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Impact of Student Satisfaction on Teaching Practice: A Case Study of Engineering Department

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Abstract: *This article presents the results of a student satisfaction study of an engineering program in relation to the quality of training received. The objective is to evaluate the existing system and propose a qualitative approach directing teaching practices to better meet the expectations of different stakeholders.*
As an indicator of performance of the process of teaching, descriptive statistical analysis of the level of student satisfaction evaluated using a questionnaire will confirm the usefulness of the proposed conceptual framework to improve the quality of training.
Keyword: *Satisfaction, Quality, Higher education, innovation, teaching practices*

I. Introduction

In a process of continuous improvement, higher education, particularly engineering education covered by this publication must conquer an array of contextual variables.

Therefore, promoting the quality of education equivalent to reorient the traditional teaching model of transmitting knowledge to skills development while encouraging on:

- Diversification of pedagogical approaches and their adaptation to different teaching situations,
- The pedagogical relationship on interaction with learners and between them;
- Encouragement of initiative and innovation, effort and educational autonomy;
- Revision of curricula and teaching methods in the direction of development of critical thinking of the learner;
- The focus on the learner as a goal of the pedagogical act and encouragement to develop the culture of intellectual curiosity and taking the initiative;
- The integration of the learner as a true partner in teamwork, by entrusting tasks of research, innovation and management and finally developing in him a sense of belonging to the establishment and sense of duty ;

This implies a rationalization of the teaching process. Taking into account the uniqueness of the pedagogical act, the study aims to assess student satisfaction levels of an engineering program in relation to the perceived quality of the training.

Nevertheless, the development of a reference framework for teaching practice will be more organizational in order to harmonize the principles of the teaching process rather than standardize practices [1].

II. Conceptual Framework

The educational innovation is one of the main levers of progress of any educational institution [2]. The optimization of the teaching process begins with managing interactions between the object of the action learning-teaching and actors which firstly have a learning task and also a mediation task [3]. The specificity of training, including the properties of the object which is the teacher, used to develop a conceptual framework adaptable to the context of the application. Fig.1

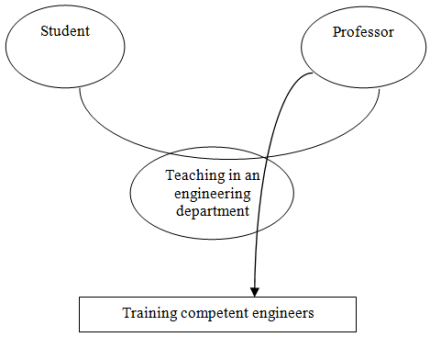

Figure 1 Horned beast diagram of the training needs of engineers

However, a design centered on the learner's needs and integrating the right means at the right time and for the right activity, allow a juxtaposition of cognitive mechanisms in the teaching of science and technology [4][5].

It is usual to recognize three major concerns of the teaching of science and technology, "the report to the teaching practice, the report on educational standards and the report to innovation and research." These foundations, closely related, can be treated in different ways analysis.

This article offers a basic conceptual framework that will reduce the impact of subjective variables of the learning process and integrate the student in a participatory and active pedagogy oriented skills development: the Deming Cycle.

The Deming cycle

The Deming cycle or PDCA cycle (William Edwards Deming, 1950), consists of four steps Plan, Do, Check and Act, is a systematic and progressive process that can be considered as a referential framework of instructional practice for teaching technical subjects in an engineering school.

The PDCA method is the most used approach for solving industrial problems. In the field of education at the University of Tennessee in the USA, two professors John E. Knight and Sandra Allen had deployed the PDCA method on eight loops where they used the Delphi method to gather knowledge experts, facilitate consensus of instructional design and develop a rubric for measuring student ability. In this study, the authors have incorporated the principles of Statistical Process Control and Six Sigma method that will be used primarily to assess and reduce gaps. [7]

Also, the University of Boras has already led this project for improvement:

- Beginning with step Plan where the work team engages in a self-assessment process that requires an analysis of the existing situation and the proposal of appropriate solutions to the problems raised. To ensure the effectiveness of the changes, the choice of the period for completion of this exercise is an important factor. The University of Boras considered the end of the second semester as the favorable period. First, because staff had sufficient time to evaluate the system, secondly, because the leaders have enough time during the summer to plan new strategies for the coming year [8].
- Do: according to the results of self-assessment, the changes are implemented in the first semester of the academic year according to the strategy used previously. At the end of step DO, the progress of the verification process begins CHECK.
- Check: This step can be done at the end of first semester to evaluate the results of changes undertaken either in personnel or at the students who are the main link in the study. Which will lead to further involve them.
- Finally, the Act step can be designed according to the second assessment is that students to conduct optimization changes together with those that have been proposed to step Plan.

ISO 9001 recommends the implementation of the Deming wheel principle in the process of continuous improvement of organizations [9].

A previous study suppose the deployment of two optimization loops toward meeting the expectations of students meet the new needs of the employment market (Table 1) and the other to the continuous improvement of the process of teaching (Table 2) as a reference guide for teaching practice at the level of science and technology in an engineering school [6].

Table 1 PDCA applied to the teaching of science and technical courses

PLAN -Establish an overview of the classroom situation student characteristics, available resources and equipment -Identify the learning objectives -Establish a dynamic and structured lesson plan -Set the skills to develop -Plan course content sessions on a schedule relative to the number of hours allocated to matter	**DO** -Go to the act practice -Manage interventions modalities -Involve students through active learning -Check understanding simultaneously with the course progress
ACT -Develop a surrender discussion of results -Adjust pedagogy as appropriate	**CHECK** -Determine a valuation of transmitted knowledge -Develop simulation tests to reconcile theory and practice: case studies, problem-based learning, team work -Check skills development

The deployment of this continuous improvement cycle (Table 1) will be enriched by the use of quality tools and methods and will be starting the second wheel optimization of the process of education (Table 2).

Table 2 PDCA applied to the quality of the teaching process

PLAN -Analyze The existing situation -Identify Problems -Search Causes -Set targets -Establish An evaluation grid of continuous progress	**DO** -Apply The changes in didactics and pedagogy -Supervise learning indicators continuously
ACT -Set corrective and preventive actions to make the system more reliable -Identify the skills and capitalize the results of the experiment	**CHECK** -Measure results relation to the targets -Test students skills -Compare from previous experiences

The modeling according to this quality approach will guide the actions of teachers in an optimal relationship between theory and practice.

So should we first:

- diagnose the interactions of the learning process,
- denominate the expected skills of the training provided
- identify educational acts that will be used to develop these skills
- Then assess the skills acquired.

III. Methodology

The relevance of the programs implemented, the adequacy of the training to the expectations of the employment market, support and the atmosphere in the class are key factors for the quality of training [11][12].

Learning in an engineering school is considered as a complex process of engagement, of investments and comprehensive development of students realized in a rich context of interactions.

In order to evaluate the current teaching practices and justify the choice of quality approach proposed by the model of Deming, anonymous surveys of student satisfaction was designed and distributed to students of Mechanical Engineering Department in Morocco.

3.1 Procedure

This is a study of the percentage of professors who meet the criteria of student satisfaction with the quality of training.

To do this, the survey includes a total of 24 statements grouped under four themes:

- Theme 1: student involvement
- Theme 2: Learning Relationship
- Theme 3: Resource professorial
- Theme 4: Planning of training

To avoid ambiguity in the understanding of the issues, a preliminary draft was developed and validated on a first sample representing 10% of the sample size [10].

3.2 Sample

The purpose of the survey is to collect some information on current trends in practices of teachers of this engineering department, the survey covered all students over two levels of study:

- 2nd year which is the first specialty year (20 students)
- 3rd year represents the second and final year of specialty (15 students)

Totaling 35 students.

The 1st year is omitted from the investigation because it is common core with other departments while the last two years are rather for specialization.

3.3 Instruments

The survey was developed by the SPSS (Statistical Package for the Social Sciences) with corresponding modalities to statements on 4 ranges: 0-25%, 25-50%, 50-75%, 75-100%. These modalities represent the percentage of the department's professors who meet the criteria of student satisfaction with respect to the quality of education.

Further, the criticality of each theme is measured from the product of the number of students responding to the statement by weight of the response category ranging from 1 to 4 is assigned to the 0-25% intervals 75-100%. The questionnaire was distributed in paper format.

IV. Results And Interpretation

The results expected by the software were exported to Microsoft Excel. They are presented by axis evaluation as a summary table of the percentage of students (Table3, 4, 5, 6) who responded in a statement to the above options terms and accompanied by a histogram [10] Fig.2, Fig.3, Fig.4, Fig.5. The illustrated histogram is to show the contribution of each element in total. An interpretation accompanies the results shown on Fig.6 and Table 7.

Table 3 Results of evaluation of theme 1: Student implication

		Percentage of teachers			
Questions		0-25%	25-50%	50-75%	75-100%
Q1	Scholarship resource framework and welcomes the needs of its students	5,9	50,0	35,3	8,8
Q2	The teacher is interested in student problems	11,4	54,3	20,0	14,3
Q3	The professor uses new teaching methodologies	20,0	48,6	28,6	2,9
Q4	The answers presented to students are satisfactory	2,9	31,4	54,3	11,4
Q5	The teacher encourages student participation in discussions	8,6	25,7	37,1	28,6
Q6	Students participate at the choice of activities and how to achieve them	8,6	42,9	42,9	5,7

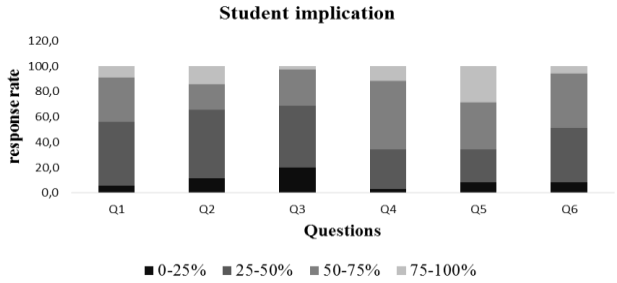

Figure 2 Histogram of evaluation of theme 1: Student implication

The question Q3 of theme 1 represents the lowest percentage of student satisfaction. Only 2.9% considers that teachers use new teaching methodologies and almost 49% believe the rate teachers using new teaching methodologies is between 25 and 50% of all teachers.

Otherwise, the majority of students think that more than 60% of teachers encourage student participation in discussions and provide students with satisfactory answers.

Table 4 Results of evaluation of theme 2: Learning Relationship

		Percentage of teachers			
Questions		0-25%	25-50%	50-75%	75-100%
Q1	Teaching strategies facilitate learning	11,4	54,3	28,6	5,7
Q2	The professor brings out the essential knowledge	8,6	20,0	65,7	5,7
Q3	The teacher uses pertinent examples	2,9	25,7	68,6	2,9
Q4	Professor connects theoretical concepts to practical ideas to facilitate understanding of the course	25,7	40,0	28,6	5,7
Q5	The teacher helps students make connections between theoretical concepts and their practical application	8,6	31,4	51,4	8,6
Q6	Recommended readings support learning	11,8	29,4	50,0	8,8

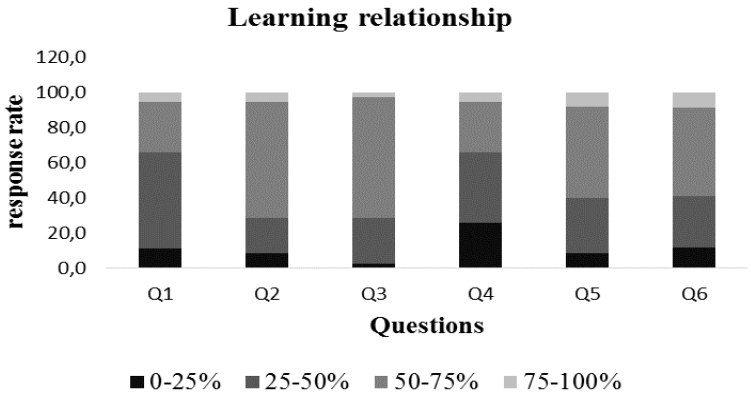

Figure 3 Histogram of evaluation of theme 2: Learning relationship

The questions Q4 and Q1 of theme 2 are highly correlated. More than 50% of students believe that the teaching strategies used by teachers do not facilitate learning. Indeed, less than 50% of teachers link the theoretical concepts to practical concepts. While the Q2 and Q3 statements of the same theme show that the majority of teachers transmit the essential knowledge while using pertinent examples.

Table 5 Results of evaluation of theme 3: Resource professorial

Questions		Percentage of teachers			
		0-25%	25-50%	50-75%	75-100%
Q1	The teacher is available	20,0	22,9	42,9	14,3
Q2	The teacher shows interest in his subject	5,7	31,4	42,9	20,0
Q3	Teachers master the content they teach	14,3	20,0	48,6	17,1
Q4	The teacher keeps the motivation among students	20,0	57,1	14,3	8,6
Q5	The teacher shows respect for his students	2,9	20,0	51,4	25,7
Q6	The teacher encourages initiatives and manifest openness to student ideas	8,6	37,1	42,9	11,4

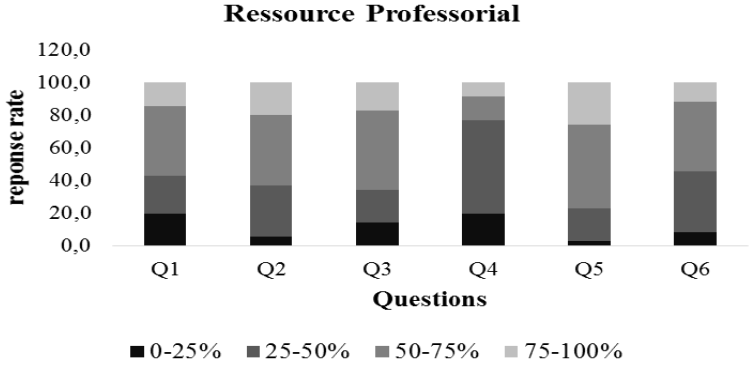

Figure 4 Histogram of evaluation of theme 3: Resource professorial

Depending on the question Q4 of theme 3, 70% of students see that most teachers fail to maintain motivation in their students.

By against, more than 40% of students think that 50 to 75% of teachers have mastered the content of their courses and are available to encourage learner's initiatives.

Table 6 Results of evaluation of theme 4: Planning of training

		Percentage of teachers			
Questions		0-25%	25-50%	50-75%	75-100%
Q1	The course plan was introduced clearly	8,6	28,6	51,4	11,4
Q2	The teaching means used facilitate learning	5,7	57,1	31,4	5,7
Q3	The work of the evaluation procedures are presented	2,9	22,9	62,9	11,4
Q4	In general, the syllabus has been respected	17,6	26,5	41,2	14,7
Q5	The work requested is relevant to my practice	2,9	42,9	45,7	8,6
Q6	The teacher accepts students suggestions	5,7	40,0	37,1	17,1

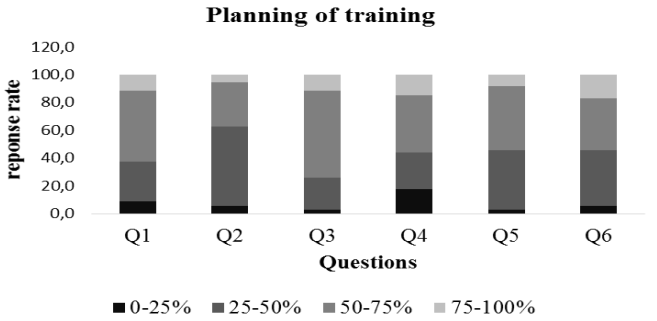

Figure 5 Histogram of evaluation of theme 4: Planning of training

Nearly 50% of teachers use only teaching resources that facilitate learning. Many of the students see between 50 and 75% of teachers clearly present their lesson plans and the evaluation methods. But on average, the syllabus is not always respected.

General interpretation

Wilfredo PARETO (1848-1923) showed that a large majority of situations, a few factors have a significant impact on the results. This is known as the Pareto 20-80, where 20% of factors explain 80% of the results. This is a visualization tool, analysis and assistance to decision making that emphasizes the distribution of facts in order of importance, it enables to choose and focus the action around the issues to be addressed in priority. It is used for measurable and quantitative data. To identify the most critical issues of the questionnaire, a Pareto study was conducted. Fig.6.The data considered for this application is the product of the number of students answering the question by the weight of the response category. To do this, a weight of 1 to 4 was assigned to the terms of 0-25% and 75-100%.

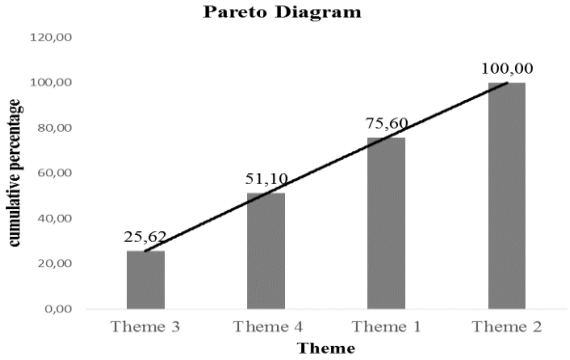

Figure. 6 Pareto diagram depicting the criticality of the axis of the survey

The plotted curve approaches a straight, which means that 4 axis evaluated at the questionnaire are of the same order of importance.

Nevertheless, there are some questions that differ greatly (see Table 7), which justifies the choice of the study in terms of the need for innovation in teaching practices.

Table 7 The most significant questions of the survey

			0-25%	25-50%	50-75%	75-100%
AXE 1	**Q3**	**The professor uses new teaching methodologies**	20,0	48,6	28,6	2,9
AXE 2	**Q1**	**The professor brings out the essential knowledge**	11,4	54,3	28,6	5,7
AXE 2	**Q4**	**Professor connects theoretical concepts to practical ideas to faciliate understanding of the course**	25,7	40,0	28,6	5,7
AXE 3	**Q4**	**The teacher keeps the motivation among students**	20,0	57,1	14,3	8,6
AXE 4	**Q2**	**The teaching means used facilate learning**	5,7	57,1	31,4	5,7

However, the traditional teaching model separating the functions of the two main actors of the classroom teacher, emitting element of information and student passive receiver, no longer meets the development requirements [11][12][13].The introduction of pedagogical approaches oriented skills development rather than the accumulation of knowledge is a central issue for the promotion of quality of education.Obviously, the successful deployment of these models is conditioned by a set of parameters related to the nature of the course, the teacher and students in person, the availability of certain materials, motivation and acceptance of change. Thus, the feature of this type of subject lies in the dependence of the context studied.

V. Conclusion

The pedagogical models must now adapt to modernization of the educational system face new social and economic challenges. The study, organized in a perspective of continuous improvement of the teaching process, describes the perceptions of engineering students of the quality of training through a qualitative survey. The questionnaire touches on the impact of the pedagogical intervention style of teachers and the emotional relationship with their students on learner satisfaction. To reinforce pedagogical and organizational choices of teaching practices in science and technology, a design of a reference framework is proposed as an iterative process improvement. However, to further enhance the results, multivariate statistical analysis is possible to study the correlations between the most critical study data.

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