

STRATEGIES TO SUCCESSFULLY COPE WITH THE REDUCTION OF HOURS OF CLASS DUE TO CHANGES IN THE STUDY PLAN OF AN ENGINEERING EDUCATIONAL PROGRAM

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Abstract

At the Universidad Veracruzana, as in many other public and private universities in Mexico and the rest of the world, the curricula of engineering programs have changed in the last ten years to meet criteria of reduction in academic credits to allow, among other things, to shorten the time needed by undergraduate students to complete their studies. Programs that previously consisted of 450 or more credits, have been reduced to 350 credits or less. All this despite the fact that technological advances impose future engineers the challenge of having to acquire more and more knowledge and to graduate with skills that allow them to be inserted in an increasingly demanding job market. The apparent contradiction has to be resolved, "do more with less", which, in terms of higher education, can be translated to "learn more in less time."

Some subjects of engineering programs divide their hours per week in hours-theory and hours-laboratory. This document describes the case of a subject whose hours per week decreased when the educational program in which it is taught was subject to modifications in its Study Plan; the subject changed from 7 hours a week (4 days of one-hour theory sessions and 1 day of a three-hour laboratory session) to 5 hours a week (3 days of one-hour theory sessions and 2 days of one-hour laboratory session). This is a subject that often has groups of 25 to 30 students.

With the reduction of the duration of the laboratory sessions, there was not enough time to complete the activities involved in practice sessions; as a result, there were groups that were unable to complete their practices at scheduled times and sometimes the teacher had to summon students to attend additional hours outside the official schedule.

In order to improve the performance of its students and after teaching the course several times, the teacher proposed the academy to modify the schedule for the course as follows: 3 days of one-hour theory sessions and 1 day of a two-hours laboratory session. As a result, the activities of the practices sessions were completed as scheduled.

The perception of students is that a two-hour practice session allows to make a better use of time than two one-hour sessions. This change in the distribution of hours per week that the students work in their subject, benefits them in their learning process.

The authors of this paper suggest that this kind of changes can be applied to the schedules of other subjects which are undergoing similar problems.

Keywords: Curriculum Design, Subject Schedules, Reduction of hours of class, changes of Study Plans.

1 INTRODUCTION

The reduction of credits in undergraduate programs has been occurring in public universities worldwide [1], [2], [3], and the Universidad Veracruzana (UV) in Mexico is not the exception; programs that previously consisted of 450 or more credits, have been reduced to 350 credits or less. This reduction of credits can be analyzed from several points of view. From the perspective of the student, reducing the time and costs involved in pursuing their studies and earn a bachelor's degree level. From an institutional approach, with the same resources they can serve a larger number of students, expanding its coverage of higher education, one of the indicators that when improved and compared with other universities, allow them to obtain more government support. Another approach is that of the governments, whose policies should aim to meet a growing demand for higher-level educational spaces, all this despite being conditioned -the governments- sometimes by international policies to reduce subsidies to higher education [4].

In relation to the curriculum of engineering education programs, the reduction of credits is reflected in the following aspects, namely:

- Subjects that reduce their number of hours a week.
- Subjects that merge, ie, two subjects become one.
- Subjects that are eliminated from the curriculum.
- Subjects to lose their natural learning sequence provided to shorten the number of periods needed to complete the studies.

While these changes in curricula are made in principle by faculty, formed by academics specialized in their respective areas of knowledge, there is no denying of the fact that, after all, the academics themselves are encouraged to (and sometimes are ordered to) respond to indications or suggestions they receive from higher authorities, whether academic or administrative.

Amidst this scenario, the work of teachers is still the core of the education of the future engineers. Academics need to apply all the resources available to ensure that the outcome of the teaching and learning process is satisfactory, ie, that students acquire the knowledge, skills and attitudes that enable them to be competitive in the subject matter of their course, whatever the subject may be.

This document describes the case of a subject whose hours a week decreased when the educational program in which it is taught was subject to a modification of the curriculum, the problems that were generated with the new distribution of hours a week and the change that the teacher suggested to the academy to remedy or mitigate the problems that were generated.

Three versions of the curriculum and their credits are analyzed. The case of the subject Electronics I (Electronic Devices) is presented, and an analysis of how the course was taught during the periods February to June 2010, 2011 and 2012 respectively.

With the analysis and the information presented, it is proposed to the academic community, to consider such amendments to be applied the schedules of other subjects, as a way to mitigate the effects of the above reductions.

2 BACKGROUND

The undergraduate educational programs offered by UV are governed by the so called "Agreements of Tepic" [5] to define its credit structure; in essence, operating on the basis of semester courses, with 15 weeks of scheduled classes each semester, given any subject, for each hour of lecture a week, two credits are assigned, and for each hour of laboratory practice, one credit is assigned.

In the particular case of the program in Electronics and Communications Engineering (ELCO), it is currently offered in two of the five campuses of the UV, namely, Poza Rica and Veracruz. In the Faculty of Engineering/Veracruz, ELCO has been offered since 1994. To date, three different versions of the curriculum have been offered, they are the plans: ELCO-1990, ELCO-2004 and ELCO 2010.

2.1 Curricula ELCO-1990, ELCO-2004 and ELCO-2010

The curriculum ELCO-1990, with two terminal options: Computing and Communications, consisted of 442 total credits, with 53 subjects organized in blocks of five or six courses per semester; a regular student could pursue his academic program in nine semesters and spend an additional semester to meet the requirements of Social Service [6] and to develop their final degree work. In ELCO-1990, the subject Electronics-I was taught to students in their 5th semester, on a daily basis; four theory sessions of one hour each, plus a practice laboratory session of three hours, for a total of 7 hours a week. With such organization of hours-theory and hours-practice, all the topics and practices of the course were covered smoothly. Fig. 1 shows ELCO-1990.

The curriculum ELCO-2004, with four terminal options: Computers, Communications, Control and Microsystems, was characterized, mainly, for being the first ELCO curriculum designed under the guidelines of the so called Flexible and Integral Educational Model (MEIF) of the Universidad Veracruzana [7], however, it was also characterized by a significant reduction to 390 credits, 51 subjects of the curriculum core plus 4 to 6 courses from different areas of knowledge. This plan is designed for a regular student to pursue his academic program in eight semesters, included the Social Service and graduation work, although it should be noted that the student has to take up to 7 courses in one semester. In ELCO-2004, the subject Electronics-I was offered in the 4th semester, on a daily basis; three theoretical sessions of one hour each, plus two laboratory sessions, one hour each, for a total of 5 hours a week. With this new organization of hours-theory and hours-practice, it became

noticeable the lack of time to cover all topics of the course and, even worse, insufficient time to complete the laboratory practices in one-hour sessions. Fig. 2 shows curriculum ELCO-2004.

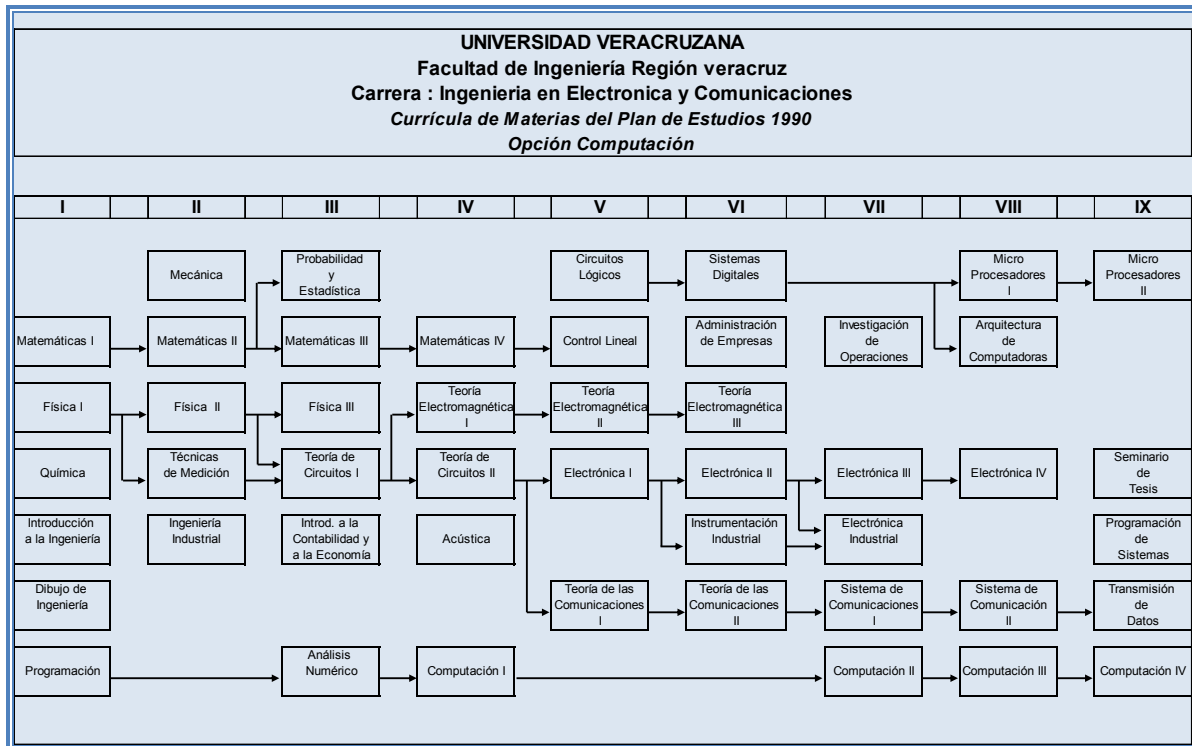


Fig. 1. Curriculum ELCO-1990.

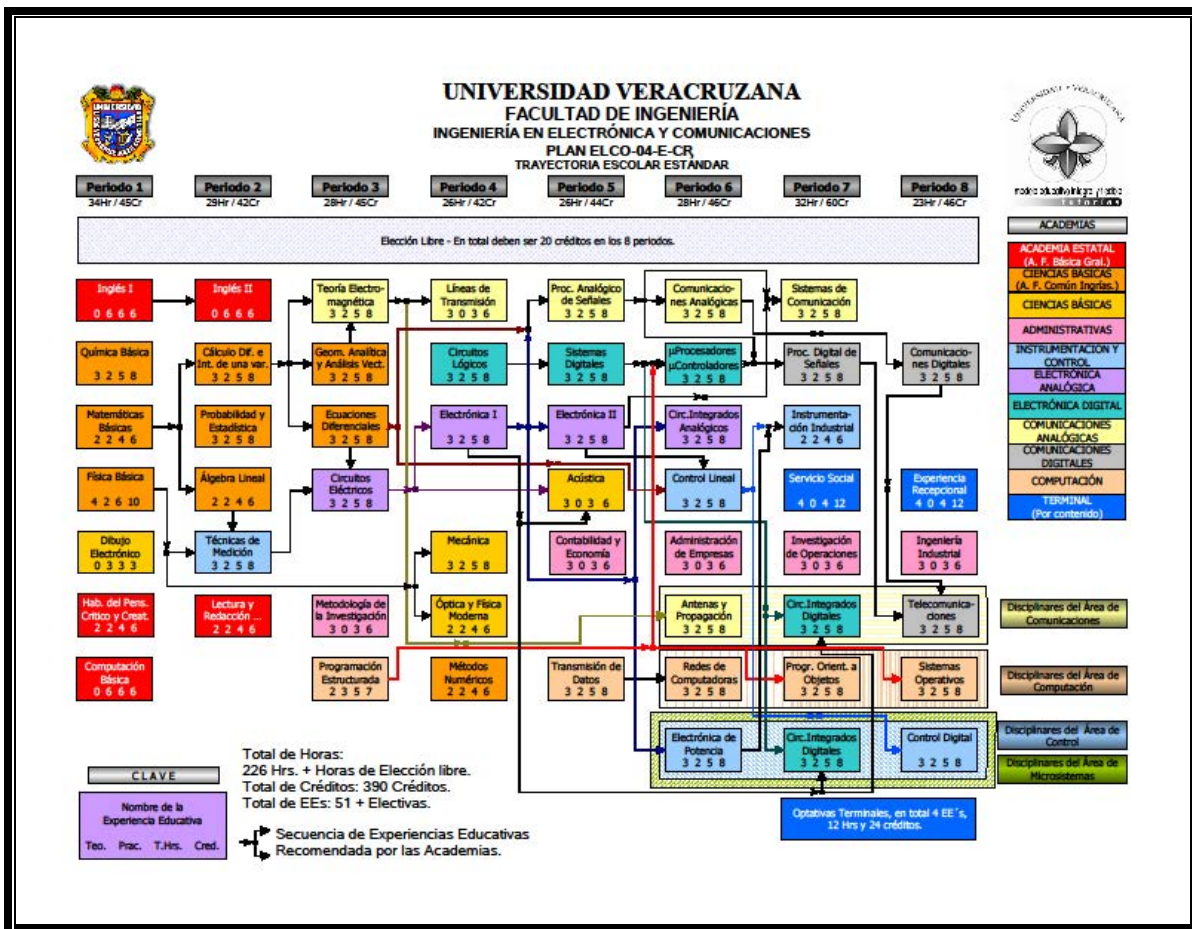


Fig. 2. Curriculum ELCO-2004.

The curriculum ELCO-2010 [8] is the current syllabus, with three terminal options: Computing, Communications, Electronics and Control, is known for being part of the "2nd generation of the MEIF" (MEIF 2G) of the UV, with even fewer credits than the previous plan, only 350 credits, 47 subjects of the program core, plus 3 to 5 subjects of free choice. This plan is designed for a regular student to pursue his academic program in just seven semesters, included Social Service and graduation work, although it should be noted that the student has to study an average of 7 and even 8 courses in one semester. In ELCO-2010, the subject Electronics-I was renamed Electronic Devices and is offered to students in their 4th semester, on a daily basis, three theoretical sessions of one hour each, plus two sessions of laboratory practice one hour each, for a total of 5 hours a week. This subject was proposed to have a change of schedule, as follows: three one-hour theory sessions, plus one two-hours laboratory session. This schedule change is the focus of this document. Fig. 3 shows curriculum ELCO-2010, also available on the UV's web site.

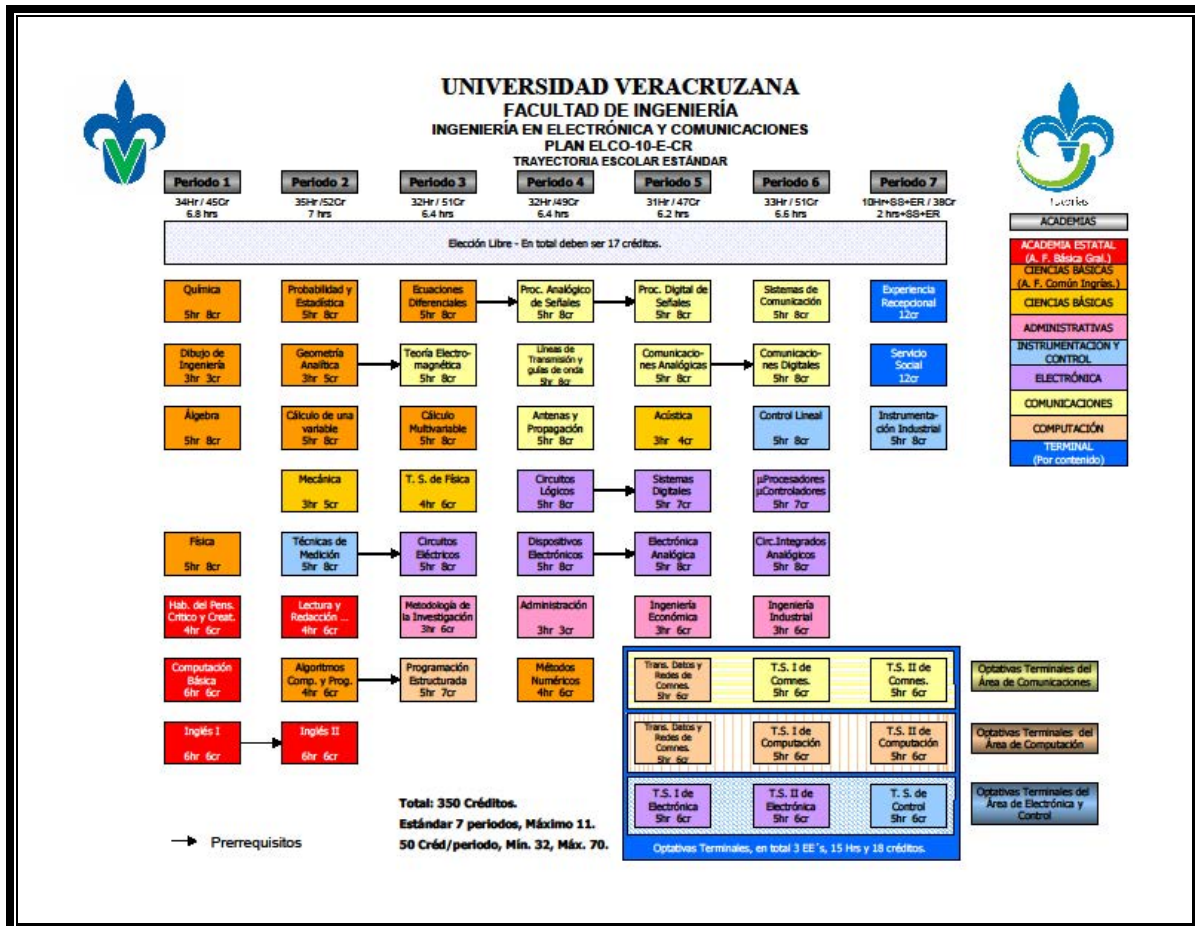


Fig. 3. Curriculum ELCO-2010.

Fig. 4 shows the reduction of credits in the 3 versions of curricula that are discussed, and in which it can be seen that, from the old curriculum ELCO-1990 up to the current curriculum ELCO-2010, there has been a drastic reduction of 21% of the original credits, showing the decreasing number of hours of academic work that students need to pursue to complete their undergraduate studies.

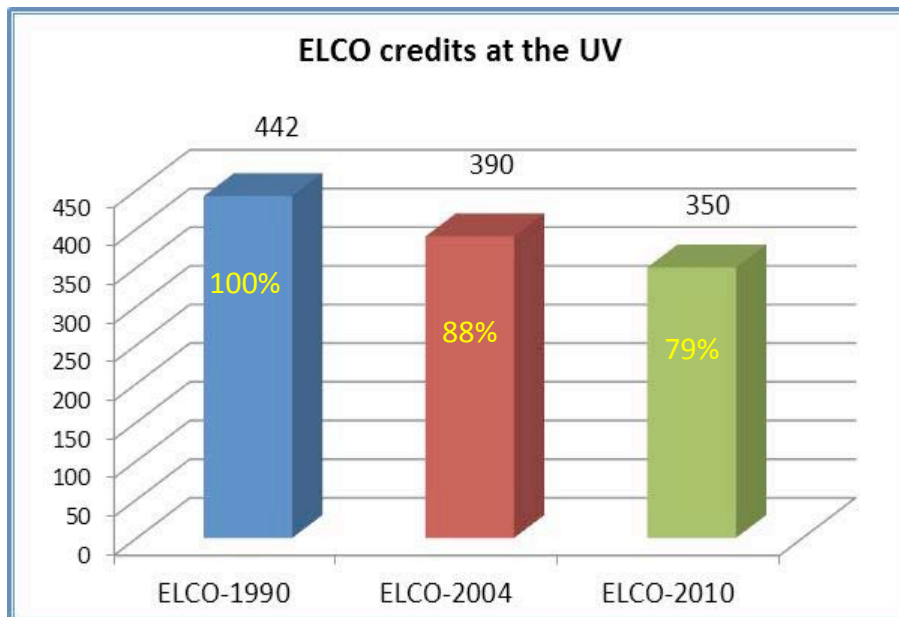


Fig. 4. Comparison of total credits for ELCO curricula.

3 METHODOLOGY

During the periods of February to August 2010 and February-August 2011, the professor of the subject Electronics-I, checking on his courses logs, noted that the laboratory practices could not be completed satisfactorily, mainly for the following reasons:

- At the beginning of each session, it takes about 10 minutes for all students to enter the laboratory, get installed in their desks and prepare their work material and measuring equipment for the practice of the day.
- At the end of each session, it takes about five minutes for students to dismantle their experiments, disconnect their measuring equipment and leave their desks clean and in order.
- With the above wasted minutes, the remaining time available for students to perform the practices core activities is, in the best of cases, of 45 minutes, which in general, is not enough, this, not to mention that sometimes it arises the need to repeat an experiment.

On the lines below, a summarization of the results of the mentioned courses is presented:

Period: February to August 2010, course: Electronics_I, curriculum ELCO-2004.

- 8 programmed practices in total.
- 6 practices accomplished in two one-hour sessions each.
- 2 practices accomplished in two four-hours sessions each, conducted on Saturdays, out of the official schedule.
- 1 four-hours session on Saturday for recovering from incomplete practices, out of the official schedule.
- 1 two-hours session for revision of final projects.

Period: February to August 2011, course: Electronics_I, curriculum ELCO-2004.

- 8 programmed practices in total.
- 6 practices accomplished in two one-hour sessions each.
- 2 practices accomplished in two two-hours sessions each.
- 1 two-hours session for revision of final projects.

Fig. 5 shows the distribution of the minutes when laboratory practices are scheduled for two one-hour sessions each. Of the 120 total minutes, 90 are well used and 30 are lost in preparing and disconnecting.

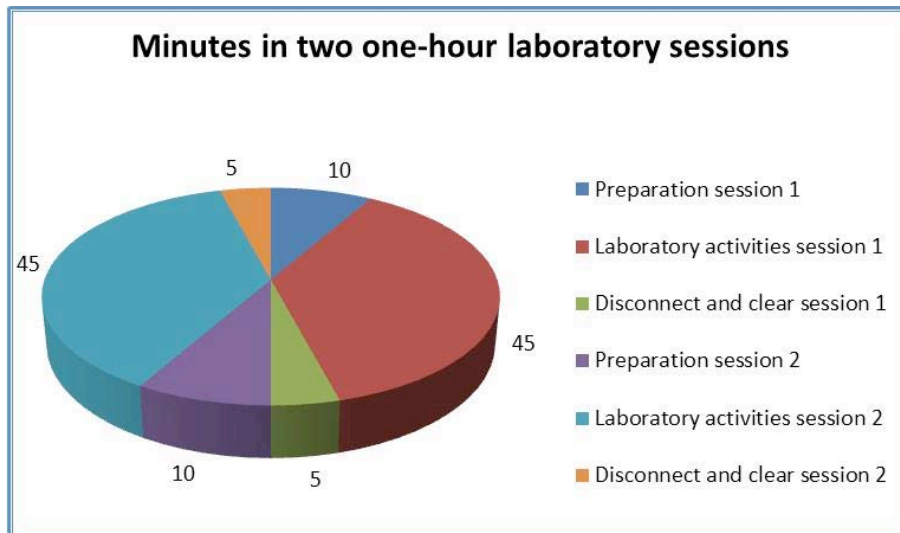


Fig. 5 Distribution of minutes in two one-hour laboratory sessions.

In a large institution such as the UV, academics are able to request for changes in the schedules of the subjects they teach, as long as they meet certain institutional requirements and do not affect the regular operation of the activities of the educational program; it is a matter of circumstances and will.

The professor who proposed this schedule change for the Electronic Devices course, has taught this and other related courses ever since the program was first offered in the Faculty of Engineering; he is a member of the Academy of Analog Electronics and has worked with the three different ELCO curricula. From the log of his course activities during the period of February to June 2012, the following information is presented:

Period: February to June 2012, course: Electronic Devices, curriculum ELCO-2010.

- 8 programmed practices in total.
- 8 practices accomplished in eight sessions, two-hours each.
- 3 two-hours sessions, to recover from incomplete practices.
- 2 two-hours sessions, to present topics that require more time.
- 1 two-hours session for revision of final projects.

Fig. 6 shows the distribution of the minutes in a typical two-hours laboratory session. It can be seen that, from the total of 120 minutes, 105 are well used, and only 15 minutes are used to prepare and disconnect.

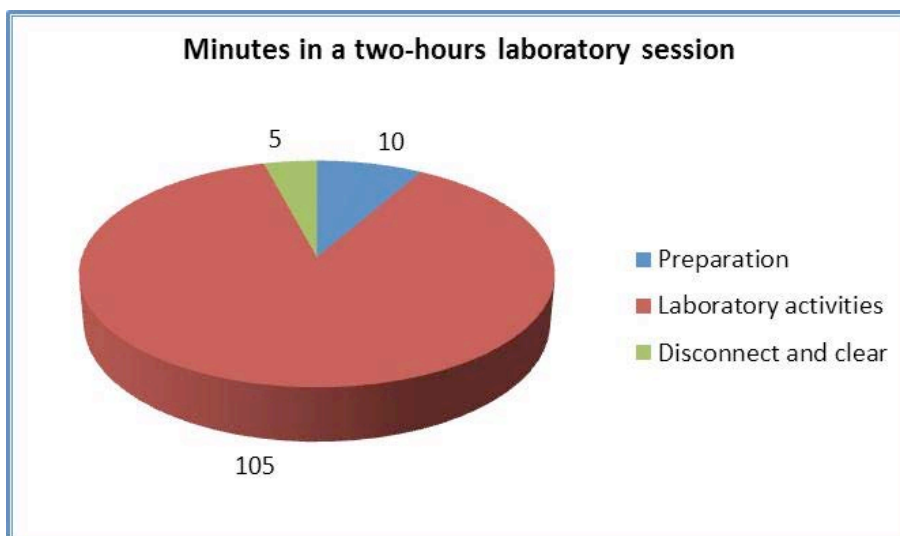


Fig. 6. Distribution of minutes in a typical two-hours laboratory session.

4 RESULTS

From the teaching experience of the last three years the teacher has taught this subject, it can be seen that, in the last course, from February to June 2012, it was feasible to complete the eight scheduled practices in the same number of two-hours sessions. In addition to the benefit of completing the 8 practices in a timely manner, two more of these “long” sessions were used for practices review, two more long sessions were used to expose issues that require more time for in-depth analysis, and one more for the final project review. Fig. 7 shows an increase of 12.5% in the proper use of time after applying the schedule change.

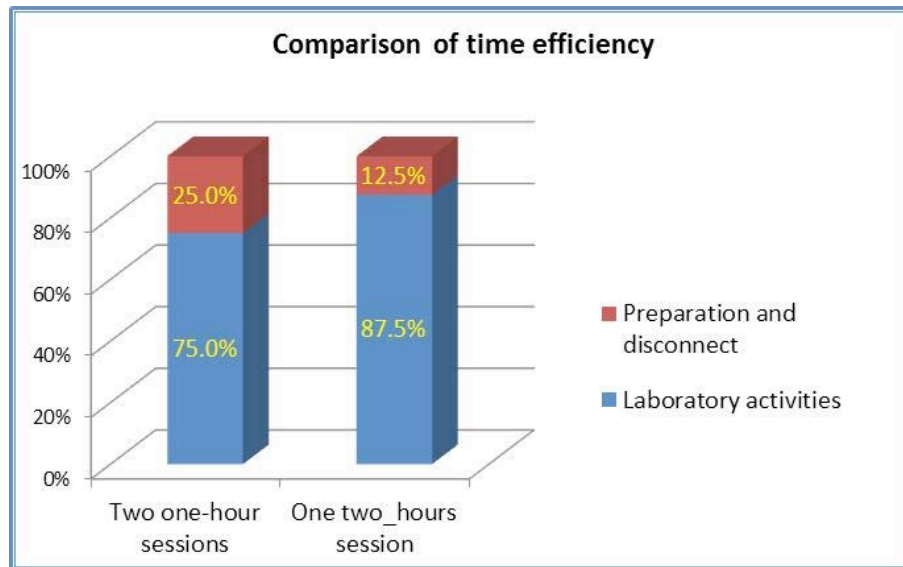


Fig. 7. Comparison of time efficiency between one-hour sessions and two-hours sessions.

5 CONCLUSIONS

We, academics of the UV, have had to face reductions in the hours allocated to subjects due to changes in curricula, with the implications that these changes bring along, such as the difficulty to complete the theory sessions in the classroom and the practice sessions in the laboratory. In such circumstances, we have looked for solutions through the implementation of strategies that will improve the utilization of the available hours for theoretical-practical courses, which are common in engineering programs. One strategy that has proved effective is the redistribution of the hours a week in which a given subject is taught. The overall outcome in terms of the proper use of time can be improved with a subtle change of schedule, applied to laboratory practice sessions, that is, to change from one-hour sessions to two-hour sessions, with the benefits that have been presented already in this paper.

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