PBL0: AN INTRODUCTORY MODULE TO PROBLEM AND PROJECT BASED LEARNING, AND MUCH MORE BESIDES…

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OBJECTIVES

Problem/Project Based Learning was introduced in the Institut National des Sciences Appliquées Toulouse in 2003. As this is a completely new approach for our students, it was necessary to incorporate some sort of 'kick-off' activity in each PBL module to prepare students for the change of method. Three years ago, it was decided that it would be more efficient to organise an activity that would introduce all first year students to PBL at the beginning of their engineering course. Over the last three years, this module has developed in such a way that it has much wider consequences.

In 2008, during the introductory PBL module (PBL n°0), the 300 first year students, in small teams, were engaged in a complex project which was designed to be both technical and fun, in their first week. Guided by older students, in small teams they had to build water rockets and measure their performance during a spectacular rocket launch event at the Cité de l'Espace.
The PBL0 project can be considered an ambitious project in the number of objectives it seeks to achieve:

1. introduce students to PBL
2. introduce concepts in physics (Bernoulli equation, stability)
3. make students aware of how groups work
4. develop autonomy in learning
5. facilitate the integration of first year students in the engineering school

But this is just the tip of the iceberg. Over the years, students from years 2, 3 and 4 have become more integrated in the project. They now play a major role in its organisation and are wholly responsible for tutoring the teams. For these students, the project lasts ten months and becomes an integral part of their engineering training. The PBL0, comprising different levels, has therefore become a wide ranging project and has won a Innovation in Teaching award.

The aim of this paper is first to present the various aspects of the project and then to discuss how it achieves far more than its initial objective which was, as its name implies, to introduce students to PBL. The specific example of the first year project presented here is linked to the INSA physics course but can be adapted to any scientific or indeed non-scientific field. We therefore propose that this approach is transferable to other courses or institutions.

DEVELOPMENT

Stages in the project
The project started in March 2008 with the recruitment of student-tutors. After a project presentation meeting, the students, from any year and any engineering specialisation, volunteer to take part in the project and choose the role they would like to assume. Two teams are thus formed: a tutor team and an organisation team.

The organisation team comprising three students meets once a week from March to June with the Director of studies and the Learning and Teaching adviser in order to set up everything that is required for the project and the coordination of the different actors/people involved.

In June, two tutor-training sessions are organised. They are run by specialists in active learning and give the tutors the opportunity to analyse the behaviour of a team or to play the role of a student in a team learning situation. Through these activities, the tutors become aware of the potential difficulties the students will face. This training introduces a teaching approach which the tutors will adapt when working with their teams of first year students. The training is completed with an explanation of the basic principles of the physics concepts that the first year students will discover in the project.

In September, the first year students carry out the project over a period of three days. The work they do is divided into sessions with and without a tutor, with team work and individual research. In October, all first year students are invited to an award ceremony for the teams with the best results.

From October, the student-tutors continue with an assessment of the project and an in-depth reflection of the pedagogical matters raised during their tutoring experience. This work takes place in a module (Unité de Valeur Pédagogie) which is a fully integrated part of their engineering course for which they are awarded credits, and during which they develop pedagogical competencies will be useful to them as engineers. At the end of the project, they are asked to finalise their work with a written report which takes the form of a research publication and to present their work orally. They work in pairs and are tutored over the three month period by the school's Learning and Teacher Adviser.

More than 300 actors involved

The project involves 290 first year students and 12 student-tutors. The tutors are second, third or fourth year students, each accompanying several teams during the project. In addition, the whole project is organised by the 3 student organisation team and 5 teachers, plus the Learning and Teaching Adviser and the Director of Studies. Librarians of the INSA library and 6 consultants working on the Professional Project Guidance programme are also involved.

Numerous teaching/learning tools developed

The organisation team creates a « student booklet » to guide the first year students in their work during the three day project. This booklet contains a detailed description of each session, references on water rocket propulsion and documents that the students must complete and hand in to their tutors.

This team also creates a "tutor booklet" to guide the tutors through the stages of the project. It contains the "student booklet" plus details concerning the organisation of the sessions and additional information on the calculations that are required of the students. These two booklets are the result of collaboration between the students of the organisation team, the teachers involved. The student organisation team also prepares a short manual on the stability of water rockets

Another important and heavy task for this team is the planning, ordering and management of all the material needed by 48 teams. Each team is given a kit with enough materials for the whole project.

The rocket launchers are made by the Mechanical Engineering Department.

CONCLUSIONS AND PERSPECTIVES

What is achieved in this project ?

An inductive approach to learning

PBL0 as its name implies is an introduction to Problem and Project Based Learning, a method which is new to students but which they will experience several times during their engineering course. There are no traditional lectures or classes, but the student experiments and discovers progressively with his/her peers. The students are autonomous in their search for the information they need and are just accompanied in their learning process by student-tutors.

A student-led project

As said above, both the organisation and tutor teams are composed of students. These students are also involved in a learning process for themselves, an active learning process which continues after the PBL0 project since

they continue with an in-depth reflection on various pedagogical matters. They can validate this work and obtain credits with the Pedagogy Module for which they write up a report and give an oral presentation to a jury of INSA teachers. Through this module, they are able to develop competencies which will be valuable for them as engineers in the future.

Contextualised study

The first task given to first year students is a scientific project that they carry out in teams and which requires that they experiment, analyse their results, look for information, investigate several solutions, in a word, what is required of an engineer.
The context is strengthened by a partnership with the Cité de l'Espace: a theme park proposing a wide range of educational activities based on space and astronomy. The organisation team obtained permission from the pedagogy/education officer of the park for the final session to take place in its grounds, an element which added realism and motivation to the project.

An interdisciplinary project

At the same time as they carry out their project (building the rocket), the first-year students begin to reflect on their professional project and engineering course. They are encouraged to think about how the team works together and their personal role and contribution by the consultants involved in the Professional Guidance Initiative, an individualised programme to help students make relevant choices in their choice of career and during their engineering education.

Assessment based on several factors

Assessment of the team work is based on a grid developed by the tutors. Throughout the project, the students are required to hand in to their tutors specific documents (appendix in the student booklet) on which assessment is based.
The acquisition of scientific knowledge is validated by a series of documents (appendix in the student booklet) which are designed to help students assess their rockets and their calculations. The acquisition of scientific knowledge is also assessed individually at the end of the project with a MCQ test.
The result of the rocket's performance (distance travelled) is also taken into account. This is calculated by the difference between the distance travelled by the rocket and the minimum target of 22 metre.

Student satisfaction

A survey carried out among the first year students at the end of the project showed that almost 100% of the students were motivated and worked actively on in the project. It was also seen as an effective means to promote student integration at INSA.

Good publicity !

Many journalists were present at the final rocket launch at the Cité de l'Espace to interview the organisation team and students, giving rise to numerous articles in the local newspapers and a report on the local television channel.

Teaching innovation award

INSA de Toulouse received an award in Innovation in Teaching at the Trophées des Grandes Ecoles 2008, organised each year to reward the most innovative engineering schools.

QUESTIONS /CONSIDERATIONS FOR THE DISCUSSION

Impact of activities to integrate new students

a) attitude to studying
- the value of an educational activity during fresher week
- preparing students for different teaching/learning approaches
- developing autonomy

b) attitude to field of study
- the importance of the links with engineering right from the beginning of the course, contextualisation
- relationship between the what is studied in the project and to the first year course

Involving older students in teaching
- why should they volunteer?
- what preparation do they need ?
- what do they gain from the experience?
- how relevant is it for engineering students ?
- advantages/disadvantages of student-tutors/teacher-tutors
- how is their participation/investment recognised?

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