

# WIPE-A Model for a Web-based Database-driven Environment for Teaching Programming

Vassilios Efopoulos  
Dept. of Applied  
Informatics  
University of Macedonia  
Thessaloniki, Greece  
[efop@uom.gr](mailto:efop@uom.gr)

Georgios Evangelidis  
Dept. of Applied  
Informatics  
University of Macedonia  
Thessaloniki, Greece  
[gevan@uom.gr](mailto:gevan@uom.gr)

Vassilios Dagdilelis  
Dept. of Educational and  
Social Policy  
University of Macedonia  
Thessaloniki, Greece  
[dagdil@uom.gr](mailto:dagdil@uom.gr)

Theodore Kaskalis  
Dept. of Preschool  
Education  
Aristotle University  
Florina, Greece  
[kaskalis@uom.gr](mailto:kaskalis@uom.gr)

## Abstract

*We describe a web-based programming environment that serves for the teaching of the basic principles of programming. The environment is accessible via the Internet through a web browser and uses a specially featured compiler to translate the source code of the programming language into a pseudo assembly code. Supplementary programming tools accompany the compiler and a database is used for storing the intermediate results (i.e., the code students develop while trying to solve an exercise). In addition, there is a complete user, file and group management environment and a tool to automate the testing of the student solutions to programming exercises.*

The scope of the present study is the presentation of WIPE (Web-based Integrated Programming Environment), a complete web-based programming environment that serves for the teaching of the basic principles of programming. Such environments that support the teaching of information technology have attracted the interest of the research community.

The programming environment we propose is based on and further expands the compiler environment of the educational software DELYS that was developed under the framework of the pilot project ODYSSEIA supervised by the Greek Ministry of Education. Among the new features of the suggested environment are:

- A complete user and group management environment,
- A compiler of a programming language which is translated into a pseudo assembly language,
- A database that is used for storing several types of data (input by teachers, outcomes of the students' homework, etc.),
- Integration of a tool for automating the testing and grading of the programming exercises.

The programming environment operates via the Internet or a local Intranet and is accessible through a web

browser. The software is installed in the network (Intranet or Internet) server.

The environment of the WIPE compiler allows users to compose, debug and execute programs, written in a popular programming language. In the initial release of the environment we have implemented our own version of a subset of Pascal (see <http://macedonia.uom.gr/~efop>). WIPE will allow for the addition of any desired language (C, Java, etc.) and the simultaneous support of many different compilers.

The environment and its philosophy of functioning incorporate a number of features with didactic value:

- Students can monitor all the intermediate states during the execution of their program: compilation, assembly code, registers, and intermediate values of all user and system variables. Furthermore, they can edit directly the assembly code and then execute it.
- Students can ask the compiler to verify the correctness of their code. This is done with the use of "algebraic assertions", a type of black box testing.
- The compiler provides students with many explanatory messages and hints that are as accurate as possible and can help novice programmers to debug and generally improve their programs.
- The system records all the attempts that a student makes in order to develop a program. This can be a very useful tool to teachers [11], since it will provide them with valuable information about the difficulties students experience and help them adapt their teaching to student needs.
- Statistical information about the performance of students and the suitability of a given exercise.
- Automatic checking of student exercises.

All the results of this project will be available through the Internet to all teachers and researchers. We hope that they will provide them with useful information about the way students conceive the principles of programming.