Transforming the Learning Strategy: 
The Unification of Learning and Teaching Environments 
with the Enforcement of Continuous Evaluation

José Antonio Turégano, Carmen Velasco, Tomás Gómez

Abstract: The development of new technologies has brought us great possibilities of improving the Learning/Teaching environments, but usually the achievements do not reflect the efforts that teachers do. During many years of continuous investigation about the way to improve the L/T environments we observed the low efficiency of some common methods, as multimedia tools, and asked why results are not the expected ones. Searching for solutions we focused on exploring new orientations based on changing strategies more than providing different materials. The outcome is a particular methodology that changes the working habits of the students and optimizes their efforts in their way for excellence.

Introduction

This experience is the consequence of a continuous process of investigation about the development of different strategies and materials to improve the learning and teaching environments. The modest outcomes of our first years of investigation, according the criteria of academic results and percentage of students attending the classes, drive us to a critical revision of our work. Consequently, we took the decision of focusing in the renovation of the learning strategies of a student body with lack of previous knowledge, appropriate working methodologies and, most of the cases, a minimal effort attitude and apathy for excellence.

Earlier works

The innovative work began at the end of the 80’s with the starting up of a virtual laboratory (Velasco & Turégano, 1992) and continued with the development of multimedia materials designed to improve the teaching environment. The creation of high efficiency tools allowed the upgrading of the master classes, enriched with interactive elements. Confronted to a standard blackboard, a colorful presentation with real images, animations and demonstrative videos, multiplied the educational capabilities in a direction that the student body appreciated very positively in the opinion polls (Velasco 2001).

The material used on those classes (Fig. 1) merged a group of new media resources into the computer, allowing the growth of a completely teaching environment for several of the courses of the Thermodynamical Department. This environment was enforced with the first versions of TermoGraf (Turégano, Velasco & Gómez, 2001), computer software that translate the abstract analysis of energetic plants and devices into realistic graphical representations. This software is considered a cognitive tool as Driscoll describes (Driscoll, 1994): “A cognitive tool is one that guarantee the necessary complexity level to incorporate real activity, that enclose contents with different ways of representation, that stimulate the perception of the own thoughts and that focus on the main role of the student in the learning process”.
All of these materials meant to promote a meaningful learning that replaces the rote learning, base of most of our students. To ease this evolution and to expand this new learning environment to the home of the students, the materials used at the classes were adapted to be used by the student body at their own. Despite the motivation and positive valuation the students gave to these materials, the further analysis did not reflect a step up on the examination marks neither on the classroom attendance. There were augmentations around 10-15% of the marks and similar attendance as before, showing some improvements but no real changes.

What was happening? The conclusion was logical: the possibility that the students use multimedia materials does not imply a sufficient stimulus to increase and to optimize their efforts. That is to say, to have these materials facilitates the understanding of the concepts but it is not enough motivation for the students to change their learning methodology.

The turning point

A self-critical analysis shown to the implied teachers that after all the didactic and pedagogical efforts, the only element not changed was the general learning strategy followed by the student body. Therefore, on an International Congress about University Education and Innovation (Turégano, Velasco & Hernández, 2002a), facing up the optimistic atmosphere of abundant initiatives about creating new computer materials, but with no data about the real effects on the change of the didactic paradigm, our presentation pointed the relative failure of the targeted goals in relation with the invested effort. Therefore, the needing was to explore new orientations based on the strategies and not on the materials.

The work of the preceding years facilitated the discovery of the difficulties in the previous attempts (Turégano, Velasco & Hernández, 2002b), so two main milestones could be signaled and achieved in this investigation as explained hereafter.

Milestone 1: Unifying the Learning and Teaching environments

The disconnection of tools and methodologies between master classes, laboratory experiences and homework of the students creates a logical disrupt on the structure of the learning concepts. It is hard to pretend a constructive...
learning considering the substantial gap, both in time and conceptually, of the topics arriving for the first time to the student and when they are conceptually used to build up the knowledge. Therefore, the first assignment is to soft this barrier unifying as much as possible the different learning and teaching environments in a unique educational environment with same procedures.

One previous step was already done, distributing the multimedia materials employed by the teacher at the classroom for the personal use of the students at home. As mentioned before, despite these materials considered by the students of a high quality and source of motivation towards the contents of the course, they were not enough to change their learning habits. Only “good students” took real profit of this mechanism, while there were no significant improvements on the greater part of the student body.

The second and main step was the development of a transversal tool satisfying the requirements of the environments previously mentioned. This meant to build up specific software that could be used in three different scenarios:

- At the classroom by the teacher trough the means of a video projector to explain the related concepts of the course.
- At the laboratory experiences to simulate different working scenes.
- At home by the students, learning through its use at their personal work.

The same cognitive tool previously mentioned, TermoGraf (Fig. 2), extended new features to fulfill these requirements.

![Figure 2: Screenshot of TermoGraf, the cognitive and transversal tool developed in this experience.](image)

Summarizing the conclusions about the influence of improvements at the different environments:

- To improve the teaching environment incorporating material and technical that uses the new resources of IC (information and communication) is important but, itself, it does not modify the learning level.
- To improve the learning environment providing the same material used at the classroom is a step with greater effects but it continues being barely significant according the results of the learning process.
- To unify the tools and methodologies of the learning and teaching environments contributes to a significant learning based on the progressive structure of the concepts and to a permanence of the learning, but it is still not enough to improve notably the results and attitudes of the student body.
The two first elements, about teaching and learning environments, must have evolved significantly before starting up the initiatives to change the learning model. As explained in the next chapter, this final change succeeds modifying the learning strategy so the work based on rote effort is replaced by the habit of a continuous work.

**Milestone 2: Getting a Trouble-Free Continuous Evaluation.**

The study on the learning strategies (Velasco, 2001) confirmed that only through the modification of the normal rate of work of the students (Fig. 3) it is possible to modify and improve the quality of the learning (Fig. 4).

![Figure 3: Learning model based on examinations.](image1)

![Figure 4: Efficiency of different learnings (Novak, 1998).](image2)

Therefore, the last step in order to transform the learning strategy is the implementation of the continuous evaluation, or continuous work as we like to name it, as a way to stimulate a work routine based on the day-by-day acquirements and reinforcement of the knowledge. This kind of methodology has become an indispensable complement to a suitable design of the learning/teaching environment.

Computer software and a particular methodology, adapted to semester and annual courses, have been created with the purpose of solving the main problem of continuous evaluation that is the tiresome labor of its implementation, both for teachers and student body.

According this particular methodology, next elements are in practice:

- Planning of a rational working dosage as demanded by the contents of each evaluation. This is only viable if the student body have tools of high productivity that optimize its effort in a reasonable time.

- The initiative must stimulate the collaborative work, but ensuring that every student performs a personal work. This require that each student get similar, but not the same, exercises to solve so the concepts will be argued on the group but each person will be the one to adjust these ideas according the values of his/her work.

- Efforts demanded to the teaching staff have to be within realistic limits. Thinking about a group of 80 students, if we want to make an evaluation with similar contents to any conventional examination this means the professor will have to correct around 800 to 1600 questions, each of them with a certain individual differentiation according the previous point. This kind of evaluation should be done every one or two weeks, so this is only possible with automatic mechanisms.

So it is clearly signaled the needed of specialized computer software that offers this requirements. From the side of the students, increasing the productivity of their work by means of automated calculations that allow them to dedicate their time on the concepts more than on the mathematical equations. From the side of the teacher, reducing drastically the time of the corrections by means of automated techniques of revision.
At this experience, the developed software corrects around a hundred exercises, with more than a thousand questions, in less than two minutes with graphical reports of the marks of the students. This information is completed with other less frequent practical activities and one or two conventional examinations.

Within these conditions, a continuous evaluation is an assumable effort by the teacher and by the students, enabling the weight-reduction of the final examination and the uncertainty of its results that do not reflect the knowledge acquired by the student body as well as the methodology here exposed.

Conclusions

As a summary, this methodology has offered a set of undeniable benefits:

- It developed towards the practice of *educational attitudes and habits of working*, facilitating a holistic educational environment within a process of constructive learning.
- Logical and rational *distribution of the efforts* made by the teacher and student body.
- Continued evaluation meaning *continued work*, allowing a significant learning based on the structuring of the concepts through the improvement of the learning strategies.
- Evaluation system free of the chance-mishap offered by a single examination, with random and individualized exercises that restrains the copy between students but promote a *collaborative work*.
- Attendance to class much more numerous, continued and useful opposed to the conventional classes (Fig. 5) that only provide, in most of the cases, material to study before the examination.
- Examination marks in agreement with all the previous points (Fig. 6).

References


