Teaching Programming Language to Engineering Students: Case Study of Al Fateh University, Tripoli

Nasreddin B. El Zoghi and Nand Kumar
Department of Computer Science, Faculty of Information Technology,
Al Fateh University, Tripoli, Libya
E-Mail: nzoghobi@yahoo.com, nandkumar12@gmail.com

ABSTRACT
In this paper, we discuss a case study about which Programming Language should be taught to the Civil Engineering Students in the Al Fateh University: FORTRAN or C?. It is decided that C should be taught with its basics and fundamentals with real world applications from Civil Engineering area. It is further proposed that the Computer Programming teaching faculty members must join hands with those of Civil Engineering Departmental since the computer programming subject teachers do not have engineering background. This suggestion for association of teachers of the two departments may be also applicable to other Engineering Departments like Geology, Petroleum, Mechanical, Electrical, Electronics, etc. It will help them to decide the course content and how the Computer Programming Language will be made useful and interesting to the engineering students. This will encourage them to give more attention in the Computer Programming language, and the subject will be taken in proper spirit and seriousness in future. For joining hands, it is also proposed that various recent techniques like Software Engineering Principles for Course Development, Use of Low Cost Hardware and the Visual Basic programming language, CALL concept, Web technology can be applied through Seminars, Workshops, Presentations and brain storming sessions for teachers in coming years.

Keywords
Computer Programming Language, C, Teaching Engineering Students, Association of Engineering Faculty, Engineering Applications.

1. INTRODUCTION
1.1 Computer in Everyday Life: These days computers are used everywhere extensively in every walk of life. Go to any shop, any office, any big hotel or restaurant, airport, railways, everywhere you will find computers at work. Thus it has become an important part of everyday life.

1.2 Admissions in Engineering Colleges: It is a common practice that when admissions are done in an Engineering college, the branch distribution is done on the basis of 10+2 marks /or based in the performance in the admission test, organized by the Engineering College or some examining authority appointed by Government.

1.3 Subjects taught in First Year: It is generally observed that the First Year Engineering Students are taught Engineering Physics, Engineering Chemistry, Engineering Mathematics, Basics Of Electrical Engineering, Mechanical Engineering, Civil Engineering, Electronics Engineering, Workshop Practices, etc. Besides these they are also taught Computer Programming subjects. Earlier FORTRAN, BASIC, PASCAL Programming Languages were common, but nowadays, C language or JAVA language is taught to the budding engineers in the first year.

1.4 Interest of Students in Computer Programming Language: When a student is admitted in a particular branch of engineering (except those who are admitted in Computer Engineering or Information Technology or Computer Science), all the engineering students feel that they have simply to pass the programming language subject. They neither have a feeling to learn the language very seriously, nor they are aware of the importance of the programming language in their future career. The result is that they do not study programming language with due attention and become pseudo-engineers.

In this paper, an attempt is made to discuss a case study about teaching Programming language to Civil Engineering students in Al Fateh University, Tripoli. It describes present status and plan of programming language to them. Some suggestion are given how to achieve more interest by engineering students to learn computer programming language. In the process, some studies have been done to review some of the programming languages, which are being taught in colleges and universities in the world.

The paper is organized as follows: Section 2 gives background of Case Study, while section 3 presents a review of programming languages and recent tools for teaching to engineering students. Section 4 presents the details of the case study. Conclusion and future work are described in Section 5. In section 6, acknowledgement is given while references are given in section 7. The two appendices A and B are given at the end.

2. BACKGROUND OF CASE STUDY
2.1 Status of Programming Language for Civil Engineering Students: In Al Fateh University, Tripoli, students of Civil Engineering Department used to study...
FORTRAN Programming language as a part of GE-108 course. In 2008, it was decided by the Computer Science Department that FORTRAN will not be taught, since it is not being used in most of the places in the world.

2.2 Teachers of Computer Programming: Generally the computer programming is taught by computer teachers, who have acquired the Masters degree before taking up teaching assignments in engineering colleges. Rarely such teachers have PhD degree. In many cases, the computer programming teachers do not have engineering background. They teach programming language with lot of mathematical concepts. Though these mathematical concepts are simple mathematical calculations (using +, -, *, / ), logical relationship (using less than, greater than, equal to , not equal to , less than equal to , greater than equal to symbols <, >, =, !=, <=, => respectively), logical calculations (using AND, OR, NOR, NAND, EXCLUSIVE-OR, EXCLUSIVE-NOR), bit manipulation (using shift left, shift right , AND, OR, NOR, NAND of one or more bits), factorial, Fibonacci series, Tower of Hanoi problem, etc. To add the simple mathematical concepts, the first year students are also exposed to the higher level mathematical concepts like array, vector, matrix as part of simple data structure. Further, new complex types of data structures like structure, union, list, linked list, queue, stack concepts, which are also common and which are taught to the first year engineering students. However, no engineering applications are taught by Computer Programming teachers to these students.

3. REVIEW OF PROGRAMMING LANGUAGES AND TECHNIQUES FOR TEACHING A PROGRAMMING LANGUAGE

3.1 Which Programming Language in First Year?: Earlier first-year engineering curricula included a course in programming in a high-level language (such as FORTRAN, Pascal, BASIC) [1-2]. Such languages had traditionally been justified as teaching logical thinking and problem solving, while providing the students with tools that they will use as practicing engineers. Now-a-days, other Programming Languages and Tools like Scheme, Mathematica, Python, Java, C, C++, Visual C++, C#, PHP, Ruby on Rails, MATLAB are common for teaching programming languages in the First Year. Consequently, there is little reason to teach traditional programming languages to the students [1-4]. In the next section, we review some of these languages and Tools for their special feathures and characteristics:

3.2 Recent Programming Languages and Tools

3.2.1 Mathematica vs Scheme: Mathematica [5] is great for symbolic manipulation, data plotting and programming of rather simple software prototypes with a nice embedded Programming Language, but extremely bad to teach programming concepts. Mathematica interface is highly problematic, counter-intuitive and ugly. No help source is provided and no pattern-matching functions are available. It does not ease teaching students Programming Techniques, while Scheme does. Mathematica makes the learning of abstract data types (ADTs) extremely difficult, while Scheme mostly enforces it. Mathematica makes it more awkward to teach the orders of growth while Scheme does not. Usual Programming Concepts like Interpreter, Compiler are not easily taught to students using Mathematics. PLT Scheme makes them explicit.

3.2.2 LISP: In October 1958, John McCarthy published one of the reports [5-6], as a series of his then ongoing effort for designing a new programming language that would be especially suited for acheiving artificial intelligence. That report was the first one to use the name LISP for this new programming language. 50 years later, Lisp is still in use. This year we are celebrating Lisp’s 50th birthday. Lisp was fifty last month (October 2008). Happy Birthday! [5]

3.2.3 Java: In some of Colleges or Universities like USA, Europe, Japan and India, Java [5,7] is used for teaching as a first programming language. Students learn Java not only as their first programming language but also they learn it in Programming Principles where they finish the modules like simple object oriented terminology including classes, objects, methods, message passing, inheritance and polymorphism. It has basic programming constructs including sequence, selection and iteration, the use of identifiers, variables and expressions. There is a range of Java primitive data types and library objects, including the Java Collection Class. It has programming style aids communication between programmers and exception handling also. It is extensively used in Internet programming and mobile equipments.

3.3.4 MATLAB: In [8-9], it is suggested that if one is an engineering educator in any discipline and would like to teach computer programming so students learn, get excited, and discover something they can really use, consider MATLAB. The main focus will be teaching programming skills using MATLAB as the introductory programming language. MATLAB has enough programming constructs to teach fundamental programming principles along with a wide assortment of built-in functions to enable students to solve nontrivial problems and produce high-quality graphics in a variety of high-level courses. to enable you to teach programming skills and to develop students' problem-solving skills. It also will provide examples that require nontrivial MATLAB programs to solve engineering application problems. Such tools are more powerful and easier to master than a traditional programming language, allowing the students to solve interesting and challenging problems earlier in the course.

3.3.5 Microsoft Office Modules: Some people feel now, there is no need to teach any programming Language in First Year, and students should be taught Microsoft Office modules only.
since they do all sorts of work which an engineering student wants to do. Such work are like drawing diagrams, writing text as lab manuals, making reports, preparing thesis, creating presentation by using various modules of MS Office [10].

3.3 Review of Techniques to Teach Programming Language

3.3.1 Applying Software Engineering Principles to Course Development: Academic institutions and training facilities in business, government, and the military increasingly use the Web to convey their curricular offerings. Design and development of these online offerings often entrusted to teachers, professors, and trainers, who have little technical expertise and inadequate technological or pedagogical support. Rather, there is a need to arrange seminars and workshops for these teachers, where they should be introduced the Course Development Lifecycle, an adaptation of the System Development Lifecycle used with success in software engineering [11-12]. These should include presentations and guided group activities to explain how online courses can be planned and developed. Topics will include developing learning outcomes, matching outcomes with online resources, assembling online resources, and evaluating online courses.

3.3.2 Use of Low Cost Hardware and the Visual Basic programming language: Using low cost hardware and the Visual Basic programming language concepts [13], the authors have developed teaching modules which can effectively introduce basic science and technology principles at several levels to freshmen of Electrical Engineering. They have also tested these methods in a National Science Fund (NSF) sponsored course designed to teach teachers to implement these modules in their classrooms. This can be also applied to teach programming language in the classroom.

3.3.3 Use of Computers to teach Language: Computer Assisted Language Learning (CALL): In the United States, the notion of CALL (Computer Assisted Language Learning) is very popular, which involve the utilization of computer programs for language learners [14]. One such program, 'Editor-in-Chief', helps students to hone their text-editing skills before they hand in the final draft of a thesis or a resume. In order to conduct CALL-related courses, language teachers will benefit from being trained in the IT domain. CALL concepts can also be used to teach Computer Programming Language.

3.3.4 Use of Recent Web Technology in Classroom: With regard to using recent technology in the classroom, researchers [14] have suggested that the teaching of language using computers could involve:

(a) accessing language material such as games and activities through the Internet or CD-ROMs; and
(b) utilizing word processors for multiple drafts of essays.

In fact, computers can be further exploited and teachers should encourage students to build their own language-learning websites. Students should learn to use certain software programmes (e.g. Dreamweaver, Microsoft FrontPage) and perhaps even master basic html and java-script programming. In addition, students should have the incentive to read books or surf the Internet to research material for their websites. They could also take more initiative in using the target language to write interesting web pages.

3.3.5 Seminars, Workshops and Presentations for Teachers: The interactive workshops and seminars [2,9,11,14.] is a combination of small groups, lectures, discussion, and group presentations. Participants can increase their understanding of how students approach assigned work and what students think about their engineering education. Participants will receive guidelines and know-how of their own teaching. Participants can also experience an example of how to apply educational research findings to engineering classrooms.

In the next section, we present our case study for Teaching Programming Language to Civil Engineering students.

4. CASE STUDY: TEACHING PROGRAMMING LANGUAGE TO CIVIL ENGINEERING STUDENTS IN AL FATEH UNIVERSITY, TRIPOLI

4.1 GE-108 FORTRAN PROGRAMMING: In Al Fateh University, Tripoli, students of Civil Engineering Department used to study Fortran Programming as a part of GE-108 course. In 2008, it was decided by the Computer Science Department that FORTRAN will not be taught, since it is obsolete and outdated and these days it is not being used in most of the places in the world.

At the start of the course, the adviser to Chairman of the department requested to the Programming Language teacher to contact the retired senior professor of the Department, to discuss and decide what should be the course content of programming language of GS-108. The retired professor, being experienced in settling of labs, specifying course curriculum, teaching aids, etc, in the department, he was also well versed in programming language He had been teaching FORTRAN Programming language to the students for the last many years. He advised discussions and suggestions by a meeting with Professors of Computer Science Department.

4.2 Revision of GE-108 as Introduction To C Programming: After the meeting, it was resolved that the full details of the Programming Language need not be given to the First Year Civil Engineering Students. They should be exposed to the only basics and fundamentals of the C Programming Language [15-16]. They should be taught the language with some real world Civil Engineering applications, so that they have a feeling that it is essential for them in future They should be made aware that C language will be useful for solving real
world Civil Engineering problems. Learning programming language is very essential to them. Once the motive behind the study of C language is clear, then there is interest also, and then they will study with proper attention and seriousness.

The course content of CS-108 is given as an Appendix – A, and some of the Civil Engineering applications are given in Appendix-B.

5. CONCLUSION AND SUUGESTION FOR FUTURE SCOPE

In this paper, an effort is made to discuss a case study about which Programming Language should be taught to the Civil Engineering Students in the Al Fateh University? It was decided that only basics and fundamentals of C Programming Language should be taught to them with real world applications from Civil Engineering area. In the process, a review was made to understand what are other programming languages, which are commonly used in the world and how to create more interest in Engineering students to learn the computer language.

As conclusion of the case study, it is proposed that the Computer Programming teaching faculty members must join hands with those of Civil Engineering Departmental since the computer programming subject teachers do not have engineering background. For joining hands, it is also proposed that various recent techniques like Software Engineering Principles for Course Development, Use of Low Cost Hardware and the Visual Basic programming language, CALL concept, Web technology can be applied through Seminars, Workshops, Presentations and brain storming sessions for teachers in coming years. The suggestion of association of teachers of the Civil Engineering Department and Computer Science Department, can be also applied to other Engineering Departments like Geology, Petroleum, Mechanical, Electrical, Electronics, etc. It will help them to decide the course content and how the Computer Programming Language will be made useful and interesting to the engineering students. This will encourage them to give more attention in the Computer Programming Language, and the subject will be taken in proper spirit and seriousness in future.

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7. REFERENCES


[10] www.office.microsoft.com


Appendix-A

GE-108 INTRODUCTION TO C PROGRAMMING.

Credits: 3, Full marks: 100,
No of hours per week: 3 hours theory and 2 hours practical

Course Content:
1. Computer Fundamentals: Introduction to Computer, Hardware and software, parts of a computer, Input and output devices, memory and central processing unit, program, flowchart, computer programming languages, typing, editing compiling, linking and running of some simple C programs.
2. C language Fundamentals: Character set, reserved words, identifiers, variables, data types – integers, float, character, string, comments.
3. Input and output data: Displaying of message on screen using printf(command, Reading of data from keyboard using scanf(command, output formats for printf() and input formats for scanf(command.
4. Expression and Assignment statements: arithmetical, relational and logical operators for making expression and assignment statements.
5. Selection and branching Statements: if-statement, if-else statement, switch-case statements, break, exit
6. Repetition and looping Statements: While, do-while, and for statements, simple uses of mathematical and logical calculations.
7. Introduction to Function: Simple applications of C built-in and user defined factions, void, return, recursion function, mathematical functions, preprocessors.
8. Array and pointers: one, two and multi-dimensional arrays, simple uses of pointers.
10. File Handling: reading, writing and appending of files.
11. Use of C language for Simple Civil Engineering Applications.

Appendix-B

CIVIL ENGINEERING APPLICATIONS:
1. Drawing of basic geometrical shapes: point, line, square, rectangle, circle, ellipse, polygon.
2. Display of colors: red, green, blue (of point, lines and various shapes).
3. Solving system of linear equation
4. Various shapes used during surveying
5. Centre of gravity of different shapes
6. Simple harmonic motion of pendulum
7. Draw load deflection curve for simple beam and Buckling of column
8. Drawing of Graphs, Shapes with holes
9. Use of fractal for drawing different types of shapes