A NEW APPROACH TO INCREASE STUDENTS' MOTIVATION: LEARNING THEORY BY DEVELOPING IMPORTANT SKILLS.

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Abstract - *An experiment was carried out within the discipline "Complements on General Mechanics" at Escola Politécnica da Universidade de São Paulo in the sixth semester of the Mechanical Engineering Course. The aim of the work was to increase students' motivation in learning the course topics, basically Analytical Mechanics. In the first class, during a group discussion session, the students chose three skills they considered important for their careers as engineers: oral communication and writing; researching; working in teams. The discipline syllabus was developed by the lecturer and the students during the next two classes. The result was a sequence of activities that helped the development of those skills chosen by the students and, at the same time, allowed for the learning of Analytical Mechanics. The most important ones were: brainstorming, cross group discussion, observation group-visualization group, seminar and Internet researching. The method was fully approved and the students strongly recommended its use in other disciplines.*

Introduction

The discipline "Complements on General Mechanics" at Escola Politécnica da Universidade de São Paulo in the sixth semester of the Mechanical Engineering Course is on Analytical Mechanics. It is difficult to keep the students' motivation in many theoretical disciplines such as this one. The traditional way of teaching, showing the theory and doing exercises, does not help to improve students' interest.

One alternative was to change the discipline format: some skills considered important for an engineer career are developed while studying Analytical Mechanics. These skills are chosen by the students in a cross group discussion session. The students decide what they will learn and the syllabus is developed jointly by the students and the lecturer. The discipline is formatted by the students. The result is a sequence of activities, whose subjects are topics of Analytical Mechanics, for the development of those skills chosen by the students.

The main idea is to change the focus from "teaching" to "learning". What really matters is what students learn during the semester. The lecturer's task is to facilitate the learning process by creating situations to stimulate the students' curiosity and to increase their interest for the subject of the discipline. Students only learn if they are active in the discipline.

A "psychological contract" is signed by the students and the lecturer: the students choose skills and how they will learn the topics of Analytical Mechanics, so they will participate.

This text describes the first use of this new approach with 62 students during de second semester of 1997.

The syllabus

The discipline syllabus was developed in two phases:

1. Cross group discussion: The students were arranged in five teams. Each team discussed one different theme suggested by the lecturer about the work of an engineer in the future. Then new teams were formed with at least one member of each previous team to report the conclusions of the discussion. All the new teams worked to answer the same question: "Which are the three most important skills for a mechanical engineer?". The answers were compared and the three most frequent ones were: oral and written communication, researching and working in teams.
2. Syllabus proposal. The lecturer proposed a syllabus for studying Analytical Mechanics by developing those skills. Students made comments and suggestions which were included in the initial proposal resulting in the syllabus shown in table 1.

During the semester

Some results were observed during the semester:

expository lessons were reduced to a minimum;

the students' engagement in each activity was very intense;
both the interest in classes and the frequency were high;
the pass rate was very high.
At the end of the semester an evaluation on the syllabus, the lecturer's attitude and the results achieved during the semester was carried out by the students. The method was fully approved and the students strongly recommended its use in other disciplines.

When they choose which skills and activities they will perform during the semester, guided by the lecturer, they sign a "psychological contract" that guarantees their active participation in the activities. They planned the discipline to see to their interests and their motivation, therefore, was very intense.

The only important process in a discipline is the students' learning. Thus the focus must be on "learning" and not on "teaching". The discipline will reach good results if it is based on activities carried out by the students and not in expository lessons with a passive attitude on the students' side.

Conclusion

Every discipline can have both cognitive and skills aims. At the same time students can learn theoretical topics and develop skills. Activities involving skills considered important by the students are very stimulating. Planning these activities with topics on the subject of the discipline, the students' learning will certainly increase.

Another point is the participation of the students in the definition of the discipline syllabus.

References

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Table 1 - Discipline syllabus - Complements on General Mechanics - second semester 1997.

GOALS (Skills)	TOPICS	STRATEGIES	CLASS
Researching Working in teams Writing (synthesis)	1- General Mechanics Cinematic of point. Cinematic of rigid body. Dynamic of point. Dynamic of rigid body.	*Brainstorming*	08/27/97
Working in teams	2- Shock Shock concept	*Expository lesson* *Groups with jobs*	09/10/97
Researching Oral communication	Shock theorems	*Lesson method*	09/17/97
	Percussion center Restitution coefficient Spheres collisions	*Expository lesson*	09/24/97
Working in teams	Application examples	*Groups with jobs*	10/01/97
	Examination	*Exercises*	10/08/97
	3- Analytical Static Virtual displacements Generalized coordinates	*Expository lesson*	10/15/97
Working in teams	Application examples	*Observation group x visualization group*	10/22/97
Working in teams Oral communication	Application examples	*Seminar*	10/29/97
	4- Analytical dynamic Dynamic general equation Second order Lagrange equations	*Expository lesson*	11/05/97
Researching Writing Oral communication Working in teams	Application examples	*Internet researching* *Discussion Panel*	11/19/97
Oral communication Working in teams	Application examples	*Seminar*	11/26/97
	Examination	*Exercises*	12/03/97

	Examination	*Exercises*	12/05/97