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APPLYING IDWBL METHODOLOGY AT THE NATIONAL HIGH SCHOOL OF MATHEMATICS AND SCIENCE

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The *Innovative Didactics via web Based Learning* project accents on an innovative methodology of web use in the classroom. During the project realization a repository, containing IDWBL scenarios was developed. Teachers of the National High School of Mathematics and Science were acquainted with the methodology through the cascade approach. After that the IDWBL methodology was experimented in the classrooms in regular classes. The current paper comments the results of the teacher trainings and the application of the methodology at NHSMS.

Keywords: IDWBL, web, methodology, experiment

1 INTRODUCTION

Nowadays, it is very important not only to teach students in particular subject knowledge but also to educate them in lifelong skills and attitudes. A new investigation shows that four groups of ICT enhanced skills are really important, both for business and for the community. The Analytical report [2] represents the need of ability for team working and project working, information and presentation skills. As it was concluded during the Lisbon conference of the European Council "Businesses and citizens must have access to an inexpensive, world-class communications infrastructure and a wide range of services. Every citizen must be equipped with the skills needed to live and work in this new information society. Different means of access must prevent info-exclusion. The combat against illiteracy must be reinforced." [3]

Following Lisbon directions in 2005 the *Innovative Didactics via Web Based Learning* project was started. It was initiated as a Socrates European program project, supported by the Minerva subprogram [4].

The project *Innovative Didactics via Web Based Learning* is a multinational cooperation between teacher trainers and researchers from Bulgaria, Lithuania, the Netherlands, Poland and the Slovak Republic. The project is aimed at developing course materials, which can be applied by teacher trainers to prepare student-teachers (or in-service teachers) regarding the use of WWW in education. The second goal is to store course materials in an international data base.

I was acquainted with *IDWBL* project and related methodology during a workshop where I was invited by my colleagues from the University of Sofia. My first impressions were that this new methodology offers tools for organized and manageable use of the Internet in regular classes. It allows applying active learning methods which affect the level of learning results. In addition it provides a repository containing rich database of assignments. The availability of such resource facilitates teachers' work in two ways: a) teachers are able to use and reuse ready for work examples and b) they can easily adapt uploaded scenarios according to the specific characteristics and needs of their students.

Based on my first impressions I decided to experiment the IDWBL methodology in my classes and to introduce it to my colleagues.

2 IDWBL METHODOLOGY

2.1 Goals of IDWBL project

The main objectives of the project are:

1. To train via a cascade approach teachers from the participating countries in developing assignments and applying web based learning in their classrooms.
2. To produce a database with assignments for several school subjects in English as well as in the national languages of the participants.
3. To evaluate the proposed and implemented web-based teaching and learning model in terms of effectiveness, added value, sustainability and transferability.

2.2 IDWBL tools

Teachers' work is supported by the handbook where the main ways of use of the Internet space are described:

Web referral: Web-referrals are Web sites, used as additional Web-based information sources for a traditional classroom activity, where a teacher can refer to.

Web quest (short-term and long-term): A Web Quest is an inquiry-oriented activity in which some or all of the information that learners interact with comes from resources on the Internet, optionally supplemented with videoconferencing.

Web research: A long term research usually based on the use of powerful search engines as *Google*, *Yahoo*, etc. Students are asked not only to search for information but also to elaborate it, to gather some specific new information, to analyze results, etc.

There are also templates for scenario development and scenario evaluation (by students and by other teachers).

Another useful tool is the **Web Assignment Database (WAD)** – a repository of original and adapted **IDWBL** scenarios.

FIGURE 1. Web Assignment Database view

The **WAD** allows teachers to develop and retrieve web-based assignments for teaching and learning in several subject areas. [6]

3 EXPERIENCE IN APPLYING METHODOLOGY IN CLASS

As a Computer Science teacher who works with high motivated students with deep interest in computer sciences, I use the Internet in my classes regularly and this is not a new idea neither for me, nor for my students. Despite this experience, there were some problems observed – it is difficult to manage the time and the quality of work in the Internet; students have different levels of searching information skills, sometimes they have difficulties with gathering and evaluation of valuable information or they do not know how to use effectively the information found.

The **IDWBL assignments** idea is to put students in a specific role. This approach allows the use of active learning methods as Role Play or Project / Problem Based Learning as

well as Case Study. Students feel responsible for solving a given problem as they have to do this in the real live. The detailed description of the work process facilitates students to keep the final goal and teachers to track the students' progress. Each assignment requires the development of specific products and offers evaluation criteria. The result is that each student sees the results of his/her work and usually the student's grade is as objective as it is possible.

Urged for more effective and more interesting for students work on traditionally hard topics for the second level students, I developed two assignments – **AVL tree** (#3243 in WAD) and **Graph** (#3244 in WAD), which are fully conformed with the educational program for 11 and 12 degree of secondary school.

In the **AVL Tree** assignment students are in the role of database programmers in a bank and their task is to develop **STree** class which realizes the most efficient way of sorting and searching data. They should provide a good documentation of the class as real programmers and to give evidence that the realized programming code works really effectively and efficiently. The assignment is planned for 2 weeks team work (groups of 2 or 3 students).

The **Graph** assignment requires developing of completed product realizing class Graph using C++ language implementing constructing a graph, adding and deleting a node, adding and deleting a rib, passing through the graph methods. The result of work, illustrated by appropriate pictures, should be published on the school web site promoting possibilities for long use as a learning object during computer sciences classes.

Later both assignments were tested with students of 11 (26 students) and 12 (25 students) degree, who study second level of the Computer Science program. Examples of products are uploaded on the NHSMS web site [5].

After finishing work on the assignments a questionnaire was given to students:

TABLE 1. Results of evaluation by students

AVL Tree / Graph	Fully disagree	Disagree	Agree	Fully Agree
	1	2	3	4	5
The assignment is difficult	1 / 0	4 / 13	14 / 10	3 / 2	4 / 0
The assignment is boring	5 / 9	17 / 6	1 / 6	2 / 4	1 / 0
We should work on more assignments like this	2 / 1	1 / 2	3 / 5	18 / 12	2 / 5
I learnt a lot working on the assignment	0 / 1	1 / 1	0 / 5	4 / 13	21 / 5
I prefer more difficult assignments	2 / 12	4 / 9	16 / 2	3 / 1	1 / 1
I prefer more interesting assignments	4 / 9	3 / 7	17 / 6	2 / 1	0 / 0
This assignment makes no sense at all	21 / 16	4 / 6	1 / 3	0 / 0	0 / 0
The estimated work time is enough	0 / 2	3 / 1	6 / 4	10 / 11	7 / 7
The implementation of this assignment requires use of more powerful computer	1 / 1	1 / 1	9 / 13	10 / 7	5 / 3

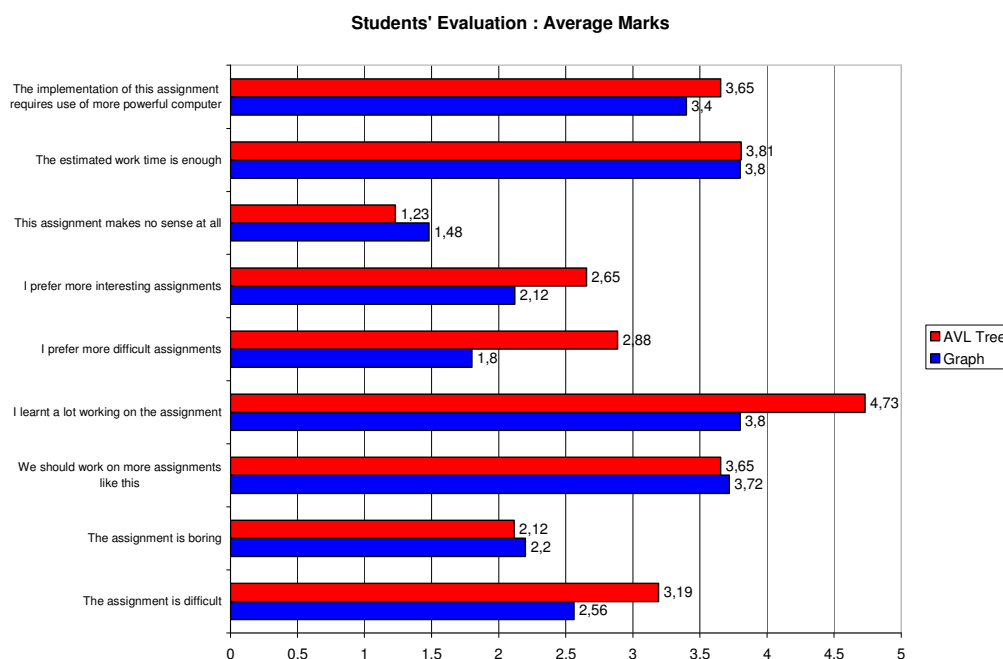


FIGURE 2. Outputs of students questionnaires: Average Marks

The input shows that situated according to the IDWBL approach assignments facilitate students when they study the given topic. Students evaluate the indicated resources as extremely valuable and useful. In their opinion the IDWBL formulated assignments are interesting and they increase their motivation for learning. The most of the students (76% of 11-th grade and 68% of 12-th grade) expressed their wish to work on more assignments like given. In addition, the requirements to produce and present a final product improve not only computer sciences related skills but also cultivate soft skills which not directly refer to the learning material. They acquire skills to express themselves (orally and in written form), to design presentation materials, to deliver presentation in front of audience, to prove their own theses.

It turned out that the **Web research** overrated the capabilities of some students (1-2 per group). They were not able to orient themselves in given web-portals and did not know which keywords to use for searching. Due to this reason assignments were adapted especially for problematic students – some concrete resources were given and students applied **web long** or even **web short quest**. The formal description of assignments was a very good base for further adaptation according to the individual students' needs.

Students share also that only problem they really met was the quite poor Internet connection and the very old computer equipment. They prefer to work in modern computer lab.

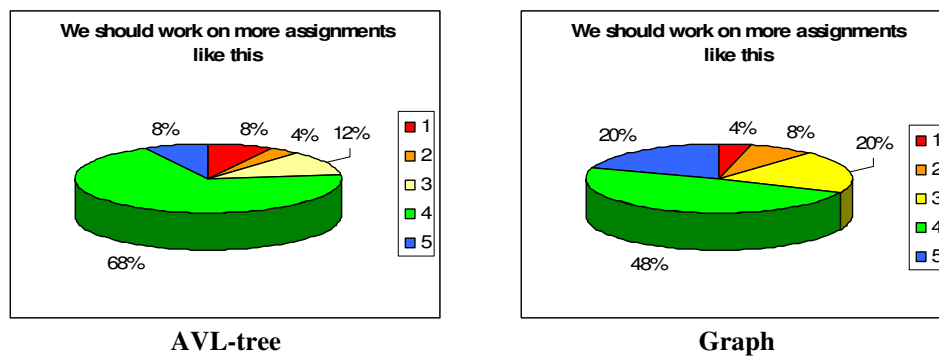


FIGURE 3. Outputs of students questionnaires

The greatest advantage they took during the IDWBL lessons was that they evaluated working on the IDWBL assignments as very valuable (79% thought they learned much more than in traditional lessons) and amazing.

4 EXPERIENCE IN TEACHING TEACHERS

The IDWBL strategy offers the cascade training approach in teaching teachers. Although this method conceals some risks, "...a cascade model of training may promote genuine development rather than surface adherence to official mandates" [1] when it is applied carefully taking all responsibilities.

Following the cascade training approach I delivered 3 studies with teachers of the National High School of Mathematics and Science. The aim of trainings was to introduce the IDWBL methodology and suggested ways of use of web in regular classes.

After the introductory meeting teachers were asked to develop their own assignments. Results were discussed during the next meeting. The last training event was dedicated to planning when and how to test ready assignments.

During the training meeting a lot of the assignments published by other colleagues on the WAD were reviewed and commented.

Mainly ICT teachers (5) participated in teachers' trainings but there were also a biology teacher, a chemistry teacher and a history teacher.

During the project meetings it was observed that the problems which teachers met working on the IDWBL project depended mostly on their specialty – if they are ICT professionals or no.

The ICT teachers have good technical skills and it was no problem for them to work with WAD. Using the Internet is tradition in their classes and they have felt comfortable in applying the IDWBL methodology, searching and publishing assignments and describing own assignments. Their general opinion is that formal description of assignments and availability of common assignment database make them very convenient for repeated application and adaptation. They evaluate the classification of types of web use – web referral, web quest and web research as very useful methodical instrument which can help to acquire students' abilities for searching and selecting valuable information from the Internet.

The main problem which the ICT teachers have met is how to gather ideas which topics are attractive for students, which ones relate to other educational subjects, how to add new value to other subjects material. Some teachers have decided to solve this problem by cooperation with other subject teachers. In this way they are able also to show in practice that the ICTs are mainly tools which can enrich results of other activities.

On the contrary, teachers in Biology, Chemistry and History do not feel so confident in the use of technological tools in class although they have a satisfactory level of computer literacy. Valentin Dojnov and Nelly Dyankova have had some experience in directing students to use information from the Internet. But they have met some difficulties in formal description of their ideas for learning projects and they have had some problems with publishing ready scenarios on the WAD. The next problem is the adaptation of other teachers' assignments. They do not know what the technical skills of students at given ages are, what product is real to expect, how to assess product from the ICT use point of view.

As a result of teachers' training and further discussions some teachers formed two-member teams: ICT specialist and ICT non-specialist – ICT and history, ICT and biology, ICT and chemistry. These teams developed and implemented common assignments. In this cooperative approach one of the teachers set up the topic and goals of the assignment in correspondence with his/her subject (history, biology, chemistry) objectives. The role of ICT teacher was to define the form of final product and how to proceed during the working process. Evaluation criteria were developed by both teachers. Each one assessed these rubrics which related to his/her subject. The implementation of the project took place mainly in the ICT classes supported by both teachers' help. The presentation of the final product was delivered during non ICT classes.

Through such collaborative work both teachers evaluate the effective class time consumption. As the Project Based Learning usually requires more time for work than traditional lessons, now teachers are able to manage and distribute time for consulting on learning content and time for practical work among both subjects.

Teachers who are not specialist in the ICT have shared their opinion that, as a result of work on the project, they feel more confident on ICT use and their students are more enthusiastic about individual work on a given problem.

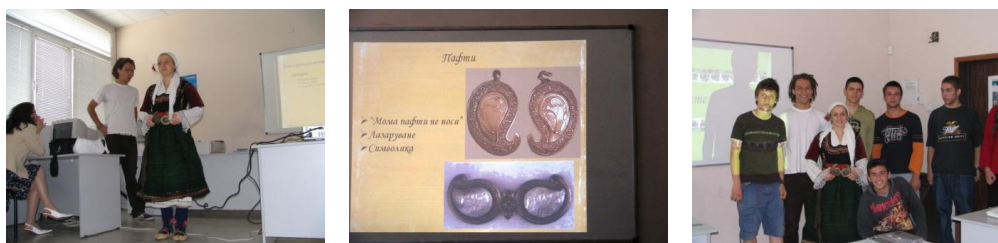


FIGURE 4. Combining history and ICTs: Students really enjoyed to present their products

The most active work in applying IDWBL methodology was presented by ICT teachers. They developed 39 assignments in total and they evaluated a lot of other assignments. 9 assignments were implemented by them in the school.

In 2006 the Nederland's evaluators visited classes of Miroslava Ilieva and Zlatka Ivanova. Their students presented work on 2 assignments in parallel: the first group had developed the web site on the topic "Varna – the beautiful and unknown sea capital of Bulgaria" (#415 in WAD) and "Sofia – the Bulgarian capital!" (#414 in WAD). Evaluators were surprised by the good team work in each of the groups and by the exiting results. Although the two groups worked on similar topics they chose totally different points of view and developed absolutely different (based on design and content) web-sites!

5 CONCLUSIONS

Students accept IDWBL assignments in a natural way as an interesting challenge; they do not have serious difficulties in examining projects. Assignments provoke students to express themselves, to prove own theses and to be more confident when they are presenting self-achieved results.

It does not take time for students to get oriented in assignment structure. If they evaluate the project as too difficult or too simple, students pretend for adaptation, usually promoting their own suggestions for what and how to be edited.

Work on assignments reflects on higher selfconfidence and on increased motivation for work on traditionally boring subjects.

In contrast to students' feelings, the most of the teachers are not aware ready for independent use of information technologies in class. Work on the IDWBL project vastly improves their assurance in their own possibilities. The idea for collaborative work ICT – non ICT teachers provides the most satisfactory results and it is accepted as the best way for applying IDWBL methodology.

The ICT teachers draw attention to the contribution of the methodology for development students' ICT enhanced information skills (search, proceeding, saving and delivering of information).

Both groups of participants – teachers and students, notice that IDWBL methodology contributes to quality of education and students' motivation improvement. It is common opinion that working on the IDWBL model will continue after finishing the project.

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