

IMPLEMENTATION OF ICT-BASED TEACHING IN BULGARIAN SCHOOLS

Valentina Terzieva¹, Elena Paunova², Petia Kademova-Katzarova³, Yanina Stoimenova⁴

^{1,2,3,4} *Institute of Information and Communication Technologies - Bulgarian Academy of Sciences (BULGARIA)*

Abstract

In today's society, ICTs are an essential part of everyday life. They are integrated in work and leisure and therefore have to be engaged in large scale in the education process. ICT offer teachers and students a powerful support in teaching and learning experience. The paper investigates the Bulgarian teachers' attitude to the ICT-based teaching. The purpose is to define the place of ICT in the context of traditional education. Technological skills are of vital importance for development and rise of education. We examine the teachers' points of view and make analysis regarding: learning subjects; the teachers' role and influence on students; challenges of introducing technology enhanced teaching as well as when, where and how to implement them in the educational process. In addition, we explore how the variety of technology-based approaches matches with classroom education nowadays. The paper analyses also diverse pedagogical methods that take advantage of new learning technologies and their application in different teaching-learning situations. We also examine the institutional support, which the teachers in Bulgaria receive with applying the new technologies in the school education. The use of new generation ICT, together with the classical teaching methods, help to realize the goals and solve problems in individual subject (e-learning concept). Migration of traditional instruments for schooling to the new enhanced learning technologies allows the learning process to be managed both individually and as a whole. The variety of e-learning methodologies ranges from computer-based training to serious games and innovative facilities such as augmented and immersive virtual reality. Some examples of effective teaching strategies exploiting ICT tools in different subjects across the curriculum are discussed. An overview of benefits and drawbacks of the technology enhanced education are presented.

Keywords: ICT, e-learning, pedagogical methods, technology enhanced teaching.

1 INTRODUCTION

Information and Communication Technologies (ICT) has become an essential part of everyday life for contemporary young people that are often called "digital natives" [1]. They expect to use technology gadgets almost in all activities that they do and especially in learning. As it is state in [2] technological skills are increasingly important for advancement in education, work, and leisure. Therefore it increases the importance of introduction of contemporary ICT-based tools such as interactive boards, personal computers, tablets, multimedia devices, smart labs etc. in schools. ICTs offer extended training capabilities compared to classical teaching methods and tools, so they can be one of the factors in improving quality of the teaching practice. They have the potential to change not only the educational environment and presenting knowledge but also the way of learning and teaching in all subjects.

There are three aspects of incorporating ICT in education process: learning about ICT, learning with ICT and learning through ICT [2]. The first one comprises technology knowledge about ICT and their potential application to support educational process. The second one concerns the ICT-based learning resources implemented in the classroom curriculum. The latter aspect regards the process of transformation the way of teaching and learning – it's about the educational paradigm change. The three aspects are inextricably bound up between. The knowledge and understanding of ICT is the necessary condition for effective usage of ICT-based tools and resources to achieve educational objectives by performing innovative and creative ways of teaching and learning.

The methodology of integration of ICT in the educational process is subject to many publications [3, 4]. The new technologies allow continuing doing the same things that all we are used to in addition to the expanded possibilities. The use of ICT in education changes paradigm from traditional to blended or computer-aided education. But the added value of incorporated ICTs in the classroom depends on the

appropriate use of modern tech-based methodologies in an educational context and teachers' willingness and competence. This pushes us to investigate the issue of teachers' attitude to ICT implementation in traditional educational process.

Since the launch of the National strategy for the introduction of ICT in education in Bulgaria [5] in early 2000 years there has been significant progress in all determined priority aspects – modernization of educational environment, development of digital content and implementation of innovative technology-based teaching methods in the educational process, improving teachers' competence to use ICT for teaching and learning. In addition almost all schools are provided with internet connection. Most of the teachers have acquired basic levels of computer literacy in short qualification courses, either organised by some software providers, or by projects funded by European programs. They usually develop skills to use word processing and presentation software, e-mail and internet browsers. The teachers self assessed these competences highly. Some of educational staff attended training courses about administration of learning platforms. As a result it is expected the overall quality of the education to be improved so that the students to be prepared for the requirements of the new information age. A new strategy continues good practices and offer new priorities of integration of ICT in schools [6].

2 METHODOLOGY

An online survey was conducted in several schools of different types (state or municipal, primary or secondary) and from bigger and smaller towns or capital of Bulgaria. The survey [7] was created using the free open source online survey tool LimeSurvey [8]. The respondents teach in different school classes: Primary – 13.64%, Lower Secondary – 38.64% and Secondary – 47.73%. More detailed description of survey is presented in [9]. Our goal was to collect the Bulgarian teachers' attitude to the ICT-based teaching and educational games and to define their place in the context of the traditional classroom education. Respondents were asked when, where and how to implement ICT tools and resources in the educational process, what is the teachers' role, what are the challenges of technology, how implementation of ICT in teaching influence the students, etc. The teachers are allowed to share their opinions in free format in addition to the closed questions. In their responses, the teachers expressed their views regarding the barriers to the implementation of educational games in teaching, as well as regarding the negative aspects in their usage.

We analyse teachers' attitudes depending on several factors including teacher's age, type of teaching activities, etc. The obstacles for widespread usage of ICT-based teaching in Bulgarian schools are examined also. Furthermore, we analyze the differences and evolution of the previous teachers' attitudes according some aspects of integration of ICT in schools. The correlation is made in comparison with a massive national representative survey, held in 2009 – 2010 year [10].

3 FINDINGS ABOUT INTEGRATION OF ICT IN BULGARIAN SCHOOLS

According to the age of respondents in our survey, now there are more young teachers (13,64%) than before (2,4%) (see Fig. 1) and almost equal distribution in the middle ages (about 32% are between 31 and 45 years, and slightly over 27% are 46 – 55 years old and also about 27% are over 55 years).

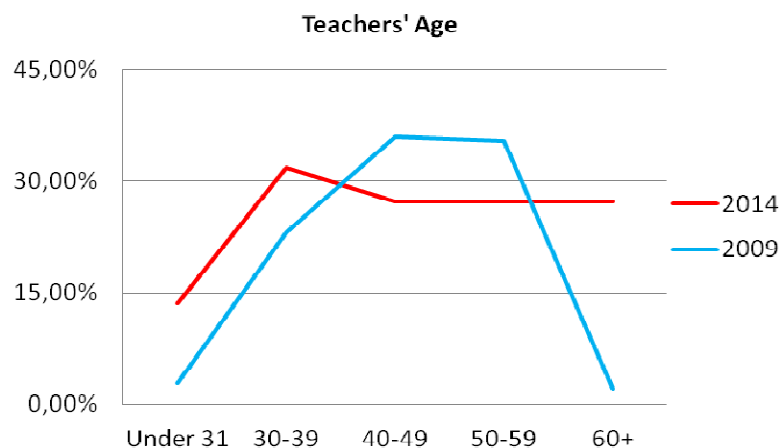


Fig. 1 Age of teachers in surveys

This finding is slightly confusing because the average age of teachers in Bulgaria is 50 years (Ministry of Education) and over 38% of them are over 50 years, while only 3.4% were under 30 years. Such quantity of young teachers in our survey is a result of the method of survey spreading – mainly online. On Fig. 1 is shown respondents' age compared to the previous survey [10].

3.1 Institutional support

One of the substantial factors in implementing ICT in educational process is availability of institutional support. This government support comes in many different forms – funding for purchasing technological tools, organizing training courses, providing internet connection; creating e-learning resources, etc. From the other hand is human factor – willingness, enthusiasm to enhance well-known teaching methods and to embrace new technology. One of the respondents said “In my opinion the motivation of teachers has great importance for the implementation of ICT in schools. We should work more in this direction.” Of course, institutional support is responsible for starting changes in teaching practice. Most respondents state that they have institutional support, but almost quarter of them didn't ask for it (Fig. 2). The possible reasons are that they don't have enough information how to receive support, or the procedure is too complicated; or they struggle alone and cope with the task other way – with the help of NGO for example. Further, it is quite disturbing that about 21% don't have any institutional support. There should be some adequate politics in solving problems in this area.

Have you got institutional support for implementing ICT-based teaching methods?

■ Yes ■ No ■ Didn't ask ■ No response

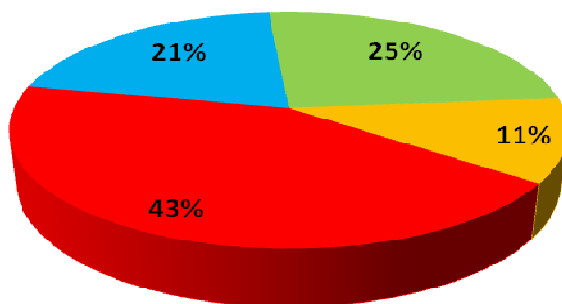


Fig. 2 Institutional support for implementing ICT in educational process

3.2 Usage of ICT in teachers' work

As stated by the survey, more than 55 % of the respondents have used ICT resources specifically designed for particular subject which demonstrates that ICTs offer teachers a powerful set of tools to support educational process (Fig. 3). In addition, nearly 18 % of the teachers have information about such resources, but still do not use them in their practice. Only 20 % of teachers do not know about ICT-based educational products, which can support their teaching.

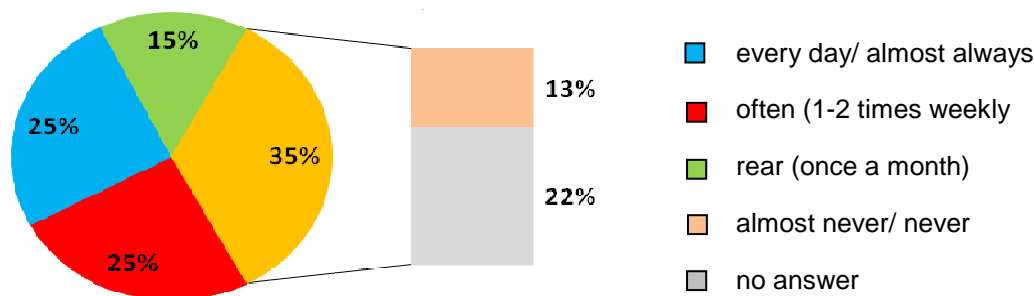


Fig. 3 Summary of frequency distribution of usage of ICT in teachers' work

Furthermore, the tendency for teachers to use ICT in their work seems to be increasing – almost 46 % use technical tools and appliances and about 36% use learning resources. This finding is quite positive. On a daily basis the ICT usage is not so encouraging as it is shown in a Fig. 3 – about 25 %

of the teachers use them every day and also 25% – often (1-2 times weekly), while rare (once a month) usage is 15 % and 35 % never use ICT.

The respondents' answers concerning the teaching activities where ICT tools and resources usage is appropriate are shown on Fig. 4. The most frequently teachers use ICTs when they prepare their lessons (34 % almost always and over 40% often) and when search for additional resources (36 % almost always and about 48% often). These results indicate that teachers strive to present interesting and up-to-date information to the students. In addition considerable part (almost 60%) of the teachers use ICTs both in classroom work (over 29 % almost always and 34% often) and for exercises (27 % almost always and about 32% – often). Very few respondents believe that ICTs are useful in preparing examinations - about 23% use them every day or often, while in composing tests over 45% use computer-based resources every day/ often. Another activity where teachers prefer to use ICTs is making projects and presentations (over 27 % almost always and 18% often). Surprisingly, few of the teachers use technology tools and resources in their extracurricular work that is not strictly predefined. In our opinion in this area teachers can deploy their creativity and use vast variety of ICT-based tools and resources.

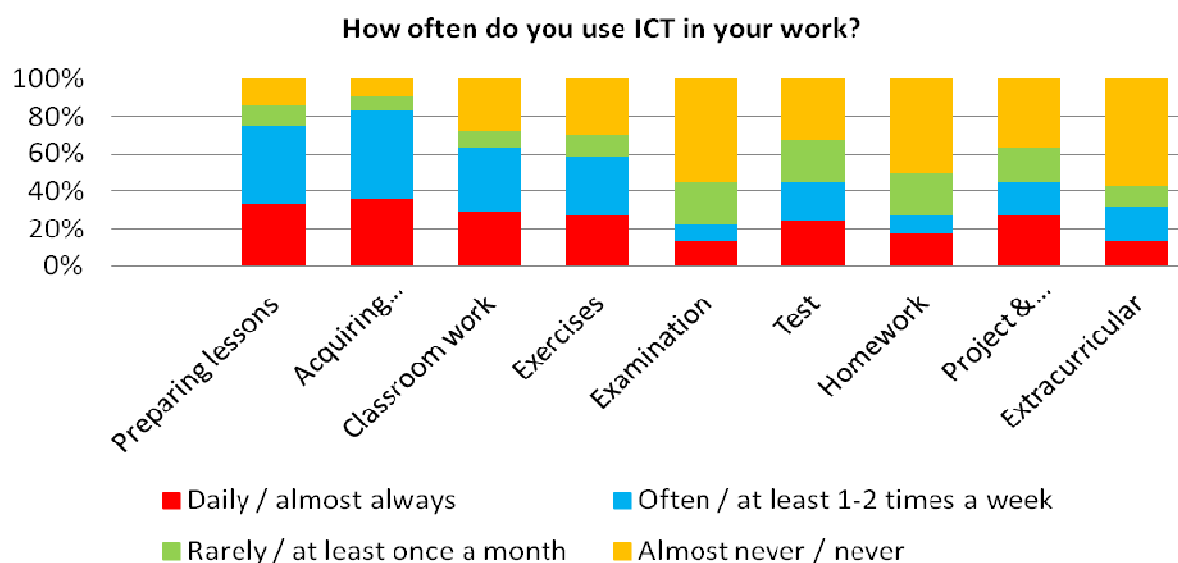


Fig. 4 Frequency distribution of usage of ICT in different teaching activities

3.3 Usage of ICT in different learning contexts

Another issue on which teachers were asked to comment was to determine what learning contexts it is appropriate to use ICTs (Fig. 5). Not surprisingly, most of the respondents admit that ICT should be used in class lessons (77%), at home (61%) or in extracurricular activities (52%). Other significant issues of implementation ICTs are for achieving specific learning goals – about 39% or in alternative education forms – about 41%. We suppose that these findings are closely connected with training of students with special educational needs (SEN), where are available some specific ICT-based inclusive appliances and learning resources. On the other hand it is obvious that only about quarter of respondents (27%) believe that verification of acquired knowledge can be performed by ICT-based examination and testing. These findings might be conditioned by the insufficient number of computers in schools, learning subjects' specifics or lack of competences in computer assessment and testing. The same are findings about ICT-based exercising studied material – only 27% of the teachers thought that it is applicable in their work. However, some teachers (32%) believed that ICT educational resources are suitable as a stimulus or reward for students, but most of them (52%) don't think so, which is surprising for us – they underestimate the stimulation effect and students' motivation to learn in deferent way. In additional comments respondent specify some of the ICT products used in different learning contexts. They are divided in 3 groups:

- ICT-based technical tools: computers, multimedia devices and interactive whiteboards;
- e-learning resources: National Educational Portal, e-books, tutorials, presentations, computer-based tests and tasks;
- software: Microsoft Paint, PowerPoint, Word and Learning management system (Moodle)

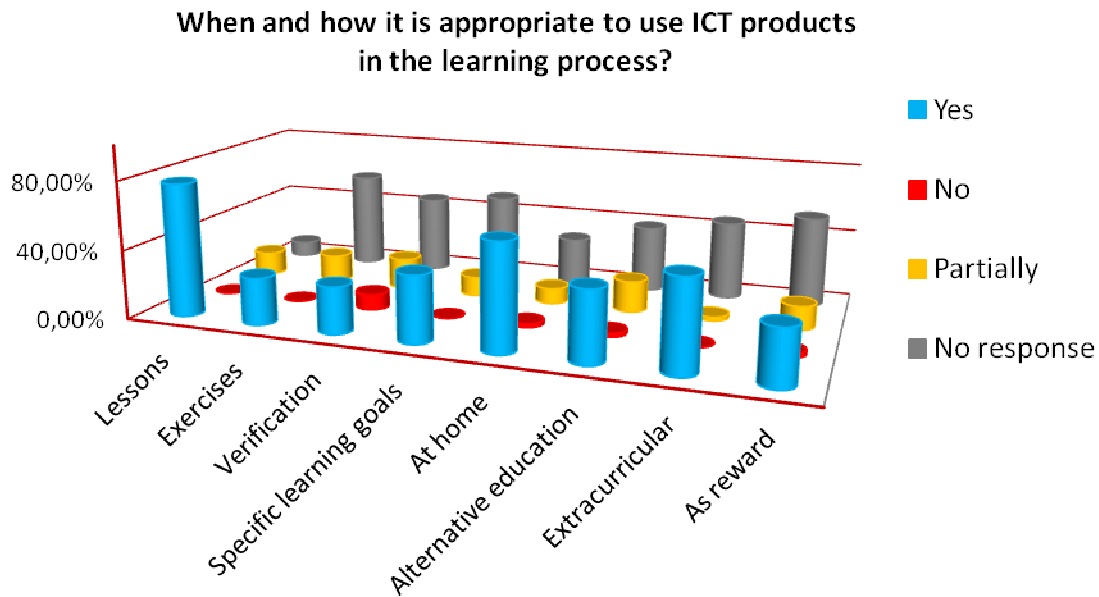


Fig. 5 The usage of ICT in different teaching/ learning contexts

3.4 Learners' qualities that are developed by ICT resources

As many psychology research state that ICT influenced entirely many of the human activities, we ask the respondents to consider the positive impact of ICT-based teaching on students, according to some basic skills and qualities. Not surprisingly, most of the respondents assert that ICT have a biggest positive effect on the following aspects (see Fig. 6): motivation (52%), effectiveness of the learning process (57%), ICT competence – integration of new technologies (61%) and team working (50%). These findings differ slightly compared to [10]. The Internet safety seems to be worse than before and that is a serious problem. Now only 40% of teachers think that using ICT tools and resources in learning process increase awareness about Internet threats, while in 2010 year about 80% of the teachers thought so. Another noticeable change is raise of effectiveness of the used ICTs, which can be result of better teachers' experience with technology. Learning activity – new methods for knowledge acquisition and problem solving – new pedagogical methods, opportunity to exercise both are developed according to 41% of the teachers. Social skills are also influenced by instant feedback - 31% of the respondents consider this aspect, which lead to improving the relations between the generations. Using ICT-based resources maintain the students' motivation and enrich classroom education, and so transform it into blended learning environment.

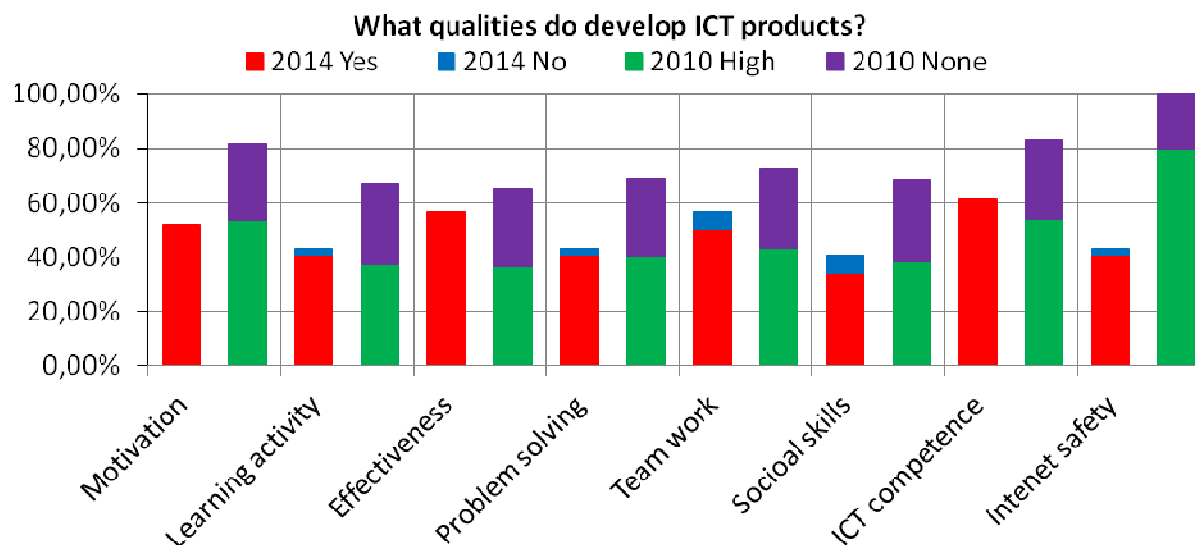


Fig. 6 Learners' qualities that are developed by ICT resources in comparison to [10]

3.5 Main obstacles to using ICT tools in the school practice

Some of the most significant obstacles, which draw our attention are Lack of teachers' training (43%), Lack of technical resources (39%) and Lack of appropriate products (36%) in the schools. The reported as a main obstruction Lack of training suggests to us that the previously held computer literacy training courses either were not effective enough or seems that there are many new ICT tools in schools that are difficult to handle. According to the survey [10] almost 80% of teachers declare relatively high basic computer skills in e-mail, word processing and finding learning resources on internet (more than 60% are self-assured while other are sure to some extent), which don't correspond with results in our survey, where 43% of respondents declare Lack of teachers' training as a primary obstacle to implementing ICT in schools.

One of the respondents shares the opinion: "The main obstacle (besides the lack of technical means) is the attitude of teachers, many of whom are afraid to use ICT due to lack of training, as well as technical and methodological. Lack of resources matching to educational program can be compensated by adjusting the available materials, but it still may take time, for example to find them on the Internet."

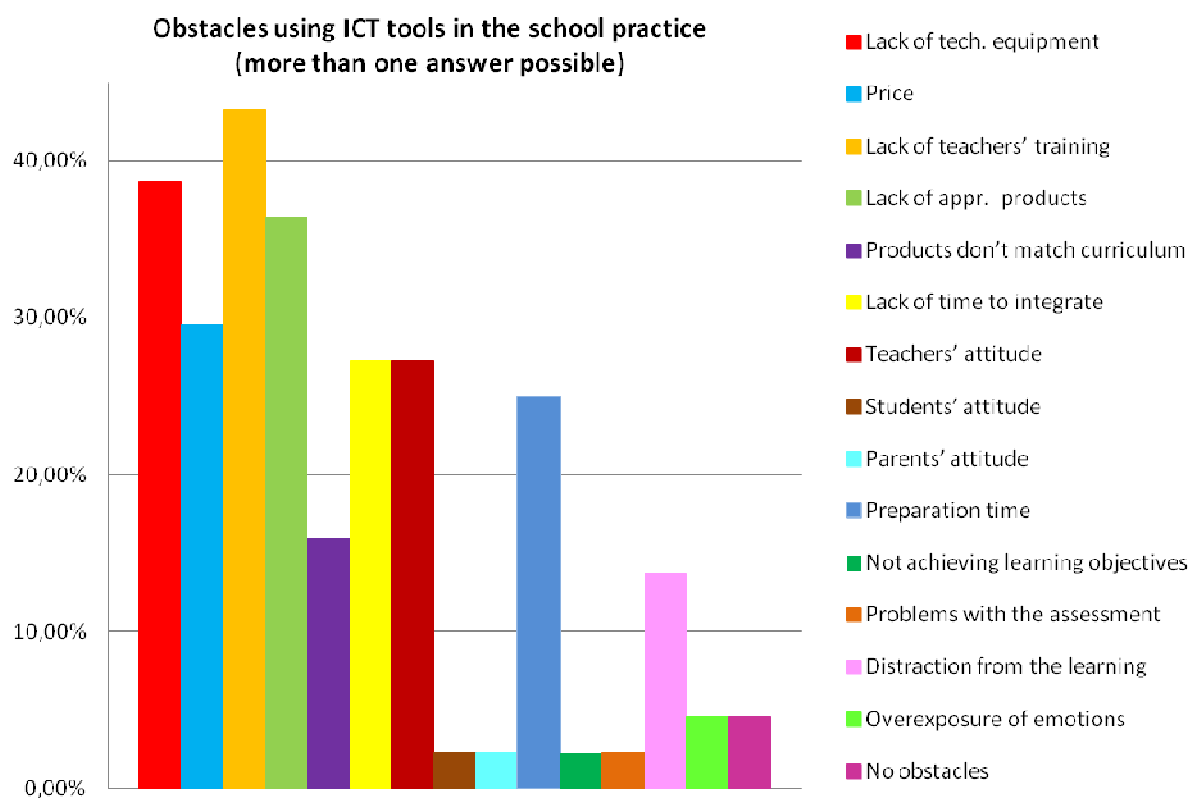


Fig.7 Obstacles to using ICT tools in the school practice (more than one answer possible)

Other appreciable obstacles are: price of technology tools (30%), the Teachers' attitude and Lack of time to integrate in curriculum (at 28% each), preparation time (25%), Existing products don't match curriculum (16%) and Distraction from the learning process (14%). A small number of teachers indicate other possible issues.

3.6 Teacher's role in ICT-based educational process

The usage of modern technologies in educational process influences the development of students' potential as individuals and their ongoing realisation as society members. It is important for teachers to incorporate a range of ICT-based teaching and learning resources into their teaching practice, because such resources usually are easily adaptable according to the individual needs and preferences of the students. In addition ICT educational tools and resources offer teachers and learners an enriched learning environment, which can support the different curriculum, teaching

methods and objectives. The technology tools and resources have the potential to augment traditional classroom education, so that they can enhance the learning process and to support teachers in designing varied approaches, teaching methodologies, learning context and sharing experiences. Technology allows engagement in large scale in the education process while providing with powerful support teachers in teaching and students in learning experience.

The integration of ICT in education doesn't change teaching methods, but transforms information transfer from a passive communication into an active one. In its essence this is paradigm shift: teachers change their role from information-deliverer to organizer and adviser.

The teachers admit that they have new role in the classroom after the integration of the ICT-based education – they mainly manage the learning process (over 77%) and select/ adapt learning units (61%), provide appropriate additional resources (about 55%) and assist students in knowledge acquisition (50%). Other activities that take considerable part in applying ICT in teaching practice are structuring the learning units (52%) and their design (about 48%), knowledge delivering and distribution of tasks and roles – both at 45%. Teachers should manage and control teaching process and learning activities in order to ensure meeting objective and requirements of the stakeholders.

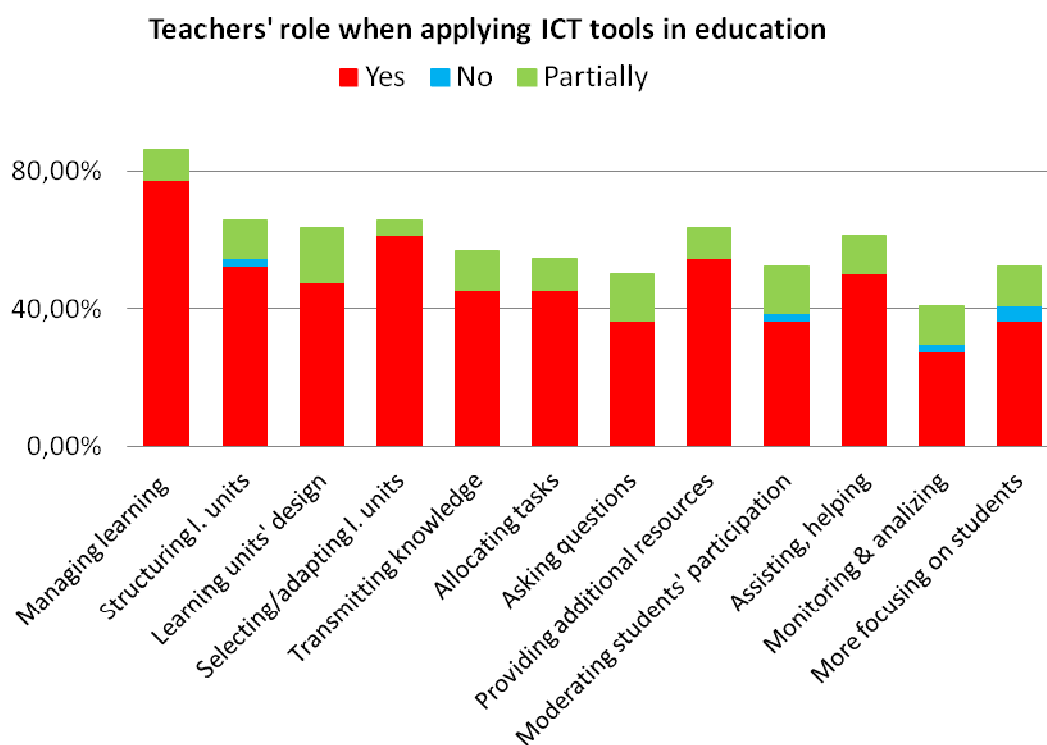


Fig. 8 Teacher's role in ICT-based educational process

4 APPLICATION OF ICT TOOLS IN EDUCATION

The usage of modern technologies in educational process influences the development of students' potential as individuals and their ongoing realisation as society members. It is important for teachers to incorporate a range of ICT-based teaching and learning resources into their teaching practice, because such resources usually are easily adaptable according to the individual needs and preferences of the students. In addition ICT educational tools and resources offer teachers and learners an enriched learning environment, which can support the different curriculum, teaching methods and objectives. The technology tools and resources have the potential to augment traditional classroom education, so that to enhance the learning process and to support teachers in designing varied approaches, teaching methodologies, learning context and sharing experiences. Technology allow engagement in large scale in the education process while provide with powerful support teachers in teaching and students in learning experience.

Integration of ICT in education doesn't change teaching methods, but transforms information transfer from a passive communication into an active one. In its essence this is paradigm shift: teachers change their role from information-deliverer to organizer and adviser.

The choice of method depends largely on the type of information or skills that are taught (learning subject) and influenced by the knowledge background and skills of the students, as well as their motivation. Basic teaching methods can be divided into three types: informative, phenomenological and cooperative.

4.1 Informative teaching method

This is the "classic" didactic teaching – providing oral or written explanations rather than demonstrations of matter. Messages and symbols are the key elements of information teaching. Education is done through "instructions" and explanations. The method is marked as lecturing.

4.2 Phenomenological teaching method

This method is based on the demonstration of phenomena, events, processes. Experiments in chemistry, biology, etc., observation of natural phenomena, watching everyday events lead to gaining knowledge through events, i.e. knowledge is built, absorbed and interpreted through senses and emotions. Demonstrations, learning through experiments/ experience, learning by doing or through adventure help monitoring, discovering, forming experience making emotional connections to the learned objects and thus understanding and memorizing the matter. Learning by adventure allows learners to explore real-world problems through authentic learning experiences within collaborative online learning environment. This approach comes from learning by doing and includes educational activities with authentic experiences ("researchers" on the spot). For example, the curriculum, the experience and observations of scientists, the online opportunities for interaction between participants are offered synchronously, so students can make the connection between what happens in the real world and their studies. Then they reflect and can provide possible solutions to the raised issues [11].

4.3 Cooperative teaching method

The cooperative method is very common in all educational institutions to acquire knowledge and skills – this is teaching in class. But formal learning process requires taking roles – teacher and student – and thus establishes a distance between them. Moreover, often it is more efficient to build smaller groups (2 to 5-6 participants) to perform certain tasks.

Collaboration allows students to actively participate in the learning process, discuss with each other and listen to other points of view. It establishes a personal relationship between students and explored topic, helping to think impartially and from different perspectives. Group projects and discussions are examples of this method of training. Teachers can use collaboration to assess the ability of students to work in teams, to present problems, of leadership qualities [12].

Learning by teaching may be attributed to the cooperative way of learning. In this method, students take on the role of teachers and trainees peers. First they need to explore and understand the subject well enough to teach the others. In this process students gain self-confidence, improve their language and communication skills. As mentioned communication is essential: between members of the group presenting educational material, and between the "teaching student" and the audience. The use of ICT contributes greatly project preparation, implementation and presentation.

Learning by doing and learning by adventure are part of the cooperative teaching method. In these cases, there is a combination with the phenomenological approach.

4.4 Implementation of ICT in different teaching methods

As a conclusion, we give some suggestions about which types of ICT tools can be exploited for enhancing teaching strategies in a relevant curriculum context. Different teaching methods require different ICT tools. For the information method drawings, diagrams, pictures, audio/ visual clips are appropriate to illustrate the learning matter. Using more colours and sounds contributes to ease of assimilation of facts and knowledge acquisition.

In the phenomenological approach demonstrations are important (not always possible in the classroom). But experience in the natural sciences can be simulated using modern ICT. In this way the students "take part" in the experiment, even if only virtually. A respondent suggests "In vocational training can be used educational films to see better practical application of theoretical knowledge and to obtain information on the developments in the subject."

In Table 1 we summarise the implementation of ICT tools in different teaching methods [13].

Table 1 Implementation of ICT tools in different teaching methods

Teaching methods	Sub-methods	ICT Tools
Informative – Minding: read, hear, watch	Didactic teaching	text, audio – music, song, narration; image – chart, graphics, table, picture, photo, scheme, cartoon; interactive board
	Demonstration	image – animation, photo, video clip, comics, movie; audio – sound effect, music, narration
	Immersion in a problem	artistic reading , artistic picture , 3D-tours film, theatre, storytelling, virtual reality
	Action	making virtual experiment in virtual labs through simulation of real processes, (the appropriate reactions are simulated too), drawing, painting, singing, role playing, making music or audio effect etc.
Informative – Minding: read, hear, watch	Adventure	remote participation in real processes – expeditions, experiments – via life Internet connection
	Small group teaching	all mentioned tools for didactic teaching, and phenomenological teaching; communication tools for exchanging information – e-mail, social networking, chat, network games, wikis, joint projects
	Peer teaching	all mentioned tools for didactic teaching, demonstration, immersion in a problem and action; exchange of information between students – e-mail, social networking, chat
	Class teaching	

A good example for integration of ICT in school is project Envision that successfully implement relatively easy to use ICT tools – it only requires a computer mouse and interactive board, but the results are significant enhanced learning outcomes and pupils' motivation [14]. This approach is appropriate for primary schools. Good practices of teaching sciences by ICT-based resources are shown in [15].

5 CONCLUSIONS

One of the goals of integration of the ICT-based tools, which change considerably not only the educational environment, but the way of teaching and presenting knowledge, is to increase the effectiveness of classroom education. The integrated ICT tools allow students to use modern technology to enhance their learning in all subjects. Main benefits are: opportunity for adaption of teaching approaches and learning resources to students' preferences and needs; learners can interact directly by studying in different simulated situations; educational paradigm shift problem-centred over subject-centred learning; comprehensive and cooperative process of studying; providing instant feedback and support by peers, tutors, mentors and experts.

ICTs bring unexpected until now opportunities for increased efficiency in education. For different training methods various tools are suitable. Very impressive are the examples of learning through adventure – such a training is not feasible without technique that provides audio / visual feedback in real time. While preserving the traditional tools for conducting an expedition by keeping diaries and documenting through photographs, measurements, etc. new ideas about the course of the expedition can be offered. ICT provides "augmented reality" and can supply additional information about the researched matter.

Having in mind the results of the survey, respondents thought that the integration of ICT in education may come up against some difficulties and obstacles, but it is obvious that it brings many positive aspects. In addition, the ICT-based education appears to be a modern, more effective approach to teaching. This can be achieved by appropriate ICT-based tools and resources blended with traditional

teaching methods and forms in such way that to intensify educational impact and stimulate active and interactive learning and contribute to continuously improvement of quality of education. There is much to do to about teachers' competence and skills, motivation and technology training to achieve better education and relevant outcomes.

There is much work to do in order to reveal in depth the results from the conducted survey. In near future we will explore various relations such as teachers' age and frequency of ICT usage and other aspects of the educational process. On one hand, most of the respondents are ICT users who understand the concept and the survey enounced positive attitude. On the other hand, a significant part of Bulgarian teachers still do not exploit the full capacity and effects of ICT-based teaching.

ACKNOWLEDGMENT:

The research work reported in the paper is partly supported by the project AComIn "Advanced Computing for Innovation", grant 316087, funded by the European Commission in FP7 Capacity Programme.

REFERENCES

1. Prensky, M. (2001). Digital Natives, Digital Immigrants. On the Horizon, MCB University Press, Vol. 9 No. 5, October
2. Information and Communications Technology (ICT) in the Primary School Curriculum: Guidelines for Teachers. <http://ncca.ie/uploadedfiles/ECPE/ICTEnglish.pdf>
3. Mellar, H., M. Kambouri, K. Logan, S. Betts, B. Nance & V. Moriarty. (2007) Effective Teaching and Learning Using ICT. Summary Report www.nrdc.org.uk
4. Lam P., J. Lee, M. Chan & A. Tong. (2012) Use of Information Technology in School-Related Activities and its Perceived Benefits among Teachers and Students in Secondary and Primary Schools in Hong Kong. Proc. of the 7th Int. Conf. on eLearning, pp. 228-235, Academic Publishing International, UK
5. National Program ICT in Schools. <http://internet.mon.bg/ikt/>
6. Strategy for Effective Implementation of Information and Communication Technologies in Education and Science of Bulgaria (2014 – 2020). <http://www.strategy.bg/PublicConsultations/View.aspx?lang=bg-BG&Id=1185>
7. Survey: <http://www4.iccs.bas.bg/survey/>
8. LimeSurvey: <http://lime.nova-media.info/>
9. E. Paunova E., V. Terzieva, Y. Stoimenova, P. Kademova-Katzarova (2014). Teachers' Attitude to Educational Games in Bulgarian Schools. EDULEARN'14, Barcelona
10. Peycheva-Forsyth, R. (2012). The Condition of ICT Integration in Bulgarian Secondary School – Researcher's Perspective. University Press Sv. Kliment Ohridski, Sofia.
11. Moos, D., B. Honkomp (2011). Adventure learning: Motivating students in a Minnesota middle school, Journal of Research on Technology in Education, 43 (3), pp. 231–252.
12. Slavin, R. E. (1990). Cooperative Learning. New Jersey, Prentice-Hall.
13. Terzieva V., P. Kademova-Katzarova, R. Andreev (2013). The Classical Education from the Perspective of ICT, Proceedings of International Conference on Application of Information and Communication Technology and Statistics in Economy and Education ICAICTSEE'2013, Sofia.
14. Envision: <http://www.nimero.com/lessons/nimero>
15. Kirova, M., E. Boyadjieva, Peytcheva-Forsyth (2012). Competencies and Beliefs of Teachers the Implementation of E-Learning into Science Education in Middle School. Chemistry: Bulgarian Journal of Science Education, Volume 21, Number 2.