



## What are our students doing? Workload, time allocation and time management in PBL instruction. A case study in Science Education



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### HIGHLIGHTS

- Monitoring student time allocation provides significant information on the strengths and weakness of the teaching process.
- In PBL students spend most of their time processing the assignment by working in groups and individually.
- Students prefer to use the internet for information searches rather than the library.
- It is possible to restructure the time students allocate by applying certain strategies.

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### ABSTRACT

What are our students doing: studying, working with classmates, looking for information at the library or Internet? During 2 years, 131 preservice teachers were monitored using a survey, obtaining hours they employed in different tasks. Within the second year, problems found in the first were managed. Results reveal that, in Problem Based Learning, working in groups is the greatest time consumer although is distributed relatively homogeneously. Furthermore, students spend too much time on almost all activities, leading to a general overload properly handled in the second part of the study. Reflections on the consequences of time allocation research offers valuable opportunities to improve the quality of teaching-learning processes.

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### 1. Introduction

Speaking in terms of economy, the scarcest resource is the human time, and time allocation determines the price of goods and services (Juster & Stafford, 1991). At the same time, good learning requires a large time investment (Entwistle, 1998; Gardner, 1993). Nevertheless, when professors plan their subjects they have to fit goals, contents and the required tasks, to a maximum time (normally, in terms of credits) in order to avoid a possible students' overload since it could carry out, not only negative academic consequences such as surface learning (Bachman & Bachman, 2006; Lizzio, Wilson, & Simons, 2002), lack of success (Cope & Staehr, 2005) or drop out (Woodley & Parlett, 1983), but also personal,

like anxiety and depression (Bachman & Bachman, 2006; Dammeyer & Nunez, 1999), and lack of confidence or self-esteem (Chambers, 1992). Then, lecturers have here an important challenge.

In Europe, as in many other places, the European Higher Education Area (EHEA) fostered student centred methods as Problem Based Learning (PBL), because is a way to develop higher order thinking processes and self-directed learning skills (Hung, 2009). Nevertheless, when this type of Teaching and Learning (T-L) is implemented on students who are used to more content-centred methods, they may lack of required skills, leading to a student overload (Reisslein, Tylavsky, Matar, Seeling, & Reisslein, 2007; Solomon & Finch, 1998). In this sense, students may be spending too much time in shallow tasks, and not in those others that professors consider best for their development.

For Biggs (2005), the way to improve teaching and learning, and to grow as lecturers by reflecting on our own teaching, is to receive

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feedback from our students. One of the sources of information may be to monitor, not only how much time students are spending in the course, but also how they are allocating their time within tasks. With this feedback, lecturers can address some strategies to help students with their weaknesses, such as organizing short workshops about how to work more efficiently or team time organization. In fact, studies as Kornell and Bjork (2007) show that students have receive little or no instruction on how to study efficiently. From this perspective, Wade (1991) recommends that students should participate in study skill instruction and that each professor should integrate study skill strategies into their courses.

But also, this information represents a chance for lecturers to rethink elements under their control, like subject contents, in order to select and reduce it to the critical aspects and, from this point, properly reach subject outcomes and improve future work-based skills (Lizzio et al., 2002). Studies as Cope and Staehr (2005), where a deeper learning was observed after content selection and reduction, support this rationale.

### 1.1. Problem Based Learning

Probably, Problem Based Learning (PBL) is the most innovative instructional method in education today (Hung, 2009). It started in health education to avoid the traditional memorization of fragmented biomedical knowledge (Barrows, 1996), and nowadays is widely used in different educational levels (Samy, 2009). Hmelo-Silver defines it as “an instructional method in which students learn through facilitated problem solving.” (2004, p. 235). Students learn by solving problems and reflecting on their experiences (Barrows & Tamblyn, 1980). Students have opportunities to apply knowledge in a quasi-real world context, practicing similarly to the way experts do (DeHaan, 2005). In most learning programmes, students work in collaborative groups (Hmelo-Silver, 2004; Holen, 2000), also promoting the sociocultural view of learning by language and interaction (Vygotsky, 1978). Active learning can increase student outcomes (Gardner & Belland, 2011) and improves student confidence (Jones & Johnstone, 2006).

Extensive literature can be found on PBL medical fields (Coles, 1985; Hmelo-Silver, 2004; Holen, 2000; Mahnaz & Sangestani, 2014; Patel, Groen, & Norman, 1991; Wigen, Holen, & Ellingsen, 2003) as well as in other scientific disciplines: Physics (Antonenko et al., 2011), Chemistry (Zhang, Parker, Eberhardt, and Passalacqua, 2011; Zhang, Zhang, Jing, & Sui, 2011), Biology (Casla & Zubiaga, 2010), Education (Erdogan & Senemoglu, 2014), Geology (Ruiz-Gallardo, Castaño, Gómez-Alday, & Valdés, 2011), or general for all sciences (Akçay, 2009). However, few references have been found referring to a field like Science Education (Draghicescu, Petrescu, Cristea, Gorghiu, & Gorghiu, 2014). The application of PBL in pre-service teachers (as in this case study) is very interesting because, as Zhang, Parker, et al. (2011) state, PBL is easily adaptable in kindergarten, where these professionals will work after finishing their studies. Certainly, teachers will develop a better PBL approach in their classes if they have practiced it at the University.

Most studies coincide in that PBL yields better results than traditional instruction (see Breton, 1999; Hmelo-Silver, 2004; Holen, 2000; Patel et al., 1991; Wigen et al., 2003). Nevertheless, a number of researches complain about PBL: Bledsoe and Flick (2011) indicate that the success of problem solving depends on the context, meaningful learning and personal habits. Kirschner, Sweller, and Clark (2006) reveal that, since the system gives little guidance and is not compatible with human cognitive architecture, PBL is less effective than lecture-based teaching. Delpier (2006) or Mikol (2005) add that given constraints on time, class size, efficiency and comfort, traditional lecture is the logical choice. Holen (2000) comments that good lecture is likely to be far superior to

a poor PBL group interaction.

It is also convenient to emphasize that the positive aspects of group work can be affected by variables on individual personalities such as anxiety, peer orientation, shyness, introversion and persistence, as mentioned in some studies (Hancock, 2004; Kagan, 1994; Webb & Palincsar, 1996). Solomon and Finch (1998) discuss ‘group panic’ and difficulties with group learning for Health students. Spronken-Smith (2005) examined problems in group dynamics in Geography students, similarly to Vardi and Ciccarelli (2008) in Occupational Therapy. Delpier (2006) found that active learning is uncomfortable for Nursing students because of the need to be prepared.

As such, a number of stressors in PBL have been identified (Solomon & Finch, 1998) which are especially significant in the adaptation process, when students are not used to independent learning and skills are not trained. Students may experience uncertainty on the breadth and depth of the knowledge required, time needed for self-directed study, time overload, a misunderstanding of PBL and the faculty role and a lack of confidence in their ability to be successful. This stress may produce adverse effects in their mental, spiritual and physical health (Can, 2010), so it is important to consider. Nevertheless, most of this stress can be avoided by taking some measures and monitoring students during the process (Vardi & Ciccarelli, 2008).

### 1.2. Time allocation: state of the question

Until now, scientific literature does not provide a formal definition of time allocation. Therefore, this study adopt the common use that most of the researchers assume (see for example: Akin & Stewart, 1982; Becker, 1965; Cook, Noecker, & Suits, 1992; Juster & Stafford, 1991; Martin, 2012; Meng & Heijke, 2005; Schmidt, 1983a, 1983b): time allocation understood as the time that students actually spend in different academic task which are demanded by the degree, subject or assignment.

Little is known on how much time students devote to different academic activities, such as searching for information, working with their classmates or class contact time. The subject of time allocation has been considered, especially, by economists in relation to market work, work production and leisure (Link, Swann, & Bozeman, 2008). In education, Robert Schmidt stated that this topic was of interest in Economical Education literature (Schmidt, 1983a, 1983b). Currently, interest has expanded to other disciplines, diverse students' ages, and different activities, models, etc., as will be seen.

LaPalio (1981) documented time allocation to various activities, such as independent study, chart work or learning experience, for interns and students in medical wards. Akin and Stewart (1982) described a model of time allocation wherein children spend more time on the activities in which they are more skilled. Schmidt (1983a, 1983b) divides time spent into lecture, discussion, studying outside of class and exam preparation, in a macroeconomic course. Results indicate that students that spend the same amount of time overall but less during final exams tended to have better results. Wade (1991) examined the amount of academic and non-academic time spent by university students in general. Results show that most of the academic time was devoted to study, and that most of the students spent less than 5 h in the library per week. In a study on third-year medical students, Cook et al. (1992) recorded time allocation in eight categories, finding that, in decreasing order of time spent, those categories were: personal time, organized education activities, chartwork, patient contact, examination study, ancillary activities, procedures and directed study. Chambers (1992) estimated the time spent on readings, problem solving, preparing assignments or practising skills for part-time students.

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