

# THE MOTIVATION OF WORKING AND STUDING

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## Abstract

The goal of this work is to study the motivation of Computer Science students making training practices in real companies during their schoolwork. This work joins University and Industry to make good engineers. Generally, the student during the different degrees is limited to attend to the university with the only objective to pass each subject without an extra motivation. The industries involve the students to put in practice the knowledge derived of these subjects. The company puts up the infrastructure and the student supply the labour. In this paper, we summarise a motivated experience of a student which has been guided along his courses by making different works in industry. In this case, the student ties to put in practice (in industry) all the knowledge acquired in the university. This applied knowledge has motivated the student to realize the utility and applicability of the university subjects. At the end of the work the student was accepted in the company to work as a computer science annalist.

## Keywords

University and industry, motivation, applied knowledge, learning

## 1. INTRODUCTION

The Degree Final Project (DFP) is considered the last step, where the student must put in practice the entire knowledge and abilities learned during all university courses. This work is supervised by the teachers responsible for these projects. The accomplishment of the DFP must fulfil the norms defined by each centre or faculty. Nevertheless, is it sufficient to apply the attained knowledge only at the end of the degree? The answer is no. It is essential that the student, during his different courses, has a direct contact with the enterprise world, as the real environment where to put in practice the acquired knowledge, and where learning necessities emerge and motivates the student learning interest.

Many Scientifics have worked on learning theories. They believed there are two processes involved in cognitive learning: the reception process and the discovery process [2]. Following this theory, our aim is to take advantage of the reception process into the University and the discovery process into the industry. Ausubel clearly indicates that his theory applies only to reception (expository) learning in school settings. He distinguishes reception learning from rote and discovery learning. The former doesn't involve subsumption (i.e., meaningful materials) and in the latter the learner must discover information through problem solving. A large number of studies have been conducted on the effects of advance organizers in learning [4].

The current cognitive view of learning has its antecedents in Gestalt theory (which emphasized learning through insight) and the work of Jean Piaget [10]. Two cognitive approaches to learning and their related classroom applications are summarized below: constructivism or discovery learning and reception learning or expository teaching:

- **Reception Learning or expository teaching** is often associated with the ideas of David Ausubel [3]. This form of learning involves receiving and processing structured information that has been presented by the teacher. As described by [9], the associated technique of expository teaching emphasizes that for the most effective learning, teacher presentations should be organized from general to specific (subsumption) and include the use of advance organizers (introductory information designed to help students prepare for learning and remembering new information), expository organizers (descriptions of key concepts), and comparative organizers (an emphasis on similarities and differences between new and previously-learned material). The reception learning must be mainly carried out in the university.
  
- **Discovery Learning or Constructivism:** Often associated with the work of Jerome Bruner [6] and Jean Piaget [11], discovery learning refers to the process of obtaining knowledge through one's own efforts. It can be done in the industry. In the classroom, discovery learning often occurs through structured or directed activities that require students to manipulate, investigate, and explore materials that may lead them to discover important principles or relationships [12]. Therefore, students are not presented with concepts and ideas in their final form, but rather are required to formulate them for themselves. Though structured discovery learning has long been a part of the science curriculum, the latest trend in discovery-based teaching, constructivism, has resulted in renewed and multidisciplinary interest in discovery-based learning. Constructivism holds that meaningful learning occurs when students construct and give their own meaning to knowledge based on their prior experiences and background knowledge [7]. It also recognizes that challenging and helping students to correct their misconceptions is essential to effective learning [12]. Conditions that foster such knowledge construction include the development of "a cognitive apprenticeship" between teacher and student, the use of realistic learning tasks, and exposure to multiple perspectives [5]. The experience acquired in the industry can be very profitable due to the student put in practice the structure information presented by the teacher at the University.

Nevertheless, these two cognitive approaches to learning are not regulated at institutional level. Our institution offers the possibility of students to work in companies and to carry out the DFP in order to offer a possibility of contact of the student with the real world during their academic formation. However, there are very few initiatives that combine these two possibilities during the process of education-learning of the students of Computer Science. Mainly, the DFP can be carried out in one of the three following modalities:

1. The teaching departments in the university make projects proposals. The student can ask for a set of projects by preference order. The commission of projects of the university analyzes the requests and assigns the projects to the students.
2. The student can develop a project on a specific subject of his interest, having to contact directly with the teacher who could be interested, so acting as the student's tutor. In this case, the approval of the project to the commission of projects will be due to request.
3. Projects developed within the framework of an agreement:
  - a. With companies, organizations or with Spanish universities. The condition to accept the project is the same that in section 2. The director could be the

responsible for his direction in the organism in which he develops the project, having to be titled superior; in this case, a tutor must be assigned in the centre. He must be a professor titled superior with teaching.

- b. International item within the internship programs that the centre has subscribed with other foreign universities.

Despite most of the DFP that are made in the centre are of type 1, since they are more comfortable for the student because he does not have to investigate in the enterprise we are looking for possible projects. Nevertheless, although the first option is most comfortable, it is not the most advisable facing his professional future. Option 3.a) is one of the strongest bets of our university, but not only at the end of the formative cycle of the student, but during this cycle with the purpose of motivating the student. In order to harness this type of projects and practices in companies, the university has started up a series of initiatives with the purpose to introduce the students of the university in the labour world throughout all the formative cycle. In this way, the training practices in companies and the DFPs serve as a bridge between the university and the company. Our Computer Science School has created a web-based management application for Training Practices in Companies that allows the students to know the training positions available at companies, to select a list of them in order to send automatically his curriculum vitae (CV) to the companies. The student once registered in the Web, he can:

- (i) Create or publish his CV.
- (ii) Look for training practices in companies using a selection criterion.
- (iii) Answer the training positions that interest to him, sending its curriculum to the companies.
- (iv) Respond to requests of companies interested in his profile and
- (v) Subscribe to a mailing list and receive the new training positions in his mailbox.

In addition, the companies can access to a curricular data base of students and make selections on it. Thus, once the company is identified, it can add new training position requests, modify previous request, and see the answer of published requests in order to contact with the candidates and to make a pre-selection on the curricular data base of interested students. The minimum requirement that has to be fulfilled in order to present the DFP is that the student is registered and have all the degree subjects approved. Despite the university also it pleads for the accomplishment of stays of students in companies or institutions, persecuting therefore the triple objective of: the technological increase of the companies with the contribution of human resources, approaching the student to his future professional reality, and to provide to the company an access road to the university.

## **2. THE PRACTICES IN COMPANY AND THE DFP AS A BRIDGE BETWEEN THE UNIVERSITY AND THE COMPANY**

As much, the DFPs as training practices in companies are considered bridges that connect the university with the company. In 1997, it was started up by the centres' Management Plan of Training Practices in Companies. Within this initiative, it was created in December of that year the unit of training practices in companies, with the primary target of harness the accomplishment of practices and DFPs of students in companies and institutions. Let's see in the next sections the requirements and the steps that must follow the students and the companies to take advantage of these initiatives. These data are gathered in the 2005-2006 educational guide of university centre.

## **2.1 Requisite and steps to follow by the student**

A student who wants to do a training practice or DFP in a company must fulfil the followings minimum requirements:

- Be registered in a centre and not to be a titleholder.
- Have more than a half of surpassed credits.
- Be enrolled in the curricular data base of the Integrated Employment Service.
- Each student can do up to 960 hours of training practices in a course while he fulfils the previous requirements.

The students who fulfil the requirements mentioned above have two alternatives. They can look for a company by themselves. In this case the University will facilitate to them all information and documentation needed. The second option will be to respond to the companies requests that are published from the training practice unit. The company requests become available by three routes; through announcement boards located in secretariat; through the Web page; and receiving them through emails. With this procedure, most of the requests (always depending of factors such as the tasks to make, the name of company, the demanded profile, stock-market economic offered or period in which it leaves), usually have good answers, allowing the company to select the indicated person. At the moment in which the student and the company achieve an agreement, they agree to formalize the training practice or project as soon as possible. The student has to consider that while he has not managed his corresponding documentation, there is no formal certainty of the training practices or DFP. The documentation necessary to formalize a training practice can be obtained from the Web and be given once complimented in Integrated Employment Service. This documentation has to be presented before beginning the training practice or DFP.

## **2.2 Requisites and steps to follow by the Company**

The companies interested in having students in training practices or DFPs have also two possibilities. In the case of a previous contact with a student, the company would go directly to the transaction of the documentation. In case the company needs to contact with students to make a selection, the usual process is to contact with the centre and to send a request. The interested students would contact with the company so that this one can make the opportune selection. Once this selection is made, the company would go to manage the necessary documentation. All the documentation can be obtained through the Web page of the Integrated Employment Service.

## **2.3 The stay in the Company**

The conditions of the stay will be committed in each case between the company and the students (day, schedule, duration, stock market economic ...), although the general requirements are due to consider. When formalizing a training practice or DFP, it is requested as part of the documentation to give a formative program description, this is, a summary of the tasks to make by the student in the company during its stay. The training practice or project must be centred as far as possible in this script. During the practice or project, the Integrated Employment Service registers the student in accidents insurance. In addition it informs to the corresponding Provincial Work Inspection of the presence of the student in the

company. It is important to know at any time that, the training practice or project can be terminated by anyone of the parts presenting a rescission letter.

### **3. Motivation and Learning: A Experience**

In this section we present an experience with a student of the Computer Science Faculty. The methodology of work used in this experience has been devised with the objective to foment the motivation and the learning of the student by means of a continued pursuit during training practices in a company and DFP, carried out by the student tutor at the university and by the company tutor. The particular training practice and DFP have had several goals:

- To activate and to integrate knowledge acquired throughout the academic courses and to apply them to real cases.
- To motivate the student in the “learning by necessity”, that is to say, the company proposes to the student suitable works to induce to the student to the study and learning of procedures that are only assimilated as such. One of the basic procedures that had to dominate is the technique to solve problems, in general.
- To integrate and to project the problems and the characteristic of the labour world of a computer science engineer in a company.

In order to fulfil these objectives, a cooperative methodology of work between the tutor of the university, the tutor of the company and the student has been followed. The knowledge of the problem domain and the real exigencies, contributed by the tutor in the company, have been studied from the perspective of the academic knowledge and the active position of the university tutor to guide the student in the application of a suitable methodology. The followed methodology was applied:

1. Definition of the specific goals of the training practices in the company and the DFP within the company framework. The tutors of the company and university decide the way to combine the goals of the practices in the company and the DFP according to: the characteristics of each practice in each level of the formative cycle of the student, and the characteristics of the DFP that must include all knowledge and abilities acquired throughout the student development.
2. Election of the most appropriate methodology in each level of the formative cycle.
3. Development of the training practices and the DFP. This is the longest stage and it is organized in: (i) monthly joint meetings between the company tutor, the university tutor and the student, in order to control the global pursuit of the project; (II) weekly meetings between the company tutor and the student for tracking the development of the training practices; (III) monthly meetings between the university tutor and the student in order to revise the training practice development in each level of the formative cycle and during the development of the DFP.
4. Evaluation of the training practices and DFP. This is the final stage in which the profits obtained by means of the evaluations of the subjects related to the made activities are evaluated in the training practices and the evaluation of the DFP. Because the training practices in the company cannot be evaluated directly within the framework by the university tutor, a periodic evaluation of them are made in the company, this evaluation constitutes 20% of the qualification obtained in the DFP, that is evaluated by the university tutor. In

the evaluation of the DFP participate: the company tutor to evaluate the work of the student developed within the company, the university tutor to evaluate the application of theoretical and methodological concepts, and the student to evaluate its own experience. The obtained qualification of the DFP will suppose the 80% in total amount of the final note.

The student profile or a suitable development of the activities is the following:

- To have an especially proactive attitude (interest, own initiative and motivation) in order to carry out this long project. This formative project usually takes three years, two years of training practices in a company and a year in the DFP.
- To have ability for team work. The team work in the classroom constitutes an educational strategy that, if there are certain conditions, it contributes positively as a learning motivation, as well as the learning that finally obtains the students [1],[8], as well as the motivation to help to his fellows in those knowledge that the student has been able to apply in the company. On the other hand, the team work in the company is essential for the formation of cross-sectional abilities that will be very useful for the student in his professional future.

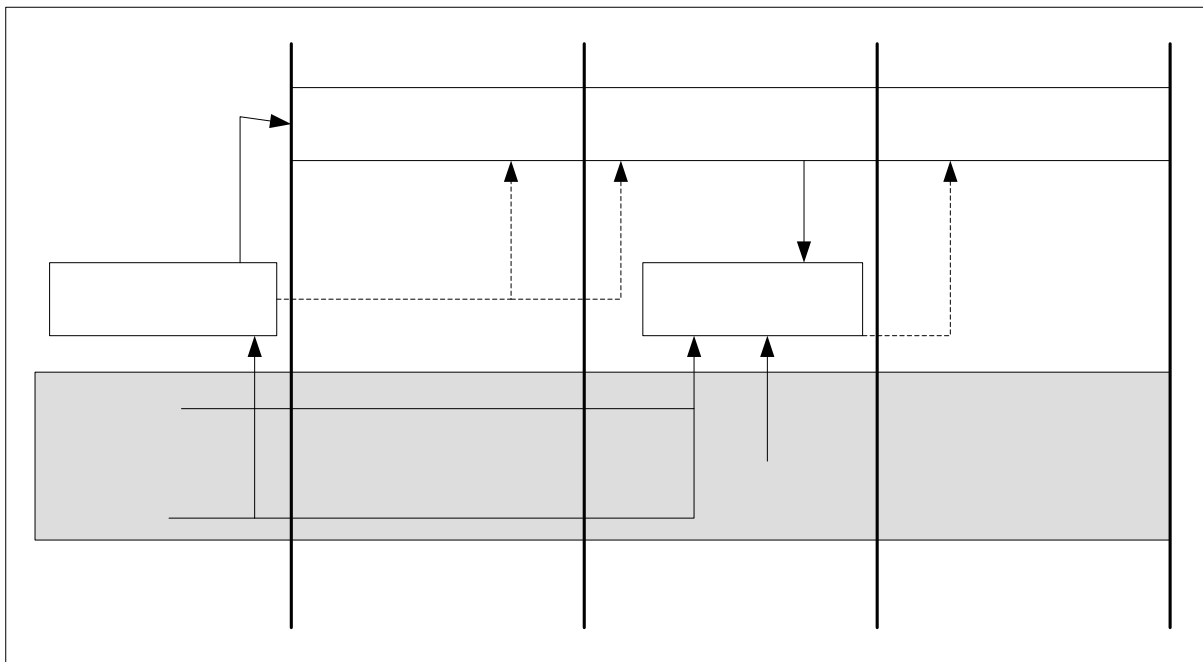


Fig. 1. A graphical scheme of the Training Practices in the Company and DFP

The key point for the success of the experience constitutes the formative program definition. The formative program includes a description of the types of activities that the student will be able to develop, both during the two years of training practices, in addition, of the preliminary goals that are tried to obtain during the DFP (last year of formation). The activities of the two years are defined according to the subjects that the student will attend in school, and with the commitment of the company tutor who will be in charge of the student guidance in the company background.

The formative program definition is made by the university tutor with knowledge on the formation program of the university centre, and the company tutor that contributes with the scenes and tools that allow the student to participate in real experiences of the professional world. Finally, at the end of the second year, it is defined the way to achieve the goals of the

DFP, with the participation of the student and the tutors of the university and the company, considering the performance of the student during the first two years.

Figure 1 shows a graphical scheme of the activities and positions of the student during the three years of formation. The form in which the student is guided is very important also for the success of the experience. One of the best approaches to use is the cooperative one. In this approach, it is tried that the company tutor transmits to the student his professional experience and orients him in his future labour, by means of a near interaction. The relation of the student with the university tutor is oriented as work meetings in which as much the tutor as the student participates in the different stages from evaluation and situation analysis and necessities arisen in the practices, contributing ideas and evaluating the best options of application of theoretical knowledge. Within this particular experience, let's see next a summary of the DFP developed by the student in a company of labour risks prevention.

### **3.1 The DFP**

The DFP previously defined, aims to use and enhancement of all the real experiences obtained in the company training practices. The final result was the creation of a tool called GAP (Automated Management of the Prevention of risks labour). This tool is a multi-user tool and it is settled in a remote server so that multiple users can collect, add and modify the data of that server. In this way the company is able to have a tool to automate the work of a technician in prevention of risks labour (gather of information, detection of anomalies, comparison of data, etc). The application is in charge of managing the elaboration of budgets, invoices and contracts of the company, allowing data communication between the prevention and management department in order to facilitate both tasks.

Following the scheme of the activities described in Figure 1, the student develops the components of this tool in a progressive fashion during the three years of formation. During the first year, the student attended third year of Computer Science Engineering, and put in practice subjects such as Design of Data Bases, Algorithms and Graphical User Interface for the information collection, comparison of data, etc. During the second year, the student completed his fourth course with subjects such as Networks, Programming Engineering, and Architecture and Engineering of Computers, to participate in the development of computer science projects in the company, as well as in the installation and network management. Finally, in fifth course, the student put in practice subjects such as Data Base Outputs, Local Area Networks and Interconnections of Networks, Management of Computer Science Projects and Data Stores and Data Mining. During this academic course, the student participated in activities of projects management, the development of a distributed database system and systems integration. In addition to these activities, the student developed the GAP tool as part of his DFP. In this way, the student applied during the training practices in the company all the knowledge acquired throughout the academic courses.

The direct application of the university subjects served as a motivation for the student, which was reflected in the final qualifications. The system developed as DFP served to apply all the knowledge acquired by the student, and had a great utility in the company. From the first moment, the student maintained a constant cooperative work with the company tutor. During the two first years, this interaction helped the student to include/understand the surroundings of the company and the exigencies of the labour world. During the third year, the transmitted guidelines and company standards to the student by the company tutor helped to develop the GAP tool following the company own work methodology.

### 3.2 Results

The results obtained by means of the accomplishment of this formative experience has been very positive, they are classified in different groups depending on the beneficiary:

- University: The University has achieved a very important objective: the immediate insertion of the student in the enterprise weaves when finalizing his academic formation.
- Student: The student complemented his academic formation by means of the real world application of the knowledge acquired in the university. During the three years of experience, the student has shown a high interest in the curricular subjects. The degree of participation in the classroom has been increased, and in addition the student has participated actively relating the knowledge acquired in the classroom to the professional world. Finally, the student was enrolled in the company.
- Company: The Company has obtained important benefits by means of the creation of a novel application made by the student, in addition to the valuable collaboration of the student as a member of the company.

### 4. Conclusions

The company training practices and the DFP can be used like magnificent propellant of the student towards the labour world. In this work we presented a promising experience of a student who has been guided during his university degree in the accomplishment of training practices and DFP in a company with the goal to apply in a professional context all the knowledge acquired in the classroom. This has generated an extra motivation in the student at the time of confronting its subjects, since a great number of them responded to the necessities of the company. We presented a student education-learning experience which was managed to finish the Computer Science Engineering studies successfully. In addition, when finalizing this experience, the student was enrolled by the trainer company.

In this way, the university-company interaction serves as a motivator and a productive tool in developing essential abilities for a Computer Science Engineer.

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