REENGE PROJECT AT THE APPLIED MECHANICS AND STRUCTURES DEPARTMENT OF THE ENGINEERING SCHOOL OF THE FEDERAL UNIVERSITY OF RIO DE JANEIRO

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ABSTRACT

This article presents the implementation and planning process, as well as the results fom the REENGE Project (Reorganization of the Engineering Education Project), at the Applied Mechanics and Structures Department (DME) of the Engineering School at the Federal University of Rio de Janeiro (UFRJ).

The REENGE Project was proposed by agencies of the Brazilian Government, such as CAPES, CNPq and FINEP, to reorganize the Engineering Education in Brazil. The REENGE Project is specially oriented to the improvement of graduation courses. It represents an unique and very important initiative, because those agencies historically give incentives only to post-graduation courses.

At the Applied Mechanics and Structures Department (DME), the REENGE Project was developed during the years of 1996 and 1997. At the DME it stimulated the creation of work groups in the Engineering Education field. The main activities of those groups were the research and the development of didactic aids for Engineering Education, the assembly of new laboratories, the introduction laboratory classes in different disciplines and the supervision of students in introductory research projects.

The positive consequences of the incentive given to the work groups and to the implementation of new laboratories are analyzed.

With the support given by the REENGE Project, tree new laboratories were assembled, within an interdisciplinar view, and support all courses of the Engineering School.

The pedagogical objectives involved with the DME's REENGE Project are presented and discussed.

The importance of the students' participation in the REENGE Project is analyzed.

Finally, the importance and the necessity of another governmental program like REENGE is analyzed.

INTRODUCTION

The REENGE Project had the financial support of governmental agencies such as FINEP, CAPES and CNCPq and involved 24 universities in Brazil. At the Applied Mechanics and Structures Department, the REENGE Project had as main consequences the creation of new laboratories and the formation of new work groups to develop projects in Engineering Education.

The REENGE Project at the DME, had a strong impact in the modernization and improvement of the offered disciplines.

The main activities of the work groups was the research and the development of didactic aids for Engineering Education, the assembly of new laboratories, the introduction of laboratory classes in different disciplines.

The following work groups were created with the REENGE's incentive:

Group of Mechanics and Strength of Materials
Group of Structures Behavior
Group of Reinforced Concrete
Group of Research in Engineering Education

ASSEMBLY OF NEW LABORATORIES

Tree new laboratories were assembled with the support of REENGE/DME Project:

Strength of Materials and Structures Laboratory
Models and Prototypes Laboratory
Multimedia Laboratory

These laboratories had been conceived inside an interdisciplinar view and support all courses of the Engineering School.

The implementation of the Strength of Materials and Structures Laboratory had the objective of promoting the quality improvement of the courses. This was made trough the introduction of laboratory classes in different disciplines, especially those at initial periods, like Introductory Mechanics and Strength of Materials

The Strength of Materials and Structures Laboratory gives support to the practical study of structures' behavior, using reduced models and instrumentation thecnics.

At the Models and Prototypes Laboratory the students are oriented to design, construct and test their own models.

The Multimedia Laboratory was created with the objectives of providing space for discussions, seminars and speeches on the uses of new education techniques and the research on new education processes and techniques. The laboratory also provides the necessary tools to develop didactic

materials such as videos, multimedia systems and audio - visual aids.

DESCRIPTION OF THE NEW LABORATORIES

STRENGTH OF MATERIALS AND STRUCTURES LABORATORY (LABRESMAT)

The laboratory started to function in August 1996. In October, practical classes with the use of didactic models were introduced in different disciplines. These lessons involved initially the disciplines Introduction to Engineering, Elements of Structural Mechanics and Strength of Materials I and II.

Initially only students from Civil and Naval Engineering were involved with the activities at the laboratory; later, students from other courses were also involved.

MODELS AND PROTOTYPES LABORATORY

The necessity of the Models and Prototypes Laboratory came from the development of the pedagogic proposal involved with the introduction laboratory classes in several disciplines.

The main difference between the two laboratories is that at the LABRESMAT the students work with finished models, while at the Models and Prototypes Laboratory the students develop their own projects, designing, constructing, testing and analyzing the relations between the model's behavior and the theory involved.

MULTIMEDIA LABORATORY (LABEME)

The necessity of the LABEME came from big growth of the work group in development of didactic aids.

The laboratory started to function in the beginning of 1997 and supplies basic structure to the development of teaching aids (videos, multimedia systems, slides and etc) and to the study and research of new teaching - learning processes and techniques. It also gives support to the realization of courses and workshops on education techniques and the training of students and teachers in the use of computational tools to the development of teaching materials.

PEDAGOGICAL OBJECTIVES OF THE NEW LABORATORIES

The contact of the students with the LABRESMAT and the Models and Prototypes Laboratory is planned to be carried through in different ways or levels, according to different objectives and necessities.

At the 1st level, the student has an initial contact with the didactic model, during the practical classes at the LABRESMAT; this can simultaneously be carried through by the hole class, supervised by the professor, or small groups supervised by monitors.

At an intermediate level, the students' contact with theory and practice is increased by means of the activities that involve creation, design, construction and analysis of prototypes and reduced models. Some models developed with this methodology will be used in practical classes at the first level.

At the advanced level, the students have more contact with experimental analysis of physical models. There are some other pedagogical aims involved with the creation of the new laboratories:

- provide to the student a basic scientific formation, within an multidisciplinary view;
- provide more contact with laboratory practice in the Engineering Courses;
- increase the number of students involved with research projects;
- join under-graduated students in research groups;
- product didactic materials for engineering education;
- establish a more clear and direct relation between theory and practice;
- help the students to increase their comprehension level of theoretical concepts;

DISCIPLINES INVOLVED WITH THE NEW LABORATORIES

The new laboratories serve to all graduation courses of the Engineering School. The amount of disciplines involved with the laboratory has been gradually enlarged. The disciplines currently involved with the laboratories are listed below:

Disciplines of the DME offered to the Civil Engineering course:

- Introductory Mechanics;
- Elements of Applied Mechanics;
- Strength of Materials I and II;
- Reinforced Concrete I, II and III;
- Structural Analysis I and II;
- Wood Structures;

Disciplines offered for other courses of the Engineering School:

- Introduction to Naval Engineering;
- Introductory Mechanics;
- Strength of Materials;
- Structural Models I and II

RESEARCH PROJECTS RELATED WITH THE NEW LABORATORIES

The implementation of the new laboratories gave support to the development of several research projects, listed bellow.

Research and development of didactic models for engineering education;

New materials for use in reinforced concrete;

Structural Accidents;

Development and use of multimedia systems in engineering education;

Teaching and learning with use of INTERNET

PARTNERSHIPS OF THE NEW LABORATORIES

The implementation of the new laboratories facilitated the establishment of partnerships inside and outside the University.

Partnerships Inside the university

Construction Materials Laboratory - LAMAC/DCC/EE/UFRJ ;
Industrial Design Department - EBA/UFRJ;
Cognitive Technologies Laboratory - NUTES/CCS/UFRJ;
Educational Computation Laboratory - LCE/DME/EE/UFRJ;
Graduation Computer Laboratory - LIG/Civil/EE/UFRJ.

Partnerships with other universities in Brazil

UFJF - Federal University of Juiz de Fora;
IME - Military Institute of Engineering;
UFF - Fluminense Federal University.

Partnerships with universities outside Brazil

Implantation of LABEME started a partnership program with the University of Havana, with the participation of a visiting professor in the UFRJ's Engineering School of Engineering.

RECEIVED AIDS

The DME's project on the reorganization of the engineering education, received financial aids and donations from different sources:

The REENGE Project at UFRJ;
University Foundation Jose Bonifácio (FUJB),
LIG Project of the UFRJ's Graduation Sub-Rectory;
CENPES/PETROBRÁS;
AROTEC.

ANALYSIS Of THE STUDENTS' PARTICIPATION

The students that have participated from the DME's REENGE Project as scholarship holders, worked on the design and construction of didactic models and the development of the multimedia systems. They worked together with professors, technicians and content consultants, and also worked as monitors at the laboratory classes, attending the groups of new students. They had received training in experimental thecnics and use of computational tools. They have also participated on the training of new scholarship holders and monitors, and have trained other students in computational tools and experimental thecnics, under professors' supervision.

Although these activities are generally considered as complementary, we consider that the abilities acquired in all those activities have great importance in the formation of the future engineer. For this reason, we consider essential the maintenance of a training program.

The participation of the students as monitors and scholarship holders had, with no doubt, vital importance to the success of the REENGE Project at the DME. Without the students' participation, there is no reason for the continuation of the project. We consider that this training is one of the more important types of the laboratories activities.

CONCLUSIONS

For everything that was previously presented, we conclude that the implementation of the laboratories and the creation of the work groups, gave excellent results in a relatively short period. In this context, the participation of the students as monitors and scholarship holders was fundamental for the success of the project.

The positive effects of the laboratories activities can already be clearly observed:

by the attendance of the disciplines (giving practical classes in disciplines of theoretical tradition);

by the students formation by means of the training programs;

by the development of didactic aids;

and by the formation of new work groups oriented to studies on engineering education.

It is important to stand out that the UFRJ and the Engineering School does not possess any incentive program or financial founds to laboratories used in graduation courses. In this panorama, in the last years, several laboratories used in the graduation courses were stinguished, while some were closed and others cannot work properly.

The REENGE Project provided some "fresh air" to this panorama and resulted in significant improvements in the education quality of the Engineering School.

The experience at the DME represents one possible proposition to the engineering education inprovement, that will only be consolidated with the existence of programs like REENGE.

PUBLISHED ARTICLES

The work developed at the DME, as consequence of the implementation of the new laboratories and the

creation of the work groups, has resulted in the publication of several papers, listed below:

Naegeli, C.H., Antonini, R.C., Ellwanger, G.B. " Development of Didactic Models for Education of Strength of Materials and Structures Behavior"; *II Meeting of Engineering Education*; UFRJ, September, 1996.

Naegeli, C.H., Antonini, R.C., Ellwanger, G.B. " Development of Didactic Material for Engineering Education: Multimedia System on Strength of Materials and Structures Behavior "; *COBENGE - Brazilian Congress of Engineering Education*; Salvador, October, 1997.

Naegeli, C.H. and Longo, H.I., Education of Reinforced Concrete Structures - Design and Laboratory Practice "; *COBENGE - Brazilian Congress of Engineering Education*; Salvador, October, 1997.

Naegeli, C.H., Antonini, R.C., Ellwanger, Practical G.B. " Laboratory Practice for Education of Strength of Materials and Structures Behavior"; *COBENGE - Brazilian Congress of Engineering Education;* Salvador, October, 1997.

Amorin, F.A.S. e Naegeli, C.H., " Theory and Practice Integration in Engineering Education - the Construction of a New Teaching Model "; *COBENGE - Brazilian Congress of Engineering Education*; Salvador, October, 1997.