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Nine Years of Project-Based Learning in Engineering

Nueve años de Aprendizaje Basado en Proyectos de Ingeniería

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Abstract

The engineering programmes offered at the Higher Education Polytechnic School of Águeda, University of Aveiro, have been organised, since 2001, around the Project Based Learning paradigm. This paper will briefly set the scene for the educational development and will then proceed to describe the curricula implementation that is nowadays on the field, reflecting the accumulated nine-years' experience of running the programmes. Finally, the author will offer his personal perspective on the difficulties of the development and its implementation, as an actor engaged in the process.

Keywords: project-based learning, engineering education, and curriculum development

Resumen

Los programas de ingeniería impartidos en la Escuela Politécnica Superior de Educación de Águeda, Universidad de Aveiro, se han venido organizando desde 2001 bajo el paradigma de Aprendizaje Basado en Proyectos. Este breve artículo se propone mostrar el marco del desarrollo educativo y proceder a continuación a describir la implementación actual de los planes de estudio en este campo, de acuerdo con la experiencia acumulada durante nueve años de funcionamiento. Por último, el autor ofrece su personal visión sobre las dificultades del proceso de desarrollo e implementación, en su calidad de actor comprometido con el proceso.

Palabras clave: aprendizaje basado en proyectos, educación en ingeniería, desarrollo curricular

Introduction

Higher education systems have been, in the recent years, under strong pressure from students, employers and society at large, in demand of adequate answers to the challenges of a rapidly changing world. Mass education, diversity of student profiles, as well as cultural, sociological and economic changes have all contributed to this scenario. In this context, a strong emphasis has been put on the need for an actual shift from teacher-centred to student-centred systems, in which the development of interpersonal and professional capabilities (e.g. working in groups, leadership, making presentations, writing technical reports, tackling a problem) gains relevance, the demand being that the opportunities for their development should be made explicit in the learning experience [1],[2].

For institutional reasons strongly related to this scenario, the Higher Education Polytechnic School of Águeda - University of Aveiro (ESTGA) has decided to move towards the PBL paradigm in its three-year engineering degrees. The process started in 1999 and developed into an overall educational paradigm change involving every member of the staff at the time. After three years of internal discussion and curriculum development, on October 2001 the move took place on the field. The process of change is thoroughly described by Alarcão [3] and by Oliveira [4], and will be the object of discussion of the next section of this article.

The paper will then set out to briefly discuss the change process, and will then proceed to describe the current structure of ESTGA's technological curricula. Finally, the author will offer a personal perspective on the development, reflecting on the accumulated nine-years experience as an actor engaged in the process, and discussing difficulties and challenges of running PBL curricula on a daily-basis.

The change process

In response to a challenge from the Rector of the University of Aveiro, in 1999, the ESTGA's staff initiated a discussion of the Danish Aalborg University Project Based Learning model using the book "The Aalborg Experiment, project innovation in university education", by Kjersdam and Enemark, as a start-up for exploration. Sensing the scepticism and doubts raised by this first exploration, the Rectorate took a further step in the promotion of innovation: a visit to Aalborg of a university delegation leaded by the Vice-Rector for Pedagogical Affairs, and including four members of the Águeda staff, was arranged. This visit made it possible to get to know, in loco, the Aalborg educational reality. As a result, a report was produced that served as the starting point for an Águeda internal discussion on the possibility of adapting the PBL model to the reality of Portuguese society and higher education framework.

The reduced number of staff members at the time, fifteen at the beginning of the process growing to twenty-four along the way, allowed for general discussion meetings in which decisions could be taken in a democratic way. It was clear that senior management, although not imposing a change to PBL, had expectations that such a project would be undertaken by ESTGA. The staff's feelings towards an overall change ranged from enthusiasm to strong scepticism, with a fair number of people staying in the mid-waters of doubtfulness. As a result, the collective decision of

developing a virtual curriculum change was taken: for the enthusiastic ones, this was a way of working out possibilities and finding solutions to the expected barriers; for the doubtful ones, a way of further incorporating what PBL was really about; and for the sceptics, a way of proving the impossibility of the change.

Three working teams were created, involving all members of staff, each dedicated to a different aspect of the development. Articulation and proposals by each of the teams were discussed in general assembly meetings. A period of slow progress, featuring steps forward and backwards, followed. Envisaging the need for a deeper insight of Project-Based Learning, senior management arranged for two workshops that should provide for teacher training, incorporating a staff development programme.

The first workshop was led by two professors from Aalborg University. It was an opportunity for the members of staff who had not been to Aalborg, to have direct contact with its model and to deepen the insight into project-based learning. The second workshop was run by a former Professor of Civil Engineering, who had acted as a consultant in Aalborg. The engineering background of the workshop leader and his broad views on education allowed for the immediate establishment of empathic communication with the participants. He managed to unleash a wealth of realities and experiences beyond the Aalborg model, contextualising some of the questions being raised by the staff from the first moment and opening room for the development of a local, adapted, educational paradigm. The work being carried out by the three staff teams began to make sense.

Following the workshop, it was clear that there was a climate for change: the teams intensified their work and the definitive decision to go forward with the innovation was made. A process of “learning by doing” was under way, in the sense that there was a project and a group of people dwelling with the necessary learning to find a solution to that problem: project-based learning itself was the methodology being used to make the educational development happen. The workshop leader soon became a consultant for the process of change, acting as the “project facilitator”: two more workshops took place on October 2000 and January 2001, fully dedicated to the actual development. In between the three workshops, electronic contact was maintained.

As a result of all these efforts, and after preparation meetings with the students, the move towards PBL took place on October 2001.

The project-based learning curricular framework

ESTGA currently offers two distinctly technological programmes: Electrical Engineering and Information Technology, both organized around the PBL paradigm. Table 1 presents the curricular plan for the Electrical Engineering programme, which will serve as the base example for the rest of this subsection.

The curriculum is organized around aggregate curricular units, each corresponding to one important theme to be addressed by the programme. These aggregate units materialize into Thematic Modules (TM), which consist of a project and a set of supporting courses. The idea behind these modules is to concentrate the delivery for the goal themes in the same semester, instead of spreading them out

along the programme, as is usual in traditional engineering degrees. This structure follows the Aalborg model [5] and besides the obvious focus on a particular subject area, allows for closer to reality projects. In Table 1, the shaded areas represent TMs; courses not included in the shaded areas are dedicated to general complementary subjects, not directly related to any of the themes, and are called Autonomous Courses.

Following the Aalborg model, all courses are taught in four-hour blocks that can be organized differently according to the course or the learning needs at any stage of the process, thus enhancing flexibility and allowing for reorganization of the provision for teaching according to students' needs. This structure also allows for a better articulation with the thematic projects.

Projects are developed in small groups of students, which are assigned a small physical space to meet and work. Students are also granted extended access to laboratories, evenings and weekends included. Each group has a supervisor for every project being carried out. The supervisor's role is to facilitate students' progression, to guide without disclosing the solution, to help by asking meaningful directing questions. Projects are assessed through a written report and a public presentation for a jury – one of the members is the project supervisor. The presentation is followed by a period of discussion, in which students may be individually requested to answer different questions. It is common practice to invite individuals from other HE institutions or from industry to sit as members of the jury, allowing students to gain different perspectives on their work. Complementarily, self and peer assessment strategies are strongly advised and have become common practice for most projects.

Electrical Engineering

	1st Semester						2nd Semester					
	Area	Course	H/smt TP	H/smt TO	ECTS		Area	Course	H/smt TP	H/smt TO	ECTS
1st Year	M	Mathematics I	80	0	8,0	1st Year	M	Mathematics II	60	0	6,0
	F	Physics	60	0	6,0		M	Applied Mathematics	60	0	6,0
	Ph	Elements of Electromagnetism	50	0	4,0		Ph	Elements of Thermodynamics	50	0	6,0
	I	Them. Proj.: Applied Informatics	0	20	12,0		EL	Them. Proj.: Electrical Circuits	0	30	12,0
	I	PC: Informatics and Programming	60	0			EL	PC: Circuit Analysis	50	0	
	MNG	Project Methodologies and Management	30	0			L	Technical English	40	0	
		Total	300		30,0			Total	290		30,0
2nd Year	EL	Them. Proj.: Analog Electronic Systems	0	30	12,0	2nd Year	EL	Them. Proj.: Industrial Instrumentation	0	30	12,0
	EL	PC.: Semiconductors - Devices and Applications	50	0			EL	PC: Industrial Electronics	50	0	
	EL	Electronic Systems	50	0			EL	Instrumentation and Measurements	50	0	
		GC.: Option I	50	0	6,0			GC: Option II	50	0	6,0
	EL	Them. Proj.: Digital Electronic Systems	0	30	12,0		EL	Them. Proj.: Electrical Technology	0	30	12,0
	EL	PC: Microprocessors and Microcontrollers	50	0			EL	PC: Electrical Machines	50	0	
	EL	Digital Systems	40	0			EL	Applied Electrotechny	50	0	
		Total	300		30,0			Total	310		30,0
Branch: Electrical Installations												
3rd Year	EL	Them. Proj.: Energy Distribution and Usage	0	30	12,0	3rd Year	EL/ME	Them. Proj.: Industrial Automation	0	30	12,0
	EL	PC: Energy Transport, Usage and Management	40	0			EL	PC: Automation	60	0	
	EL	Electrical Machines, Actioning and Protections	50	0			ME	Hidraulics e Pneumatics	60	0	
	EL	GC: Electrical Apparatus	40	0	4,0			GC: Option III	50	0	6,0
	EL	Them. Proj.: Electrical Energy Installations Project	0	60	14,0		EL	Them. Proj.: Special Installations Project	0	45	12,0
	EL	PC: Electrical Installations I	80	0			EL	PC.: Electrical Installations II	40	0	
		Total	300		30,0			Total	285		30,0
Branch: Mechatronics												
3rd Year	ME	Them. Proj.: Thermodynamics and Fluid Dynamics	0	30	12,0	3rd Year	ME	Them. Proj.: Computer Assisted Machining	0	20	10,0
	ME	PC: Fluid Mechanics	40	0			ME	PC: Computer Assisted Production	30	0	
	ME	Thermal Machines and Heat Transfer	50	0			ME	Technical Drawing	50	0	
	ME	GC: Materials Resistance and Mechanics	60	0	6,0		ME	GC: Hidraulics e Pneumatics	60	0	4,0
	ME	Them. Proj.: Materials Technology and Processes	0	30	12,0		EL/ME	Them. Proj.: Mechatronics Project	0	60	16,0
	ME	PC: Technological Processes	50	0			EL	PC: Automation	60	0	
	ME	Materials	50	0			ME	Elements of Mechanical Systems	50	0	
		Total	310		30,0			Total	330		30,0

Remark:

The shadowed areas represent a module of a Project + Project Courses.

Abbreviations:

Them. Proj.	Thematic Project
PC	Project Courses
GC	General Courses
TP	Theoretic and Practice
TO	Tutorial Orientation
TH	Total Hours

Table 1. Curriculum Plan for the Electrical Engineering Programme

Once again following the Aalborg model, semesters are organized into three five-week periods, allowing classes to be concentrated at the beginning of the semester; the end of semester is for the most part devoted to project work. At the end of each five-week period there is a week without classes, dedicated to various assessment activities. For the assessment of projects, there is a more extended assessment period at the end of the semester.

This approach has been on the field since 2001 [4]. However, for institutional reasons concerning the way students accessed Higher Education in Portugal at the time, there were no projects in the first year of the original curriculum, which consisted exclusively of autonomous courses. Internal evaluation outcomes [4], [6] have indicated that students found it difficult to cope with the demands of project work dynamics, especially in the third semester. The need to develop group work, time managing and communication capabilities at the first year level became evident. Taking advantage of the formal adjustment to the Bologna process that took place in Portugal in 2006, two new TMs were introduced in the first year of the programme. One of the driving ideas behind the new first-year TMs is to incorporate a non-technical course within an otherwise technically oriented module, thus creating context, on the one hand, yet specifically dedicating teaching time to important transversal competences, such as group work strategies, time management, project management, and communicational skills.

This framework, apart from the adjustments just mentioned, has been on the field for nine years, at the time of writing. However, curricular frameworks alone are not enough to establish a project-based learning environment, a move that requires significant attitudinal changes from all the players involved. The following section will offer the Author's personal perspective on the challenges of such a change process.

On the challenges of running a pbl environment: a personal perspective

The Author has been involved with the development from the beginning, first just as another member of staff, and later as the informal coordinator of the change process and further development. He is still an involved member of staff, one that is engaged with project supervision and facilitation of associate courses, which allows him an overall perspective of the development.

The first conclusion to be taken out of whole development is that it is, at least, as hard to keep it running than to set it up. One cannot regard such an ambitious development as a time-limited experiment, but rather as an on-going process, and one that requires time, effort and constant monitoring. Attitudinal changes do not happen overnight, and moving towards project-based learning requires at least three dimensions of attitudinal changes: one concerning the teachers involved; one concerning the students' attitude towards learning and the institution; and finally, a change in the institutional culture. The following sub-sections will address each of these dimensions in turn, trying to identify the challenges of running a PBL

environment on a daily basis and offering, whenever possible, suggestions on how to address those challenges.

The teachers' dimension

The first dimension – teachers' attitudinal change – is probably the most difficult to achieve, a statement which has almost become commonplace, given the number of times it has been repeated, either orally or in the literature. But in fact, no matter how student-centred the environment becomes, teachers always play a central role in fostering the learning process and guaranteeing its development. The difficulty with teachers' attitudinal change lies in the different aspects addressed in the following paragraphs.

Teachers' personal beliefs and attitudes towards the learning process are always an important barrier to overcome. Most academics, especially in engineering, have been educated in quite traditional environments and are often compelled to reproduce their own educational experience, especially when it comes to assessment activities. Breaking that barrier usually requires proper training, in which a balance should be sought between substantiation of proposals through adequate research results and pragmatic, hands-on, experience sharing. For this purpose, the contribution of experienced staff developers with an engineering background may be extremely valuable, since empathy with the audience is more easily established.

In active learning environments, in which students are engaged in learning activities involving discussion, presentations, brainstorming, and other similar activities, teachers are much more easily confronted with the lack of knowledge some students exhibit, especially when it comes to the pre-requisites. In this respect, there is nothing more comfortable than a traditional lecture, in which the lecturer can go about his business, reassured by the occasional, and more often than not, meaningless nod. The greater exposure to students' difficulties should be seen as an opportunity to address those difficulties and purposely help students to overcome them. It is also an opportunity for us teachers to reflect on our practices, on the scope of the tasks proposed to the students, and on our assumptions on students' capabilities. However, some teachers tend to feel daunted and sometimes jump to hasty conclusions on the validity of the pedagogical approach (*"it doesn't work"*), thus finding the right excuse to go back to more traditional lecturing practices. It is important to create an environment in which these issues are discussed and demystified, not leaving teachers alone with their own insecurities. This can be accomplished by establishing a culture of group work and group discussion among teachers.

Creating a working team out of a group of staff members is always a challenge. Establishing a common feeling that the development is the right way to go is a first and important step to accomplish that goal. In the development presented in this paper, regular staff meetings are held, with the purpose of discussing issues related to the programme and the PBL environment. These meetings also serve the purpose of developing a culture of exchange of ideas, views and practices, thus helping the creation of a sense of team. The institutional culture plays an extremely important role in this matter, in that it can either foster the development of the climate for staff

teamwork, or make it very difficult to establish and maintain. The role of top management is unavoidable in this regard: it should create adequate conditions and nudge staff members to participate, yet without being too imposing. It is important to keep remembering that most academics have not been educated within the framework of PBL environments, and thus lack the necessary team working capabilities. It is the Author's personal belief that it is impossible to establish a meaningful learning environment unless the staff is able to cooperate and work as a team, on a daily basis, establishing connections between courses, discussing difficulties and achievements; in brief, coping with the dynamics of the learning process their students are experiencing.

Another extremely important aspect of teachers' attitudinal change has to do with the student-teacher relationship and the change in the traditional roles of both agents. Although in an environment such as the one proposed in this article a closer relationship between teachers and students happens naturally, due to the nature of the learning activities, teachers are not always prepared for the implications of this closer relationship. It usually means that teachers have to be more available for students, both in terms of the amount of time dedicated to informal, out of class, student-teacher interactions, and in terms of the schedule for those interactions, which may be very hard to deal with, given its spontaneous and unforeseeable nature.

Even more important than time management, teachers have to be prepared to deal with dimensions of students' lives with which they are seldom confronted in the traditional environments: group work problems, inter-student relationships dilemmas, time management difficulties, and even their emotional problems when going about the learning process. Most teachers find it hard to deal with this dimension of student interactions, which can be quite stressing, at times. However, given that students' affective needs are almost as important as their cognitive needs, if they are to be successful in their learning, one may view these situations as an opportunity to help students move forward in a way that is seldom possible in any other learning environment. Sometimes, it only takes a sympathetic comment, such as *"It is natural that you are feeling overwhelmed by this task"* or *"I remember I felt that way when I was a student, too"* to make a difference in the way students feel and help them move forward and overcome their insecurities.

When facing all these difficulties, and unless a proper support network has been put in place, it is only natural that some teachers tend to go back to their traditional teaching practices, well within their safety zone. Others will, on the other hand, feel that they are actually, and finally, making a difference and that there is no way back. The challenge becomes, therefore, to foster the latter attitudinal change and prevent the former.

The students' dimension

In Portugal, and probably elsewhere, students get to Higher Education with limited, if any, experience of self-directed learning. Introducing students to a PBL environment, in which they have to take responsibility for the learning process and engage in self-directed learning activities, is therefore a challenge, and one which requires an attitudinal change on behalf of the students.

From their first day into the curriculum, it is extremely important to explain to the students what PBL is about and the reasons why the institution is committed to pursue that pedagogical approach. This can prove to be a powerful way of getting students on board. Discussing the different roles of the teachers and the students in the PBL context is also unavoidable, thus clarifying what is expected of students and what students should expect of teachers in the new learning environment. Even if all these efforts are successful, the necessary attitudinal change that students need to undergo will still be an everyday battle, and one that can only be won by supporting students during the journey, both cognitively and affectively. Purposely helping students to develop their personal and professional capabilities (group work, presentation and time management skills, just to mention the more obvious ones) is also important in this process. From the students' point of view, the barrier of entering Higher Education, within a PBL environment, in which their pre-conceptions about learning and their role in the process are severely questioned, can be overwhelming.

Engaging students in the overall process is definitely very important, and that is also one of the reasons why self- and peer-assessment are so important in PBL. In the author's experience, illuminative formative assessment [7] activities can be a valuable tool in promoting students involvement in the process and pushing them to reflect on the learning experience. Apart from the obvious intention to collect data for the internal monitoring process, the formative illuminative sessions may constitute a forum for the discussion of the pedagogical aspects of the development.

In more traditional environments, students tend to regard programmes as mere collections of courses, which they are required to pass, one by one, in order to obtain a diploma. Changing this conception to one in which they view the programme as an overall learning experience, in which they are required to develop themselves, both professionally and personally, is the ultimate (and maybe utopic) goal. Overcoming that conceptual barrier is a major challenge, and one that is definitely crucial for the development of a PBL environment.

The institutional dimension

Institutional cultures also have to be developed in order to address the challenges of an overall PBL development. Trying to establish, and more importantly, to maintain a PBL environment running requires an institutional culture which regards the teachers, the students, and the available resources in a significantly different way than in most traditional environments.

The way in which the institution deals with the teaching staff is crucial to the development. It is vital that proper training and support is made available for the staff involved, not only during the implementation phase, but also on a regular basis, and as part of the regular institution activities. It should be clear, to all involved, that the institution is committed to the development and regards PBL as an important feature of its strategy. As it was stated in an earlier section, the institution plays an essential role in the fostering of a team-working climate, which is essential to the articulation and congruence of the curriculum.

PBL can be extremely absorbing for teachers, requiring unusual doses of involvement and commitment. This will naturally have an impact in the time staff can dedicate to other activities, such as research and administrative tasks. In the "publish or perish" paradigm that has been established within the academic community over the recent years, this can represent a major hurdle for the establishment of an overall PBL environment. It is therefore crucial that the institutional culture develops to regard teaching activities as an important factor for career progression, and strategic for the institution development. Creating schemes in which teachers get free time for research activities on a regular basis may also prove to be a valuable tool in finding the proper balance between staff involvement with the absorbing PBL environment, and the demands of the academic career development.

Monitoring the process is absolutely essential in any educational development, and even more so within a PBL context. It serves the purpose of informing whether the goals are being met, finding out the strong and the weak aspects of the development, so that measures can be taken in accordance. But an effective monitoring system can also be regarded as a tool in promoting the development of the desirable institutional culture: it exerts a healthy amount of pressure on all the involved agents to show that they are aligned with the development; it usually also creates the opportunity to discuss blockages within the structure and examples of good practice. In this context, establishing a well-designed monitoring system also becomes part of the new institutional culture.

When it comes to resources and their management, the institution also has to rethink its usual procedures. Apart from the obvious need to provide appropriate resources for the projects being developed, if self-directed learning in a project context is to be fostered, broader access to laboratories and equipment should be granted to the students. This requires new ways of managing the working spaces. For instance, at ESTGA, common-use laboratories and students' rooms are open on a 24h/day, 7days/week basis, allowing students to manage their own schedule and meet and work whenever they feel is needed.

The working spaces themselves should, ideally, also be adapted to the needs of a self-directed, active learning, project based environment. Traditional lecture halls no longer make much sense and can give way to more flexible, smaller spaces, in which chairs and tables can be rearranged to meet the needs of the learning activities. Student rooms, ideally one small office per working group (as in the Aalborg model), help to create an atmosphere in which students view the institution as their working place, fostering work group activities and establishing a closer connection with the institution as whole. A significant change in the working space setting and the way it is accessed is in itself a factor of change in the institutional culture, since it influences the way students and teachers interact with the structure and among themselves.

Finally, the institution also has to redefine the way in which it interacts with the students. This issue has already been discussed in the previous sub-sections, but it is still important to mention that the institution should view students as partners in the process, and not as mere clients.

The institution is made up of the teaching staff, the students and is governed by top management, which has a definitive role in the culture change being discussed. Changing the institutional culture is, in fact, the result of the overall attitudinal change of all the players involved in the process. That is why, as it has been stated earlier in this article, developments such as the one described in this text should be regarded as an on-going process.

Conclusion

In this paper, an example of a PBL implementation and change process has been described. The Author's personal perspective on the challenges that need to be addressed in establishing a project-based learning environment has been discussed and some suggestions for addressing those challenges have been offered. However overwhelming these challenges may seem, after reading the paper, it should be noted that it is the Author's deep belief that it really is worth the effort and that moving towards a student-centred, project-based learning environment may represent an answer to the challenges of our globalized, fast changing world and society. The world has changed dramatically over the past few decades, and higher education systems should change accordingly, becoming a part of the adequate response to that change.

References

[1] J. Cowan, *Education for capability in engineering education*, Thesis for the degree of DEng, Heriot-Watt University, Edinburgh (1987).

[2] S. Fallows, C. Steven, *Integrating key skills in higher education: employability, transferable skills and learning for life*, Kogan Page, London (2000).

[3] I. Alarcão, "Changing to project-based learning. The role of institutional leadership and faculty development", in *Management of change – Implementation of problem-based and project-based learning in engineering*, Graaff and Kolmos (Eds.), Sense Publishers, Rotterdam/Taipei (2006).

[4] J.M. Oliveira, "Project based learning in engineering: the Águeda experience", in *Management of change – Implementation of problem-based and project-based learning in engineering*, Graaff and Kolmos (Eds.), Sense Publishers, Rotterdam/Taipei (2006).

[5] F. Kjersdam and S. Enemark, *The Aalborg experiment, project innovation in university education*, The University of Aalborg Press, Aalborg (1994).

[6] V. Gil, I. Alarcão et al, *Novas abordagens no ensino superior e a função ensino*, Final report of project SAPIENS POCTI/CED/43396/2001, Aveiro (2004).

[7] George, J.W. and Cowan, J., *A Handbook of Techniques for Formative Evaluation*, Kogan Page, London (1999).

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