Oral Presentations of Students in Product Engineering Lectures*

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In order to introduce a more dynamic approach to lectures in a product engineering course, presentations have been carried out since the 91/92 academic year, based on groups of students presenting works related to parts of the syllabus in public. In these sessions the rest of the class evaluates the work presented and then take part in a debate. The System Test Manager device is used to collect and summarize the group's opinions in order to relate them to the teacher's evaluation in real time. Finally the results obtained up to the present time are evaluated and the perspectives for future actions are presented.

INTRODUCTION

THROUGHOUT the fourteen years that the subjects of Product and Project Engineering have been taught in the Faculty of Engineering of the University of Zaragoza, it has been observed that traditional lectures are not a very effective means of passing on knowledge in this subject. This situation has been amply commented on by different authors [1–7].

In our case the subject involves two different assignments for students, one which is practical and the other theoretical. Traditionally the practical assignment has consisted of carrying out work in groups of four to five students, generally related to a problem/need posed by industries in the area and which has then been presented in public at the end of the course. The theoretical part, until the 91/92 academic year, consisted of a test or examination on the syllabus covered in this subject. The course lasts 9 months and students have two two-hour sessions a week, one which deals with the theory and the second which is used to prepare and supervise the progress of group projects.

The Product Engineering programme examines, amongst other aspects, topics related to:

- the product and product life
- need analysis
- exploring the design situation
- product specification
- viability studies
- development organization
- technical development
- estimates and costs
- value analysis
- industrial design
- product ergonomics
- responsibilities related to the product and patents.

These topics are dealt with by means of talks which involve processes of synthesis of vital experiences and project organization techniques which are given to students who have no experience in these subjects and who are, moreover, used to following presentations of processes of analysis through sequences of physico-mathematical reasoning. The result is that there is a distancing between the speaker (teacher) and those attending (the students) which is difficult to overcome. Evidence of this distancing has been found both in the evaluation of the theoretical tests and in the student opinions collected.

On the other hand 'theory' is necessary; students must think about different aspects which may or may not arise during the practical work they are assigned in order to assimilate the basic knowledge and professional aspects related to the field of Product Engineering. The term 'professional aspects' refers to developing attitudes and skills which are specifically professional. For example:

- how to present work;
- what is expected to be achieved by a presentation;
- what tone should be used;
- what support can be sought;
- what should be the relationship with suppliers, etc...

How to deal with what we could term as the theoretical part of the subject was the crux of the question.

Venables [1], along the same lines as Skinner, has used a behavioural approach to the teaching

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of Design Engineering; focusing more on teaching students how to do things than how they are done or on understanding them. His objective has been to develop a professional behaviour amongst engineering students basing his ideas on the fact that the work methods of a professional are developed and strengthened through a chain of actions each of which has been reinforced through a series of experiences which the individual has had throughout his/her life.

Kohne and Spiegel [2], in a course aimed at helping students with the preparation of senior thesis design projects, point out the value, as a learning aid, of allowing students to present the results of their work in public and for this work to be assessed by the rest of the class during an exercise of joint critical analysis where the teacher also, in turn, assesses the evaluators' comments on the presentation carried out.

Eder [5] includes a series of recommendations in relation to the experiences which have been gathered over the 15 years that the Workshop Design Construction has been in operation, in connection with teaching in the field of Engineering Design. Some of these recommendations are:

> 'Students should be helped to develop an opinion as well as an open attitude which allows and encourages them to freely express their ideas. Motivate them and force them to improve their oral and written communication skills.' 'Focus teaching on the existence of a problem which has to be resolved, using cases.' 'Team work and co-ordinating with others, psychologically reinforcing the group, are additional tasks the designer faces.'

In another part of the same work Eder refers to Design Engineering as almost never being the result of one person working alone.

FIRST STEPS

Bearing the aforesaid in mind, in the 91/92 academic year we decided to try and bring a more dynamic approach to the previously mentioned syllabuses by means of the active participation of students in class. This involved replacing part of the classes taught by the teacher by 30-minute presentations carried out by groups of students. At the end of the session the teacher and the rest of the students wrote down their evaluation of the presentations given (never more than two per session).

The themes of the presentations were not of a purely technical nature but rather were chosen bearing in mind aspects of interest which had arisen in the practical assignments as well as the application of theory to specific cases which involved contacts with companies, the Administration and other University Departments.

The evaluation was carried out by students and each presentation was awarded from 1 (the lowest score) to 5 in accordance with the following criteria: scope of the work, information, depth and quality of the presentation. These criteria are further explained in the following sections:

- *Scope of work.* In relation to the title of the assignment. This referred to the variety of aspects covered The 'completeness' of work was judged by the fact that no relevant aspects of the theme had been omitted.
- *Information on which the presentation was based.* The evaluation of the bibliographical references, consultations with experts, visits, etc. on which the contents of the presentation were based.
- *Depth of treatment of the subject.* This criterion referred to the accuracy with which the subject had been treated.
- *Clarity of presentation.* An assessment of the way in which the talk was presented by the group in general.

Presentations were carried out by the group members in turn and audio-visual means were used.

COMPARISON OF RESULTS

The idea of an assessment carried out by both students and teacher had three objectives:

1. As a means of ensuring the attendance of a student audience in presentations by classmates.
2. For students to be transformed from passive listeners to active critics.
3. To judge to what extent the class as a whole coincided with the teacher's evaluations.

In the first experience, in the 91/92 academic year, we observed difficulties in assessing results due to:

- The fact that it was impossible to obtain the results of the evaluation from an audience of over 70 students in the time the session lasted. In addition, there seemed to be little sense in analyzing the evaluations of a presentation one week after the presentation had been given as students could not remember exactly what had been said in the previous session.
- The fact that students have to assess a theme when the teacher himself/herself may encounter difficulties in evaluating it. In particular, it was seen that there were problems in assessing the criteria which had been established, mainly those referring to the scope and the information on which presentations were based.

In the 94/95 academic year the evaluations carried out by students during the course were subsequently analyzed. Using statistical techniques student's scores were compared to those of the teacher. The different opinions of students when evaluating a given presentation do not coincide. Nevertheless, the opinions as a whole, can be treated statistically and the mean value and dispersion of scores gives an idea of class opinion. The extent to which the class trend coincides with

the teacher's evaluation shows that the two parties have judged the work presented in a similar way.

ASPECTS OF DEVELOPMENT AND EVALUATION

The possibility arose to test a device of collecting student opinions in such a way that the students' responses could be made available in the same presentation session and a group discussion of the results could be carried out. The System Test Manager (STM) developed by Bienvenido Gil, S.A. (Fig. 1) is based on each individual using a small keypad which emits a signal that is picked up by infrared sensors and entered in a personal computer (PC). This carries out the processing of the signals received from the set of terminals that are distributed amongst the audience to collect students' opinions on a series of questions which are displayed on a screen by means of a video projector activated by the PC.

The possibility of using this method meant that during the 95/96 academic year we were able to test it for the collection and processing of class opinions on the theoretical presentations whilst at the same time a new look was taken at the whole experiment.

This task was focused on the following aspects:

- *Reconsideration of objectives.* Students were asked about their willingness to participate; to make classes more participatory as well as to contribute in the analysis and discussion of the technical presentations of groups of their classmates. Initially students expressed their willingness.
- *Updating of the questionnaire.* As has already been mentioned there was a great difference in

the interpretation, evaluation and discrimination between different aspects of the questionnaire. Initially, this series of factors had been thought of for evaluating written works rather than oral presentations by groups of students. After having used the previously mentioned questionnaire in a couple of sessions it was decided that it should be revised with the help of a member of the Institute of Educational Sciences of the University of Zaragoza. The revision sessions led to five sections being considered, with a total of ten questions.

The questions were divided into the following sections.

QUESTIONNAIRE COURSE 95/96

Contents
- Information that the work contains, the variety of said information and the omission of any points which are considered to be important.
- Quality of work presented (precision with which the subject is dealt with).

Procedure
- The way in which the talk is structured and how the general points are presented.
- Continuity (one point leads on to another), absence of redundant information (unnecessary repetitions out of context).
- Distribution of time (according to the points to be dealt with in the presentation) and keeping to the limits set.

Presentation
- Coherence between the text and images. (What is being displayed on the audio-visual material is
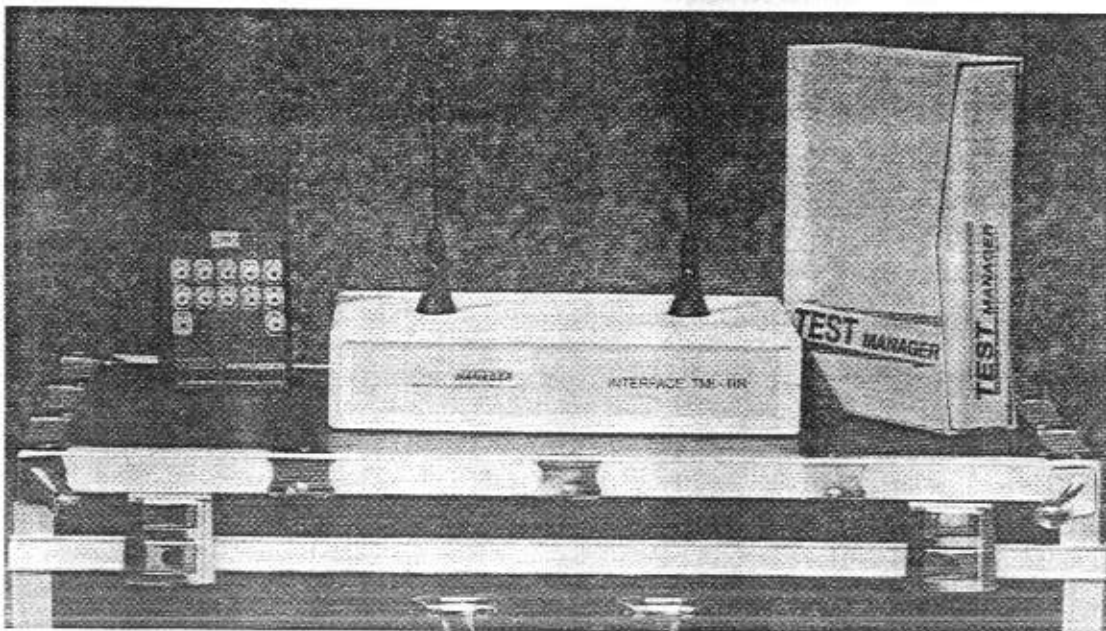

Fig. 1. System Test Manager (STM).

what is being discussed at that moment. There is continuity between what two consecutive members of the group say).

- Pleasantness and originality of the presentation. (The audience is keep alert not so much due to the subject but to the way in which it is presented).

Attitudes

- Group motivation (judged by observing the effort made by the group to give a good presentation).
- Level of knowledge of the subject that is being presented. (It is obvious that the speakers are well acquainted with the subject or they do not really know what they are speaking about).
- Encouragement to participate. (If relevant, providing the audience with charts or summaries with which they can follow the presentation or allowing questions to be asked).

Students in general are not keen on assessing their classmates, especially if they have to give a numerical score to each factor. In order to lessen this reluctance to a certain extent we decided to use the options of VG (very good), G (good), G–A (good to average), A (average), P (poor), instead of the 1–5 scale used until then.

Organization of evaluation sessions with the STM

This involved adapting the STM to the questionnaire to be presented to the students as well as

summarizing the global information shown to the class.

It must be pointed out that as the system could not be installed on a permanent basis, the facilities it required had to be prepared for each session and involved setting up a double screen, portable video projector and computer, setting out 90 keypads, installing infrared sensors and installing the software in the PC. The fact that the lecture room was not available before noon and that sessions ended before 2 pm due to the proverbial decrease in students' attention towards the end of the morning, meant that sessions were seriously limited in terms of the time available.

RESULTS OF THE 95/96 EXPERIENCE

The STM device has proved effective in that, apart from other functions, it permits the use of the audience's answers in the same session as the presentation, allowing a clear, graphic view of the group's opinions to be obtained (Fig. 2).

Although an initially positive student attitude to the experiment was observed, the conditions in which each session has taken place has led to delays which students have found tiring.

Although the new questionnaire would seem to be better designed than the previous one there

Question 1

Once you have attended the presentation of your colleagues, Could you explain, in a clear manner, what was it about?

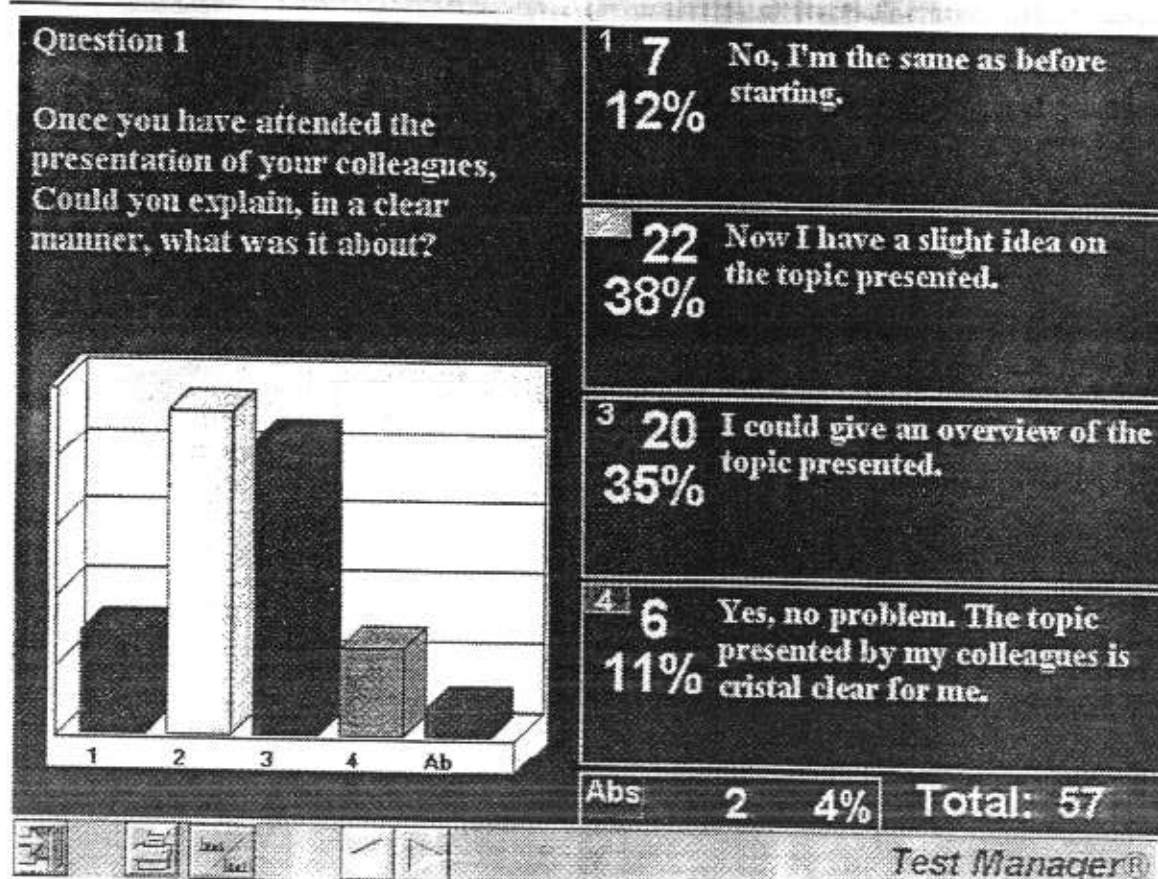|		
1	**7** 12%	No, I'm the same as before starting.
2	**22** 38%	Now I have a slight idea on the topic presented.
3	**20** 35%	I could give an overview of the topic presented.
4	**6** 11%	Yes, no problem. The topic presented by my colleagues is cristal clear for me.
Abs	**2** 4%	Total: 57

Test Manager®

Fig. 2. Groups' opinions.

may be too many questions to assess in each presentation.

From the tests carried out with both types of questionnaires no pattern which correlates the opinion of the class with that of the teacher was found. It would seem that the group coincide in classing most of the works as 'good' when this is also the teacher's appraisal; on the other hand in those cases in which the teacher's opinion is unfavourable, it would seem that students are not sure of their opinions and so opt to follow the saying in Latin '*in dubio pro reo*'.

The .self-assessments carried out in public by the group of students who presented the work are worthy of special mention. From the point of view of a learning exercise it proved to be highly enriching and the opinions of the group itself coincided very closely with those of the teacher.

Student opinion

Over the past years the opinion of students has been sought concerning the theoretical part of the subject. The questionnaires have included two sections, one which invites comments from students on aspects of the part of the subject which they consider to be positive and the other in which they can comment on all those aspects which they feel should be improved. Briefly, it can be said that the fact of having participated in presentations carried out by students has been very positively valued by students, from the point of view of preparing the theme (visits to companies, contacts with professionals, etc.), the presentation in public before the class audience and finally the proper evaluation of the classmates' work.

Perspectives

In view of the results obtained we are going to continue our research with the following perspectives. Firstly, to clearly establish, at the beginning of the course, a specific pedagogical objective aimed at improving the way in which the evaluation sessions are carried out by means of:

- controlling the duration of presentations;
- reducing the number of questions to be assessed;
- reducing the time involved in setting up the System Test Manager (STM);
- introducing a fixed analysis group for each session.

Secondly, to carry out a sufficient number of presentations (no less than seven sessions), so that the experience acquired allows us to compare the opinions of:

- the class
- the teacher
- the experts
- the analysis group
- the group of students carrying out the presentation.

CONCLUSIONS

The oral presentations of groups of students in class which have been carried out since 91/92, have proved to be a very effective teaching instrument. At the moment the use of a system for the immediate collection and synthesis of opinions, allows approaches which have not been used up to now and opens up a whole range of possibilities particularly in terms of critical analyses by students and facilitates the exchange of opinions in the classroom. In future years we plan to carry out sufficient tests to be able to form an opinion on the correlation between the evaluations by teachers, the class as a whole, analysis groups and the self-assessment of the group carrying out the presentation as well as student acceptance of this approach.

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