Should Students Use Their Private Laptop Computers for Study Purposes?

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Abstract:

Project and Problem Based Learning has become a standard method of teaching at Technikum Wien. In the course of Computer Science students used their own Laptop Computers for all lessons. If students could not afford a laptop, one was provided by the department. The over all results of this experiment have been very promising. It was possible to reduce the total costs of teaching, mainly because less support for the student laptops was needed. Even more important, most teaching obstacles previously caused by hardware/software problems disappeared completely. The majority of computer science students say, they prefer to use their own laptop and that it is very motivating to have all necessary prerequisites for the course on one computer system.

1 Introduction

Efficient use of computer resources is a basic need in any course of computer science and also in courses in related fields. Today around 2500 students study at the University of Applied Sciences Technikum Wien in some 25 degree programs. Although all the degree programs are technical studies, the diversity is huge. The range covers many specialist areas e.g. sport equipment technologies, robotics, electronics, computer science, just to mention a few.

All courses do need computer equipment for use in the teaching process in different subjects. Requirements between courses and even between different subjects of the same course differ a lot. At Technikum Wien most computer labs are a shared resource between all degree programs. On the one hand this is a big advantage in terms of efficient use of faculty equipment; on the other hand it implies many demands onto the software and onto the configuration management of the workstations.

2 Project and Problem Based Learning

Project and Problem Based Learning has become a standard teaching environment at Technikum Wien. For more than ten years these methods have been used in many courses.

2.1 Didactical Issues

One major task in developing a curriculum straight from the professional field is to keep in mind that students should be "fit for profession" at the end of their studies. The decision

which didactical means produces the best results for a specific goal is not always easy to answer and in many cases a mix of methods is the best way.

GOALS	Acquisition of organized knowledge	Development of intellectual skills (learning skills)	Enlarged understanding of ideas and values
MEANS	Didactic instruction	Coaching, exercises, supervised practice	Socratic questioning and active participation
AREAS	math, natural science, "hard facts" of a professional field	Speaking, listening, calculating, problem solving, critical judgment	Discussion of books (not texts), managing groups of people

Table I: Basic curricular needs

A point of great relevance for giving appointments to teachers is also: who should teach what? More clearly - at Technikum Wien a policy has been developed which says that approximately 50% of the lectures students get (all types of instructions, coaching, seminar work, projects, …) should be given by full time university staff and the other 50% by external experts working in the specified professional field. That should lead to a balanced mix of fundamental and practical skills and knowledge. These preconditions give experts from industry and SMEs the status of brokers between two communities of practice – the University/FH and the industry [1].

2.2   Communities of Practice

This approach views learning as an act of membership in a "community of practice" [2].

The main Assumptions taken from Markowitsch [1], Lave [3] are:

- *Learning is fundamentally a social phenomenon.*

- *Knowledge is integrated in the life of communities that share values, beliefs, languages, and ways of doing things.* They are called **communities of practice**. Real knowledge is integrated in the doing, social relations, and expertise of these communities.

- *The processes of learning and membership in a community of practice are inseparable.*

- *Knowledge is inseparable from practice.* It is not possible to **know** without **doing**.

- *Empowerment-or the ability to contribute to a community-creates the potential for learning.*

2.3   The basic Idea of Problem- and Project Based Learning

Problem Based Learning is basically student work in self directed learning groups following a well defined process of problem solving [4]. The previous lecturers have primarily the function of coaches, watching the process of learning, not giving special advice to the topic itself. Asking the right questions to stimulate students to find their learning objectives and later on the solution of the given problem is the new main task of the lecturers, [5].

Training in industry-related project work starts one year before the practical training Semester also Problem Based Learning methods. These methods are developed in cooperation with the University of Maastricht/Netherlands and some other Universities of Applied Science in Austria.

The setup of Problem Based Learning started as a further development process for didactics in the project work during the 5th and 6th semester of the study year 2000/2001 and all of the economic lectures. Goal was to give a broader view to the technical projects inspired by the interest of industry partners to become more involved with the projects in early stages of the education process. This fact brought also the need to see management and economic topics not in a separated way. And – last but not least – it was an opportunity to establish a learning environment that comes close to the Community of Practice approach mentioned above.

Necessary steps are:
1. Informing the students about the curricular changes (methods)
2. Training of the lecturers
3. Establishing organizational rules

It was relatively easy to manage point (3) – organizing rooms for the team meetings, bringing students and coaches together on a regular basis. Informing the students about the changes in the first year - point (1) - in a pilot project has turned out to be more challenging. The group of students in the pilot project often mentioned, they perceive they "do not learn enough".
As a result the problems of how learning takes place and which ways are possible are now discussed more deeply with the students – an important step.
The training of the lecturers, point (2) was done in two steps. First key persons of our organization have been trained at the University of Maastricht, one of the partner organizations of Technikum Wien. Next step was the training of all Lecturers which are involved with the new method in problem solving, coaching and leadership [5].

Besides discussions about whether Problem- or Project Based Learning is the better approach, main focus should be given to a maximum of involvement of students in the learning process. One major fact is giving students possibilities to contribute with their learning outcomes to a group of students in a role close to that of a teacher. To become a teacher and to contribute to a community of practice becomes a key factor for efficient learning. Conditions for making that possible may com from Problem- and Project Based Learning as well.

2.4   Project - Cooperation with Companies

Special emphasis is given to practical training at companies in Austria and other European states immediately whenever possible tightly connected to the elaboration of a Bachelor- or Master-thesis. Research projects arising from topics of the practical training often end up in the Bachelor- or Master- thesis. As a result students spend a considerably amount of time of education at the industry or at SMEs. This structure is currently seen as a very good method in helping students to migrate from the study-phase of their life to the professional-phase.

3   Difficulties to Provide Reasonable Shared Computer Resources

Sharing a computer lab between different courses on the first glance seems to be an appropriate method to minimize costs. However during the last years it became increasingly difficult to provide students with reasonable shared computer resources. Especially configuration and availability of needed software turns out to be a major problem in many cases.

Project Based Learning counts for a significant part of the curriculum in Computer Science . Projects start very small but increase rapidly in complexity and size from the first to the sixth semester (table 1). Around 50% of all projects do have real customers. Especially these projects often require a specific environment. In most cases it is simply impossible to provide this environment in a shared lab. The difficulty increases, because in many of these projects a workplace is not provided by the customer.

Semester	ECTS Credits	Workload per Student [h]	Remark
1	3	75	First experiences with IT projects.
2	3	75	Software development process
3	4,5	112,5	Standards and project management
4	4,5	112,5	Special issues of teamwork
5	6	150	Self-directed Learning
6	15	375	Internship (Company or University)

Table 1: Project Based Learning in Computer Science (Bachelor)

For statistical reasons the authors keeps track of different project types.

Type of project	Number of projects in 2005/06 Semester				
	1	2	3	4	5
Students do a project they suggested themselves	10	11	7	6	9
Students do a project for a company. The idea and/or contact to company was provided by the students themselves.	7	5	6	6	3
Students do a project for the internal needs of the faculty (teaching or research)	2	1	5	2	1
Students do a project for a company	1	1	1	5	2
Total	20	18	19	19	15

Table 2: Number and type of projects in the academic year 2005/06

The needs of individual projects are extremely hard to satisfy by shared computer recourses. The main reasons for this are:

1. *Many projects do need special development systems and configurations.* In many cases even the installation of a needed environment becomes a time consuming task. Very often it is not clear if the actual configuration is working or not, until the students actually do some real work.

2. *It is extremely difficult to assign a shared computer lab for a continuous period of time to a specific project.* Most computer labs are used 50% to 60% of a week for teaching purposes. Usually the lab is reserved in units of some hours for a specific

purpose. However, individual projects do have unforeseen periods of heavy work and require the use of the lab for a longer period.

4   Financial aspects of shared computer labs

In this project the impact of project based learning in combination with the usage of private laptops has been investigated. The financial aspects cover costs of hardware, maintenance and rental fee.

4.1   Cost of hardware:

Per student the pure hardware cost is calculated with €100 each year. This assumes that a group of 15 students uses a computer room for 1/3 of the available time. Each computer room is equipped with 15 personal computers with initial cost of €900 each and a product life of 3 years.

4.2   Rental fee:

The 170 students use 11 computer rooms in groups of 15, each group 1/3 of the available time per year. If the presence time is reduced by half, two computer labs are needed instead of four. This gives a cost reduction of €200 per student per year.

4.3   Cost of maintenance:

In this project the maintenance of the computers is done by the students themselves. By this the personnel for computer maintenance can be reduced, the cost saving calculates to €250 per student and year. This is possible in study programmes which deal with computer science, where the students are experienced computer users. If the programme is extended groups of other study programs the savings will be reduced.

5   The student's point of view

To study computer science is not an easy task. Students have to be very efficient in planning their time resources for being able to achieve good results. In many cases, especially in computer languages much practice is needed for reaching the required level to pass an exam. From the students point of view using their own laptop has a significant number of advantages.

1. *Most students in computer science already are in the possession of a medium or high end laptop computer*. Individuals who choose to study computer science like to work with computers and most of them already use a laptop computer for their personal needs.

2. *Students suggest using their own computer equipment for study purposes*. Many students in the course of computer science argue, that faculty equipment is more difficult to use in projects and also they argue being able to get better results if they can choose to work on their own equipment.

3. *Students wish to do significant parts of the work at home*. Very often students want to work in the evening or even during night time and would like to do that at home.

4. *Students do not know in advance when they will work.* The availability of time is seldom known sufficiently prior to the actual period to allow a reservation. Working on a project is more efficient, if you do not have a time limit. Many students prefer to work at evenings or even at weekends.

Because of the above reasons, the authors decided to start a trial in project based learning with all students in the degree of program computer science in the academic years 2004/2005 and 2005/2006 . Students have been officially allowed to use their own laptop computers in project based learning and also in all other subjects. If students did not want to use their own computer, a laptop computer had been provided by the faculty for the period of one year, which usually is also the period of a project.

6   Results

One of the main questions which had to be answered during the experiment was, will students prefer their own computer, or will students instead try to get a laptop computer from faculty.
In general students prefer to use their own lap top computer. The reasons for this behaviour are various, among the most important is the availability of the own computer after the end of the project.

Around 150 projects have been carried out by around 170 students in the above mentioned time. The percentage of students who applied for a laptop was relatively low around 17%. Only 30 laptops from faculty have been required.

The highest number was found in first year students with 24% and the lowest number was found in third year students with 4%. We expect these numbers to drop in the coming years.

Typically a laptop computer can be used for 3 years, this means around 10 laptops per year are needed. In terms of hardware the trial did not cause additional cost. However, no man power for the maintenance of computer equipment for the involved students was necessary, thus resulting in a significant cut in over all costs. In numbers this can be estimated as follows.

6.1   Maintenance of the laptop computers

The laptop computer is *not* maintained by faculty staff. It is the individual student who is responsible for the installation of all software and for the solving of any problems. Most students are very willing to do so. It also must be mentioned, the learning effect by maintaining the own computer also does have a positive influence.

6.2   Software licences

All necessary software licences are acquired by faculty and are being made available through intranet or other media to the individual students. Although the cost for the licences is the same, there was a significant drop in costs of distribution an installation of needed software.

6.3   Financial aspects

The present study indicates financial benefits. If only cost of hardware and rental fee is calculated a cost reduction of €300 per student can be assumed. On the other hand 10 laptops have

to be purchased each year to equip also these students with hardware, who do not want to use their own computer. In this project a cost saving of €51.000 and additional laptop costs of €10.000 results in about €40.000, which could be saved per year. These numbers depend on the willingness of the students to work at home and to use their own computer.

6.4 Avoidance of teaching obstacles caused by malfunctions of computer resources and motivation of students

The motivation to learn is a very important issue in teaching [7 – 9]. It seems that students are better motivated to work, because there are fewer problems with the computer equipment. Shared computer labs always had been a source of troubles for computer science students. It is nearly impossible to satisfy the needs of these students on computers where they just have limited rights to change the configuration. Now students themselves are responsible for maintenance of their laptop. Of course this is only possible in courses like computer science, because here students can be assumed to have the necessary skills. Some students expressed that they highly liked being able to configure the laptop exactly to their needs. The maintenance of the laptop also does have a positive side effect on teaching. Installing and configuring needed software packages fosters valuable skills.

7 Conclusion

The usage of private laptop computers in project based learning raises some questions. Students might not want, or might not being able to use their own laptop. The present study indicates that computer science students are willing to use their own laptop computers. The few students who do not own an adequate laptop are equipped with a laptop from faculty.

Compared to the usage of shared computer labs, the over all costs for the university could be significantly reduced. But more important, having all necessary software on one computer system, they can carry with them does have a positive effect on learning.

References:

[1] Markowitsch, J. Werte und Bedingungen praxisbezogener Hochschulbildung, Schriftenreihe des Fachhochschulrates 4, Wiener Universitätsverlag, 2001

[2] Wenger, E. Communities of practice. Learning, meaning, and identity. Cambridge University Press 1998

[3] Lave, J. and Wenger, E. Situated learning, legitimate peripheral participation. Cambridge University Press, 1991

[4] Gijselaers W Connecting Problem-Based Practices with Educational Theory, New Directions for Teaching and Learning, no. 68, Winter 1996, Jossey-Bass Publishers

[5] Kriger M. (1999), The Art and Power of Asking Questions, The Organizational Behavior Teaching Review, Volume 14, Issue 1

[6] Pucher, Robert; Mense, Alexander ; Wahl, Harald: JAVA-Fußball-Roboter. Wien, Schriftenreihe der ÖVE Nr. 33. Beiträge der Informationstagung Mikroelektronik 2003, pp 401 – 406, ISBN 3-85133-030-7, 2003

[7] Pucher, Robert; Mense, Alexander ; Wahl, Harald ; Nimmervoll, Alexander ; Hofmann, Alexander ; Hammerl*, Barbara; Schmöllebeck, Fritz (2004). Intrinsic Motivation of Students in PBL Courses. In Proceedings of the International Conference PPL2004 Pleasure by Learning, Cancun Mexico, June 13-19, 2004

[8] Pucher, Robert; Mense, Alexander; Wahl, Harald; Schmöllebeck, Friedrich: Intrinsic Motivation of Students in Project Based Learning. Rep. of South Africa, Transactions of the SA Institute of Electrical Engineers, Vol 94 No3 pp 7 – 14, 2003

[9] Sprenger, Reinhard: Mythos Motivation. Wege aus einer Sackgasse, Frankfurt/M, Campus Verlag 2002

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