A Basic Computing Course Experience with Multimedia Equipment

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Abstract *- This work describes a practical experience in a basic computing discipline, for freshmen in Engineering courses, at FEI, using multimedia equipment, aiming at a major student participation in class. These classes are held in the computing laboratory, and make use of microcomputers and multimedia equipment. Such equipment is normally used not only to present new concepts or resources, but also to describe the programming environment characteristics, and to test programs related to the solution methods adopted: this allows the students to have a greater facility in perception and more time to discuss the mistakes they made in the solution process. The use of this equipment also allows the instructor to gain speed in the course and to enrich his exposition activities. All this contributes to expand the necessary time dedicated both to discussions, involving computational problems, and critical analysis of the solution methods that were adopted by the students. As a result, the students have really increased both their participation in class and interest in the course, and this has finally led to a significant rate increase in the comprehension of the discipline concepts and class approvals.*

Introduction

The general lines that guide the work of the discipline were based partly on some conclusions of *Masetto* and *Furlani* and partly on a didactic-pedagogical line adopted at FEI to deal with a new attitude, which is based on learning rather than teaching. In his work, *Masetto* proposes some clues for a better use of resources. The first indicates that the professor should adopt an educational, and not just the traditional informative posture, he should visualize the classroom situation as a group of adults at work, where each one has its space of action and effective participation, where dialogue and exchange of experiences are motivated and the relationship professor-student is a relationship full of responsibilities among adults. The professor should be a stimulator and facilitator of the teaching-learning process.

The second clue points at the need of bringing the characteristics of a social coexistence place into the classroom, where knowledge is treated and shared by all, and is directly linked with the social life of the group. The third clue emphasizes the importance of considering the student as an adult and, therefore, with potentials and needs different from children or adolescents. So, it is not an adequate procedure to bring to the university one's secondary school didactic experiences.

The last clue reviews the concern in deepening our domains and knowledge about Educational Technology, so that a lot of new techniques, that allow stimulating the participation, integration and compromise of each group or class, considering their peculiarities and different interests, can be used.

Furlani mainly discusses the authority inherent to the university professor and proposes the exercise of that authority based on the educator's competence and in the existence of an open relationship, where the dialogue is a constant practice, the authenticity of both the professor and the student is preserved, the objectives are clear and the compromise with these objectives is assumed by all components of the group.

Another focus of orientations is derived from a group of professors at FEI, organized to think over new studies and analyze new experiences. Emphasis was given to the use of multimedia in teaching, and the development of a method for the students continuous evaluation.

The application of computer technology resources allows that material for class support and studies complementation, be used in microcomputer labs. This brings larger flexibility to instructors and increases the student involvement and interests.

The continuous evaluating method has the advantage of creating the habit of constant study in the student, and allows a more frequent reference on their acting and response to the course, pointing at eventual needs for reinforcement or review of concepts.

In six-month courses, and large classes, students have difficulties when reinforcement is needed in their studies. The resources of computer technology and the methodology of continuous evaluation try to avoid these difficulties, and to facilitate the process of learning.

About the discipline

The objective of the discipline is to develop the capacities and abilities in a student so that he may deal with computing problems, from understanding and analysis of the problem and choice of a resolution

method, up to the representation of this method through flux diagrams, and the implementation and tests of the corresponding program. The discipline intends to improve also the student's critic capacity and creativity. The discipline is given in one semester, with approximately 900 students with four a classes week. The students are distributed in 12 or 13 groups of 70 each, with 4 or 5 professors taking care of them. The discipline coordination is carried out in small informal meetings realized during the course, when specific problems are devised and discussed. These problems are sometimes taken and discussed also during the general planning and evaluation meetings, usually at the end and at the beginning of each term. During these meetings the needs and possibilities for improving the course are analyzed in all their aspects: new focus, adaptation of support material, new propositions of practical works and re-evaluation of the discipline objectives.

Although the course is based on textbooks, multimedia material and evaluation activities, professors are free to manage their own classes, incorporating their own interests and also the interests and needs of each group to the general objectives.

At the end of each semester all professor's suggestions to reformulate the didactic support material and activities are collected and organized. Besides the functional objectives of these meetings for coordination, planning and evaluation, they also have the purpose of maintaining and motivating the professors' involvement and compromise in the conduction of the course.

The relevance of the discipline as a component of the engineer's basic formation is based on two main aspects, which are the stimulation for the future engineer to use the computer, in every possible way, since this will be one of his working tools, and the development of the students capacities and abilities for the treatment of problems.

Besides these main aspects, it is expected that the discipline may also contribute to improve the capacity of the students' teamwork, with creativity and critical participation.

The evaluation activity

During a semester five evaluations activities are realized in classroom, and they are developed in several ways, some individually and others in small groups.

Each evaluation is followed by comments or discussions with the students, about the questions and the answers that have been formulated. All evaluation situations are used as reinforcement in the process of the student's learning. In this way, it is expected that both the student and the professor have always a good reference about the development of the student and the course.

Besides evaluation activities in class, the students have four practical tasks during the semester, With this, the students get through all the computing problem treatment such as enumeration of the characteristics and contours of the situation proposed as a problem, analysis and discussion of the possible resolution alternatives, description of the defined resolution method, and implementations and tests of the corresponding program, realized in microcomputers lab. In these activities it is also required that a minimum of documentation and programming style be matched. The students may rely on the professor's orientation for these tasks. At the end of the semester final tests are given, with questions that involve all the subject contents which have been studied along the course. All these activities aim at the stimulation of a regular and permanent studying habit during the course, and not only on final tests eve!

The contents organization and multimedia

The contents are organized in six modules, and each module includes three to five double classes, which makes a fourteen effective week course.

Multimedia presentations are prepared by the professors themselves for each class, using the *Medi8or* software. These presentations are installed in a system composed of a microcomputer and a multimedia projector, which is connected to the local computer network lab and shared by all professors in their classrooms.

These presentations include topics that are relative to new concepts or resources of the language system and its representation in a flux diagram. In other classes the multimedia material presents the proposition of problems, whose resolutions require the application of concepts and resources relative to the modules already studied. After this, the solution of problems is worked out.

These resources allow the course to gain speed and the didactic material exhibited is enriched with details. Another interesting characteristic is the possibility of the professor to raise quickly topics already studied in other classes, whenever it's necessary, to reinforce or review any concept or resource, specially during the presentation of problem solutions. In short, the professor can work with a level flexibility and mobility, otherwise difficult to get without the aid of a computer-projector system, and with a much more satisfactory degree of clarity and richness.

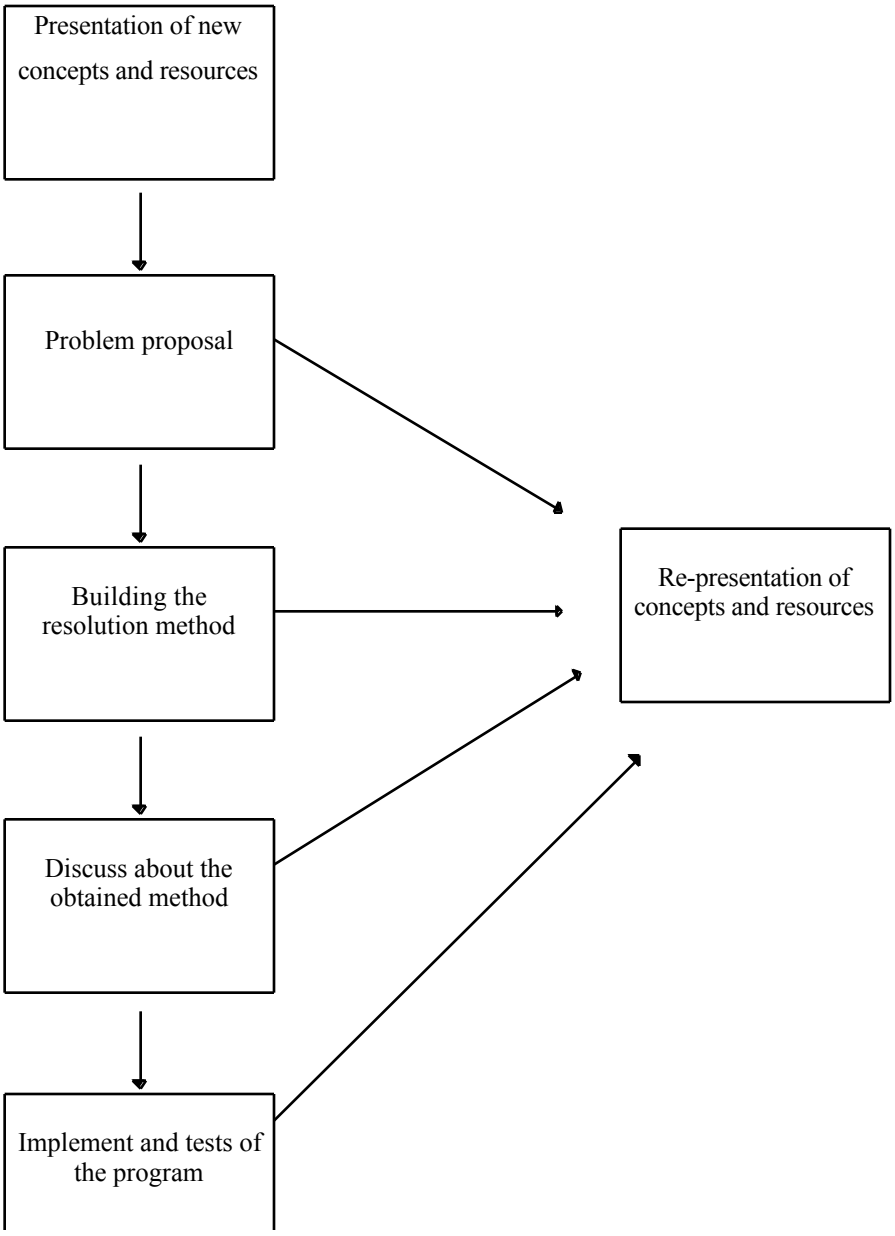
One of the most mentioned aspects, when discussing freshmen deficiencies, is the resistance to the habit of reading books: this kind of work makes the student drop the practice of writing down everything they see on the board in class, without paying attention to what is said. On the other hand it causes the need for complementary readings, at least for the tests shown as support, and requires more attention from them during class. The most important result of the application of these resources is the space created in class for a larger involvement of the student. They have more time to work on the resolution of the

proposed tasks, and they have an opportunity to think over, discuss and criticize the results obtained by them, or even over those presented by the professor. This time it is fundamental that professor act as a coordinator, trying to stimulate the discussion, direct the analysis, clear out every doubt, and put in evidence the importance of team work, considering all the contributions the students may bring.

The last phase of problem analysis is the implementation of the software program correspondent to the adopted solution method. In this phase, during implementation and program debugging, the use of the computer-projector system is again fundamental. The student can visualize the necessary operations for the implementation and the characteristics of the language system used, and then analyze, when executing the program, the several possibilities of mistakes during both the development of the solution method and the implementation phases.

At this time it is opened the possibility for the student participation by pointing out mistakes, suggesting alternative procedures and again analyzing the method that was implemented. Sometimes the professor does this implementation by giving hints suggestions or critical analysis. On other occasions the codes are either prepared previously or the students are called to execute this task. In this way, even without direct access to the computer, the student can realize which is the methodology to be used to implement, test and debug programs.

Class outline



Examples of screen presentation

Problema computacional

Problema cuja resolução envolve manipulação de informações (cálculos aritméticos/ matemáticos, operações lógicas - comparações, testes, operações com caracteres ou cadeias de caracteres, etc.)

fechar

Algoritmo

Computador

Módulo 2 - Fluxos seqüenciais

próxima

Tratamento dos problemas

Primeira etapa
identificar informações iniciais e informações finais

Segunda etapa
estabelecer o método de resolução

Nesta etapa deveremos, a partir de nossos conhecimentos e experiências anteriores e nossa criatividade, buscar estabelecer um caminho de resolução do problema, até mesmo já organizar um esboço do método de resolução. Aqui o foco deve ser a resolução do problema.

Terceira etapa
descrever o fluxograma e as variáveis envolvidas

Quarta etapa
codificar o programa

Módulo 2 - Fluxos seqüenciais

anterior próxima

Problema computacional

Algoritmo

Descrição do método de resolução de um problema.
O método de resolução consiste de uma seqüência de ações que se for executada leva à resolução de uma instância do problema.

fechar

Computador

Sistema apropriado para executar determinadas tarefas de manipulação de informações ou processamento de dados.

fechar

Módulo 2 - Fluxos seqüenciais

próxima

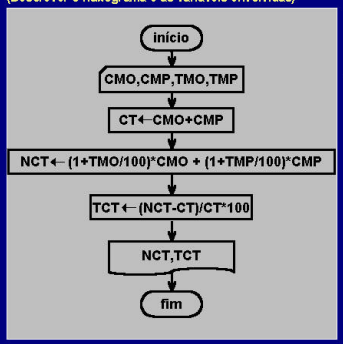
Quarta Etapa: (Codificar o programa)

```
Program ProblemaResolvido;
Uses Crt;
Var CMO,CMP,TMO,TMP,CT,NCT,TCT:Real;
Begin
  Clrscr;
  Writeln('Digite os custos parciais');
  Write('Matéria prima : '); Readln(CMP);
  Write('Mão de obra : '); Readln(CMO);
  Writeln('Digite digite as taxas de reajuste');
  Write('Matéria prima : '); Readln(TMP);
  Write('Mão de obra : '); Readln(TMO);
  CT:=CMO+CMP;
  NCT:=(1+TMP/100)*CMP+(1+TMO/100)*CMO;
  TCT:=(NCT-CT)/CT*100;
  WriteLn('Novo custo total: ', NCT:7:2);
  WriteLn('Taxa de reajuste: ', TCT:7:2);
  Readln;
End.
```

Módulo 2 - Fluxos seqüenciais

anterior próxima

Terceira Etapa:
(Descrever o fluxograma e as variáveis envolvidas)



Informações variáveis envolvidas

CMP,CMO : custos parciais
TMP,TMO : taxas de reajuste
(informações iniciais)

CT : custo total antes do reajuste

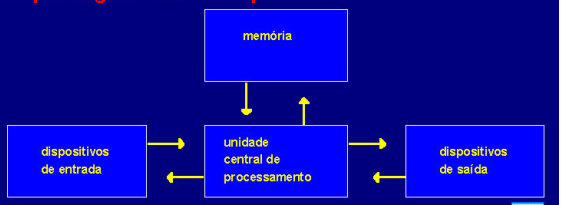
NCT : novo custo total
TCT : taxa de reajuste do custo total
(informações finais)

todas de tipo valor real

Módulo 2 - Fluxos seqüenciais

anterior próxima

Esquema geral de um computador



fechar

Esquema geral de uma tarefa de processamento de dados

Módulo 2 - Fluxos seqüenciais

anterior próxima

Conclusions

As a main result it was observed that the time in class has been better used and, in general, the students have shown more interest and disposition in participating in classworks and practicing in microcomputers labs. It was also observed that the students had a larger interest for orientation about subjects or resources other than those already studied in class. The approval rate in the discipline shows this evaluation, which is here reported over the last six semesters.

Groups of first semester

Year	approval (%)	average of the final scores
1995	71	5.8
1996	76	5.4
1997	79	5.6

Groups of second semester

Year	approval (%)	average of the final scores
1995	48	4.1
1996	67	5.0
1997	74	5.2

On analyzing these data it is necessary to consider that the practice of the new strategy and teaching methodology has begun in 1996. The improvement was more significant with the students that take the discipline in the second semester, which historically have had a worse performance than those who take it in the first semester have.

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