A development environment for cooperative programming
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ABSTRACT
This paper proposes an environment for the learning of program languages in a web environment. We consider that the student has to do exercises when he is learning a programming language; these tasks cause extra difficulties in conventional web environments. To remove these difficulties we propose an application that we have called DWE [9] (Development Web Environment); the core of this application is a language compiler integrated in the web application. Along with this compiler there are other modules to help the student while he is developing the programs; to obtain this we try to facilitate the communication and collaboration teacher–student and student–student and we try to use the experiences of all the users in a group. We propose a group-based methodology for developing the programming assignments with a CVS system as central point and a help system for the design and programming based in a Wiki system which allows both teacher and students to insert and browse information.

Keywords
CSCW, Cooperative programming, programming environments, e-learning.

1. INTRODUCTION
The learning of programming paradigms and their applications in specific languages is not a trivial task. There are many authors that approach the cognitive difficulties that the learning of new paradigm or the change from other paradigms presents [10].

The assimilation and setting in practice of concepts that involves a paradigm of programming implies an important effort to achieve its assimilation by students. On the other hand, for a correct understanding it is essential to combine the work of theoretical concepts with the practical tasks utilizing a programming language. It helps the student to strengthen those things learned in theory and to improve his level of knowledge. If we notice the taxonomy of Bloom's knowledge [1], is when the student is practicing when he uses more objectives of application and analysis and where he can discover errors of understanding.

All this implies a constant interaction between student – teacher that will provide the student a suitable knowledge of this programming language and of the tool of compilation, and that will permit the student to apply techniques to avoid errors and to solve them if they happen. In a classic learning environment where the teacher is present, this interaction is produced automatically. It is even necessary to take into account the factor of communication student – student. This model of programming learning is hardly transferable to the classical virtual learning environments. These environments are not enough when the student is doing practices of programming languages, because expressing the difficulties that he has with a fragment of code turns out to be difficult for the student. This makes difficult the solution of problems.

At present, there are tools that make it possible the automatic correction [3] [5] and proposals [7] are being developed so that these tools may make the student receive information about the type of errors that he has committed and the concepts he has to review. But there aren’t tools that provide advising the student while is accomplishing the practices of programming and before the student obtains the final result.

2. OVERVIEW OF DWE

Figure 1. The interface in a prototype of the system.

DWE uses a Web interface, therefore the student only needs a browser to enter to application, and he won’t have to install anything in his home computer.

DWE allows the users to write, compile and correct errors of their programs written on Java Language. The interface of compilation (Fig. 1) allows the user to go to the principal functions of the manager of files. It has an area of edition of the source files. When the user compiles one file, the system captures errors that are
produced and it gives the user information about the errors and he keeps the information in a database.

3. MODULAR ARCHITECTURE OF THE SYSTEM
DWE is composed of distinct functional specialized modules (Fig. 2).

![Module Schema](image)

Figure 2. Schema of the modules belong to DWE system.

3.1 File manager.
A priority target of the application is to make workspaces where each group member can develop its assignment task. Usually these involve create or modify a file of a class in a application. In the current version of the system, each user works individually which a Web interface, and shares the finalized version with the other members of the group.

CVS [2] is used to avoid concurrent and synchronization problems. CVS stands for Concurrent Version System and, as its name suggests, it is a concurrent system for the collaboration in software development, and to make easier the version control.

3.2 Compiler manager and warning building
The compiler manager module allows the user to call the compiler with appropriate options and other auxiliary tools for making a lint process on the source code of the files build by the student. The error catcher module catches the compiler out and stores all the messages and warnings in the database.

There is claimed that the system is preventive, that is, not only helps the students to fix mistakes in a finished program, but it allows the user, while he is writing the code, to realize which are the most common mistakes and he doesn’t make mistakes again. For this the system searches for error data and statistics in the database and it shows warnings to the user in the interface. For example, it searches for the last errors and more common error makes by this user and by the group and it shows them in the screen.

3.3 Collaborative help manager
We think that the help in the development environments is insufficient and it isn’t adapted to the level of the student, therefore we think that is necessary to make more detailed and adapted help pages. This is a main role of the teacher but I think that all students must collaborate to build the help pages with examples and their ideas. For making easier this task we intend to use a Wiki System [6].

A Wiki System allows both teachers and students to add, modify and browse all the pages of the help system in a easy and friendly way.

3.4 Student tracker and review of the group work
The system allows the teacher to see and to review the current state of the work of every group; but it also allows him to see the different versions of the project, that is, the actions that the group has performed over a period of time.

All the users that belong to a group (students and teachers) can do reviews of the work done until that time. To make it possible the review of different stages of the work we use a mechanism (called by some authors) work history [4] [8] and that we called active history.

The CVS used as shared workspace, also helps us to store and afterward review the active history of the project. In a natural way, CVS allows us to store versions of one or more files that are part of the software project. Besides CVS allows us to recover stored versions at any time, and moreover it allows us to compare the changes between different versions. This makes the review of the changes along different stages of the project easier.

Another function of our system is to propose different choices in each stage of the project development. We can also carry out this using CVS. It allows us to store sequential versions and forks of versions. For every file of the project we have two or more alternatives.

4. CONCLUSIONS
We have designed and developed an environment for the learning of programming languages that provided several new things to other present environments:

- The compiler integrated in a web environment, avoids the installation and configuration by the user of environment and permits the centralization of maintenance.
- Help assistance for the student while he’s writing the code, not only when errors happen.
- The user can make good use of the experience of others in the solution of regular errors with the help manager based in a Wiki system.
- The teacher can do a students’ tracking individually looking up the errors that the student has committed.

5. REFERENCES


