

# Application of New Didactic Techniques “PQRST” to teach difficult subjects in Telecommunication Engineering

Dr. Carlos Blanco and Dr. Francisco Álvarez  
Dpto. Electronic and Communication Engineering  
European University of Madrid  
Villaviciosa de Odon  
Madrid- SPAIN

**Abstract**—This paper describes a completely new method used to improve education in complex subjects in the Telecommunication Engineering field, by applying PQRST methodology to the educative environment. This methodology has been applied to a subject which has been traditionally considered as difficult within the Telecommunication Engineer Major, and which students find difficult to pass, confirming student’s improvement when attending these classes, as well as the popularity of this educational methodology among them.

Considered objectives are described, as well as activities developed during the year 2004-2005, introducing, finally, the conclusions obtained by the application of this methodology.

**Index Terms**— PQRST, didactic technique, educational, infrastructure, didactic technologies, information technologies education.

## I. INTRODUCTION

This article shows different activities put into practice during a Teaching Innovation Project during the 2004-2005 academic year at the Telecommunication Polytechnic School of the European University of Madrid.

The chosen teaching method to be used is one substantially different from traditional education models, and at the same time, capable of adapting itself to new educative techniques which must be implanted with the new Common Undergraduate European Space arrival.

In section two of this paper, some of the project’s goals are introduced. Activities developed to achieve the already mentioned purposes are described in section three. The

document ends with a record of conclusions derived from this pilot experience

## II. PROJECT’S OBJECTIVES

It is well-known that in the study of every major, there are some subjects usually considered complex or particularly difficult for students. This is quite common in particular engineering studies.

Some of the reasons to rate classes as “difficult” are the following:

- Subject inherent complexity
- Syllabus length regarding assigned time to teach it.
- Class level, usually established by the teacher
- Previous knowledge required to the student in order to take the class
- Student level and skills regarding previous knowledge
- Time available to solve exercises (this point is often related to the syllabus length)

The combined effect of all these factors, makes students final academic performance (measured in pass marks percents) unsatisfactory

Considering education evolution in Spain towards Common Undergraduate European Space, some of the matters mentioned above turn into critical, since the planned education model may come into conflict to solve all of them in a harmonic way.

The PQRST method has been considered as a possible solution to help students to improve their assimilation degree concerning this type of classes and to obtain, at the same time,

a better final performance without necessarily sacrificing syllabus contents.

The PQRST learning method was advocated during the 80's in the USA as an effective procedure for analyzing and studying particularly difficult courses, and it was successfully applied in organizations such as NASA, research centres and Universities across the country.

Its methodology consists in a systematic application of the following stages:

- P (Preview). Previous revision
- Q (Question). Questions
- R (Read). Reading
- S (State). Consolidation
- T (Test). Test

As such PQRST was initially pioneered as a learning process. The real innovation introduced here is to adapt this methodology to a new didactic method.

This adaptation involves applying this systematic to courses traditionally considered complex or difficult. Concerning the specific application of the technique, teachers save for themselves Preview and Read stages (in this case, the theoretic part of the lecture) and leave Q, R and T stages for the interactive part of the class.

The last two Stages are the ones from which a substantial benefit is expected. At this point students must prove themselves the level reached by them.

Efficiency of the procedure is based on the fact that students begin to demonstrate their mastery of a subject when they are able to formulate themselves increasing complexity problems.

### Objectives

The aims established for the application of the PQRST systematic to didactics are the following:

1. Stimulate students to improve their previous knowledge by analyzing in depth the Q-(Question) stage. This stage detects lacks in their education
2. Motivate Students to actively reflect on the subject before being explained in class, and to look for explanations or solutions by themselves.

3. Prepare students to meet stage R (theoretic Classroom) with an inquisitive attitude towards the topic that is going to be explained.
4. Motivate students to look deeply into a reflexive study (S-State stage), which is preparatory for the final stage.
5. Stimulate students to ask themselves increasing complexity problems T (Test) through which their degree of knowledge can be evaluated
6. Promote among students autonomy in learning, most of all through State and Test Stages
7. Improve student's final results performance

### III. PROJECT'S DESCRIPTION

The investigation project of PQRST techniques applied to didactics was implanted during the 2004-2005 school year in the Telecommunication's Engineer Major, at the European University of Madrid in two consecutive phases. Each one of them takes a semester and discusses a different subject, with goals and orientations clearly different.

#### PHASE 1

This phase is preparatory for the real investigation target (phase 2), and it was intended to observe student's reaction to a new teaching method

The subject chosen to apply this new didactic method has been Data Transmission. A no complex class traditionally considered in the Telecommunication's Engineering Major. The number of students involved in this phase was **50**; this is considered to be a **noticeable** base to obtain conclusions from the results of the investigation.

Due to the fact that PQRST systematic is aimed to complex subjects, Data Transmission class has been offered extending and analyzing in depth its syllabus content, including topics of a higher level of abstraction and a higher level of mathematics complexity regarding other year's syllabus

From the satisfactory application of this systematic the following has been accomplished: To increase the academic level of the class without spoiling assimilation of contents or students academic performance.

The quantitative result of the investigation has been measured comparing the percentages of students who passed the class last year and the current year and the comprehensive average grade of the classroom obtained in both years. This comparison has been made considering student's different segmentations.

Except for increasing academic level of the class, the other parameters remain the same as last year during the experience

Qualitative result has been measured through surveys at the end of the class

## PHASE 2

This phase is the investigation focus and intents to improve assimilation and performance of a class traditionally considered as “difficult”

Communication’s Electronics has been the class chosen, a subject which secular difficulty comes from:

- Syllabus Density
- Reduced time to take it
- Previous knowledge of other lateral subjects
- Important abstraction level and mathematic content
- Insufficient time to solve problems and practical exercises

The number of students involved has been 60, which again is a relevant statistic sample

In order to obtain coherent conclusions and to make a valid comparison, the class must be taken maintaining invariable parameters of previous years, (same teacher, same programme, same grading method, etc), except for the introduction of the PQRST didactic technique.

As we will see, from the satisfactory application of this systematic a stronger motivation and a better understanding and performance by students at the end of the year, have been obtained.

As in PHASE 1, the quantitative result of the investigation have been measured comparing the percentages of students who passed the class last year and the present one and the global average grade obtained each year. Since there has been no change in the course syllabus, this comparison has directly measured improvement grade in the problematic already mentioned, obtained from the application of the PQRST technique.

The qualitative result has been also measured by opinion surveys handed over to students at the end of the semester.

Student’s progress follow up has been made in a continuous way. Therefore, students were divided in groups of two or three people. Taking into account its basic operative, the method application has been done as the following:

1. PQRST Systematic has been applied to each one of the topics of the course syllabus (usually 10-12 topics).
2. The five indicated stages P, Q, R, S, T. have been applicable in each topic
3. Once a topic is finished, students have 1 or 2 weeks in which to prepare a public speaking presentation about it
4. The presentation has to be done in teams, in English, and it has to be basically focused on developing Q, S, T phases, emphasizing the Test one.
5. In order to motivate students to carefully develop phase T, they have been told that some of the exercises work out by themselves could be, with a few changes, in the class final exam.
6. To help students with their presentations, a complete and in detail PQRST session has been done. This session, which is previous to the one to be done by students, is moderated by the teacher.

## IV. CONCLUSIONS

The innovation teaching project put into practice in UEM Telecommunication’s area, and already explained in this paper, is intended to develop a didactic methodology to help students understanding and assimilating better a class considered as difficult.

Up to the authors knowledge this didactic method has never been used before, so comparisons with other previous publications about the subject is not possible.

Conclusions obtained throughout the application of PQRST didactic methodology in its two phases are the following ones.

### PHASE 1

1. In phase 1 (Preparatory) the PQRST method has allowed to expand considerably, in extension (six new chapters or topics), depth and difficulty, the contents of the Data Transmission class.
2. Students have felt strongly motivated to follow new topics explanations in spite of the mathematical complexity used in them (probability’s theory, Markov’s chains, traffic models, etc).

3. Student's presentations in a foreign language (English) were excellent. This shows how far they have gone with the PQRST method.
4. The P phase (Preview) has been valued by the students positively (11%).
5. Q Phase (Questions) has obtained an excellent valuation from opinion surveys (25%), with positive comments about its practical character
6. During T phase (test) students imposed themselves problems of a true complexity. Deepening in this phase allows explaining the satisfactory results obtained in quantitative final tests. This phase valuation is the best one, with a 33 %.
7. The objective comparison of results between the 2003-2004 academic years and the present one, 2004-2005 is conclusive in this respect.

	2003-2004	2004-2005
Passed/ Attendance	60 %	80 %
Average Grade	4.73	5.94

8. As it has been already pointed out, the class taken during 2004-2005, using the PQRST technique has been substantially enlarged regarding the class of 2003-2004 in extension and in difficulty.

Opinion surveys results also offer decisive information

The following is a selection of some of the question

QUESTION	YES	NO
Has PQRST been a motivation for the study of this class in a reflexive way?	86 %	14 %
The activities derived from PQRST method should be part of the final grade?	82 %	18 %
Do you consider the PQRST method useful for your professional development?	94 %	6 %
Should this method keep on being used the following years?	97 %	3 %
Do you consider activities developed during the method as an add value for your education?	85 %	15 %
Did the teachers know how to transmit the message?	88 %	12 %

## PHASE 2

As it has already been explained, this phase is the most important section of the investigation.

The most important conclusions of the didactic methodology PQRST in this phase are:

1. The class has been taught similarly, in extension and difficulty, to last year, but students have felt much more encourage to study than other semesters.
2. From classroom comments, the fact that students have considerably increased their understanding level of the class can be deduced.
3. This improving idea of assimilation and understanding is reflected, as it will be seen in the quantitative results
4. Surveys have shown than each topic global vision, provided by P (Preview) phase, has been evaluated positively (12 %) since it allowed students to know in advance the details of the discussion topic
5. Q (Questions) phase, has also been very well considered (20 %), due to it has allowed the students speculating and pave the way for what was about to be explained
6. However, is T phase, with difference, the best one valued (41%), because it is where the students have been able to demonstrate their knowledge level and subject deepen
7. The debate in English, made and recorded from one of PQRST sessions, has been meticulousness and professionally prepared by the students, as a result of the obvious interest aroused by the PQRST method.

Surveys results also offer in this phase conclusive results. This is a sample of some of the questions asked:

QUESTION	YES	NO
Has PQRST been a motivation for the study of this class in a reflexive way?	61 %	39 %
The activities derived from PQRST method should be part of the final grade?	65 %	35 %
Do you consider the PQRST method useful for your professional development?	78 %	22 %
Should this method keep on being used the following years?	68 %	32 %
Do you consider activities developed during the method as an add value for your education?	72 %	28 %
Did the teachers know how to transmit the	72 %	28 %

message?		
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