concrete skill. More specifically, a scenario: integrates a set of tasks in an active learning context; aims to reach one or more IES; requires students to obtain a product; is based on the use of ICT; can be divided in tasks; groups and integrates tasks* (I*Teach Methodological Handbook 2006).

To facilitate the design and the development of scenarios appropriate templates were developed and negotiated among partners. These templates constitute an effort to obtain a kind of standard in communicating scenarios, thus enabling comparison, sharing and reuse.

The theoretical basis of the I*Teach methodology together with educational-scenario samples, templates and other supporting tools have been included in *I*Teach Methodological Handbook* - a joint effort of all partners; written so far in English.

4.2 The methodological handbook

The conceptual design of the handbook aims at supporting teachers in implementing the *I*Teach* methodology (Figure 2).

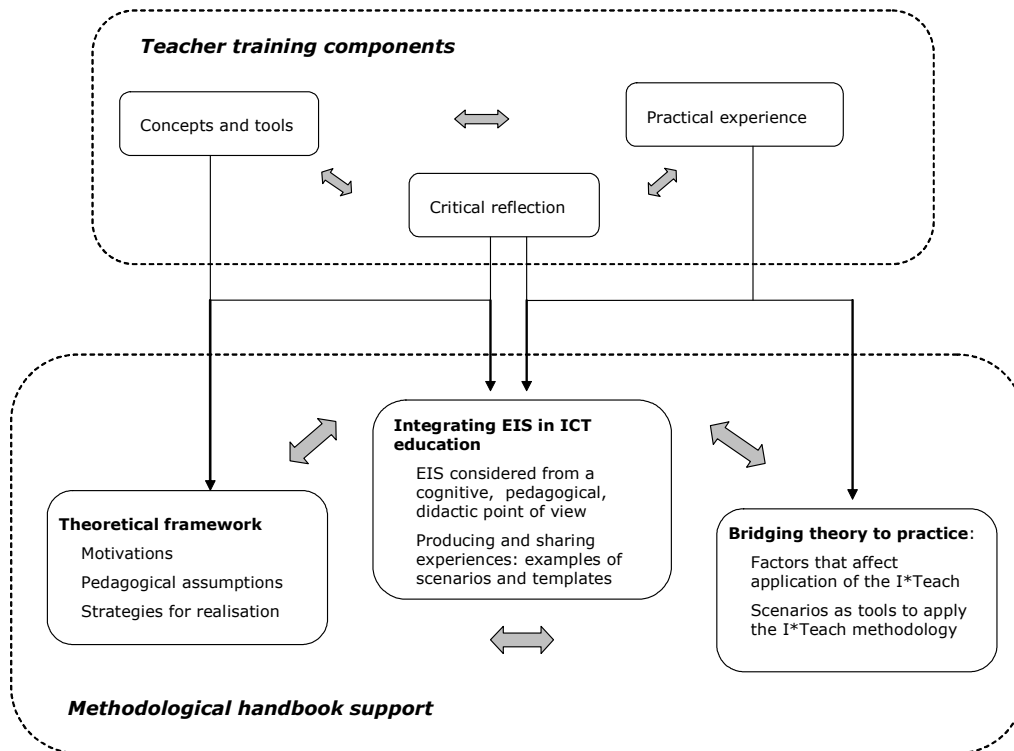


FIGURE 2. Training components and conceptual organisation of the handbook

The Handbook is organised into three chapters.

The **first chapter** is of more theoretical nature, and presents the concept of the *ICT-enhanced skills*, a description of active learning methods, the *I*Teach* methodology together with the concept of *scenario*.

The **second chapter** focuses on practical methods to render *I*Teach* methodology concrete. This second part includes four sections (Information skills, Working-on-a-project skills, Working-in-a-team skills, Presentation skills). Each one focuses on building a concrete skill category. Let us note that in most of the cases isolating just one of these groups turned out to be artificial since the various skill categories are interweaved in a natural way.

All sections have the same structure: the considered IES are introduced (Introduction); the main theoretical aspects and sub-skills are deepened (Preparation), strategies to support their development are suggested with examples of application in scenarios (Elaboration) and methods to assess them are indicated (Verification). Bibliographical references and practical hints conclude each section.

The **third chapter** contains *I*Teach* scenarios developed by teachers according to the *I*Teach* templates.

A preliminary version of the material has been experimented in an international pilot training course held in Iashi, Romania, 2006. The international training verified the acceptance of the methodological proposal as international level. The feedback received was used to improve and enrich the handbook. As for the implementation of the *I*Teach* methodology a very important observation was shared by the project coordinator in her analysis of the event: *Bear in mind that it would be difficult for teachers to adopt an innovative methodology if it is introduced in the traditional "preaching" style.*

5 THE OPERATIVE PHASE

To render the material produced useful for teachers, we proceeded along two different lines: on one hand, we designed and carried out a pilot training activity at a national level; on the other, we prepared a set of technological tools in support of teachers willing to share their innovative experience.

The main objectives of the national training courses were to analyse the adaptability of the *I*Teach* methodology to the different national educational systems, to form a core teacher group in each country to implement the project ideas, in particular - to create initial scenarios, to be experimented in schools.

For teachers coming from countries in which the active learning methods were used in school reality (e.g. Italy) the innovative element was mainly the possibility to share their good practices and ideas. For the rest (Nikolova et al. 2007) the active learning methods were a challenge to adopt since they were in contrast with the educational systems with more traditional, teacher-centred style of teaching.

The main challenge during the national training courses in Bulgaria for the *I*Teach* educators team was to *teach as we preach*, i.e. to introduce the *I*Teach* methodology by applying it at the same time (Stefanova et al. 2007). The idea was not only to demonstrate that this methodology works but also to make the teachers feel as co-authors of the *I*Teach* main concepts. While engaging our trainees in activities whose shape was finalised with them in a brainstorming mode, we would ask them later (but still before presenting the methodology formally) to enlist the methods we have used. In practically every instance of the training course the list composed by the teachers overlapped with what we had prepared in our slide-show presentation. Another important idea was to present the whole training process by means of the road map metaphor (*ibid*) and make the particular groups of participants enrich this map with a similar one reflecting the road the group had traversed. To teach as we preached turned out to be both challenging and rewarding – many of the teachers decided to try out the methodology immediately after the training course, others rethought their own pedagogical practice in terms of *I*Teach* and shared a valuable experience in the form of educational scenarios included in the specially developed repository. As one of the Bulgarian teachers (awarded with *the best ICT teacher for 2005* title) exclaimed: *How nice, that you gave us a tool to formalise our good practices and thus share them with others more easily!*

As shared by the project representatives during the regular virtual meetings, the teachers being trained in all countries had expressed their interest in the *I*Teach* methodology and willingness to implement it.

The participants in the national training courses were given an edited version of the handbook reflecting the recommendation of the international training course. Still, the handbook was lacking sufficient homogeneity since the different chapters were written by representatives of different cultural realms. This problem will be overcome when translating its final version. In addition, the best two scenarios of each country, developed at the national training courses will be included in it, a fact contributing to the sense of teachers' co-authorship of *I*Teach Handbook*.

As for the technical tools supporting the teachers in their sharing ideas and good practices we have developed a web-based repository. Thanks to the joint efforts of teachers from all over the world the repository could be considered as a dynamic extension of the handbook, thus becoming itself a growing virtual handbook.

Furthermore, the teachers can establish a learning community oriented to active learning on IES thanks to the *virtual training centres* defined as virtual teachers' communities aiming at facilitating their professional development, by integrating communication facilities with a repository of scenarios and life support with practitioners (teachers' trainers and other teachers) (Racheva et. al 2006). National virtual centres are not described here for the sake of brevity. We refer to (Doderio et al. 2007) for their illustration.

6 CONCLUDING REMARKS

A central aim of the *I*Teach* project is to discuss the possibility to successfully apply an international view to the *I*Teach* approach to the introduction of IES in schools and to check the appreciation of teachers for it. For this sake, a number of methodological tools have been produced, a communication/collaboration platform merged with a repository of educational material has been developed and replicated in different national contexts; we also outlined the main outcomes of its first application with novice teachers.

The initial positive response of the trainees involved in the pilot activities highlights the availability and interest of a number of teachers of different realms to get involved in the sharing of educational material and collaboratively reflecting on its practical use. However, this impression has to be confirmed by the practical use of the technological tools produced, that will be carried out to the end of the project.

In a nutshell, the *I*Teach* project gives teachers a hand so that they could give each other a hand.

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REFERENCES

1. Ausubel, D. (1963). *The Psychology of Meaningful Verbal Learning*. New York: Grune & Stratton.
2. Beard, D., Schwieger, D, & Surendran, K. (2007). Incorporating soft skills into accounting and MIS curricula. *Proceedings of the 2007 ACM SIGMIS CPR conference on 2007 computer personnel doctoral consortium and research conference: The global information technology workforce*, pp. 179–185.
3. Bottino, R.M., Forcheri, P., & Molfino, M.T. (1998). Technology Transfer in Schools: from Research to innovation. *BJET*, vol. 29, n.2, 1998, pp. 163–172.
4. Bruner, J. (1966). *Toward a Theory of Instruction*. Cambridge, MA: Harvard University Press.
5. Carr, N.; & Chambers, D. P. (2006). Cultural and organisational issues facing online learning communities of teachers. *Education and Information Technologies* Volume: 11, Issue: 3, pp. 269–282.
6. Dettori, G., Forcheri, P., Molfino, M.T, Moretti, S., & Quarati, A. (2002). Shaping teacher preparation content according to emerging pedagogical paradigms. *Proceedings of Int. Conf. On Computers in Education*, IEEE Computer Society, pp. 1044–1050.
7. Dillenbourgh, P. (ed.) (1999). *Collaborative Learning - Cognitive and Computational Approaches*. Oxford U.K.: Elsevier Science Ltd.
8. Dodero, G., Forcheri, P., & Luzzatto, G. (2006). Progetto I*teach: formazione degli insegnanti di materie scientifiche nell'Europa allargata. *Atti di Didamatica 2006*.
9. Dodero, G., Ratcheva, D., Stefanova , E., Miranowicz M., Vertan, C., & Ridkaite, M. (2007). The virtual training center: a support tool for teachers community. *To appear 2007 proceedings of Balkan Conference on Informatics BCI'2007*.
10. European Commission (2005). *Proposal for a recommendation of the European Parliament and of the Council on key competences for lifelong learning*. http://europa.eu.int/comm/education/policies/2010/doc/keyrec_en.pdf.
11. Harris, R.A. & Higgison, C.A. (2003). “Reuse of resources within communities of practice”, in in A. Littlejohn (ed.). *Reusing on line resources: a sustainable approach to e-learning*, London: Kogan Page, pp. 234–247.
12. Howard, E. V. (2005). Promoting communication and inclusiveness in the IT classroom. *Proceedings of the 6th conference on Information technology education SIGITE '05* pp. 311-316.
13. *I*Teach Methodological Handbook* (2006). Retrieved from <http://i-teach.fmi.uni-sofia.bg>
14. Kristensen, P.D., Kristensen, T.P., & Kristensen, E. (2003). Online Communities of Practice: A Catalyst for Faculty Development. *Innovative Higher Education* 27 (3), pp. 183–194.

15. Ma, W. W., Andersson, R., & Streith K.-O. (2005). Examining user acceptance of computer technology: an empirical study of student teachers. *Journal of Computer Assisted Learning*, 21, Issue 6: 387–395.
16. Nikolova N, Miranowicz M. (2007). I*Teach methodology in school practice, *To appear 2007 proceedings of Balkan Conference on Informatics BCI'2007*.
17. Novak, J.D. (2002). “Meaningful learning: The essential factor for conceptual change in limited or inappropriate propositional hierarchies leading to empowerment of learners”, *Science Education*, 86 (4), pp. 548–571.
18. Piaget, J. (1976). *The grasp of consciousness*. Cambridge, MA: Harvard University Press.
19. Ratcheva D., Stefanova E., Nikolova I. (2006), “A Virtual Teacher Community to Facilitate Professional Development”, Proceedings of the ISSEP2007, Vilnius, Lithuania, 7-11 November 2006, ISBN 9955-680-47-4, pp.297–305
20. Semoushin I, Tsyganova J., & Ugarov V., 2003, Computational and Soft Skills Development through the Project Based Learning. *Lecture Notes in Computer Science 2568*, 2003, Berlin: Springer-Verlag, pp. 1098–1106.
21. Stefanova E., Sendova E., Nikolova I., Nikolova N. (2007), *When I*Teach means I*Learn: developing and implementing an innovative methodology for building ICT-enhanced skills*, in Benzie D. and Iding M. (Eds). Abstracts and Proceedings of the Joint IFIP Conference: WG3.1 Secondary Education, WG3.5 Primary Education: Informatics, Mathematics, and ICT: a ‘golden triangle’ *IMICT 2007* , CCIS, Northeastern University, Boston, MA, ISBN-13:978-0-615-14623-2
22. Watson, D.M. (2001). Pedagogy before Technology: Re-thinking the Relationship between ICT and Teaching, *Education and Information Technologies*, 4 pp. 251-266.
23. Vo, H. V., Chae, B. , & Olson, D. L. (2006). Integrating systems thinking into IS education. *Systems Research and Behavioral Science* 23(1), pp. 107–12.
24. Vygotsky, L.S. (1978). *Mind in Society*. Cambridge, MA: Harvard University Press.