Positive Reinforcement Social Networks: Online Social Interactions to Measure, Analyse and Improve Academic Outcomes

Doctoral Thesis
Sebastián Romero López

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Many voices are currently calling for a change in educational systems. A number of experts propose bringing students’ outside life into school in order to keep them motivated and engaged. The main goal of this thesis is to work with online social interactions through the use of Positive Reinforcement Social Networks (PRSN) in education to analyse, enhance and predict academic outcomes. Several steps have been taken in order to achieve this goal.

A systematic study of the state of the art was conducted to find the connection between Information and Communication Technologies (ICT) and educational settings. Following this study, fieldwork was conducted in real educational settings in order to collect data oriented toward student and teacher perspectives.

Several initial prototypes and platforms were created: Tweacher, Moods and Looking for Leaders. Their first results helped to forge the main outcomes of this research, as they were the basis of the work described in the following paragraphs.

A Positive Reinforcement Social Network (PRSN) model was created. PRSN is a social network on which individuals interact with each other and their environment, receiving a reward based on the type and number of actions performed through the system. As part of this model it is necessary to highlight the PRSN participation model, the event co-interaction diagram, the reward co-interaction diagram and the interaction co-interaction diagram.

Once the PRSN model was created, a platform based on the model, but specifically created for educational environments, was implemented: BeingExample. This tool helps to measure, analyse and improve academic outcomes by using online social interactions. Its main rewards were based on the creation of groups and examples.

Measurements are a key element when assessing and analysing impact. To this end, a set of measurements based on the interactions of BeingExample was created. Several educational settings and their requirements for social skills were analysed. The result was a set of three indicators: communication, participation and initiative. These three indicators were based on the basic interactions of the platform.

After the platform was created, experimental research lasting 20 weeks was conducted. To gather data on the use of BeingExample, participants were assigned to a control group and an experimental group. Data from several sources was collected: classroom participation, academic performance and BeingExample data. The results for the experimental group showed a statistically significant improvement in the academic outcomes in comparison to the control group.

Finally, a prediction model for academic performance and classroom participation is proposed and statistically validated. This model is based on online social skills such as initiative, participation and communication.

PRSNs are shown to be useful to measure, analyse and improve academic outcomes by using online social interactions. This can be generalized by affirming that social media can be used for this purpose if carefully adapted to educational environments.
Dedicatoria

A mi familia y a mis amigos, los cuales son lo más importante. A mis directores y a toda la gente que ha participado de forma directa o indirecta en la investigación que ha dado como resultado esta tesis doctoral.

En especial a mi padre, con el cual no tendré la suerte de disfrutar este logro en mi carrera académica, y que aunque hace mucho tiempo que no está en nuestras vidas, es y seguirá siendo un gran ejemplo a seguir y seguirá estando en nuestros corazones.
Acknowledgments

Many years ago a teacher once told a student: “You should become an engineer when you grow up”. What that teacher did not realize was that this thesis was to be the end of the path. An enormous number of people deserve to be acknowledged here for their support, their help, their dedication, their influence etc.

However all I want to say here is that, as is my wont, I will acknowledge them by my actions, not by my words. In Spain we say that words are carried away by the wind but actions last forever (Las palabras se las lleva el viento pero los actos perduran para siempre).
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<th>Definition</th>
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<tr>
<td>AJAX</td>
<td>Asynchronous JavaScript and XML</td>
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<tr>
<td>CnBL</td>
<td>Competition-based Learning</td>
</tr>
<tr>
<td>CSCW</td>
<td>Computer Supported Cooperative Work</td>
</tr>
<tr>
<td>DGBL</td>
<td>Digital Game-Based Learning</td>
</tr>
<tr>
<td>DST</td>
<td>Digital Storytelling</td>
</tr>
<tr>
<td>EMIS</td>
<td>Educación por un Mundo Igualitario y Sostenible</td>
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<tr>
<td>ERO</td>
<td>Electronic Registrar Online</td>
</tr>
<tr>
<td>E.S.O.</td>
<td>Enseñanza Secundaria Obligatoria</td>
</tr>
<tr>
<td>FAQ</td>
<td>Frequently Asked Questions</td>
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<tr>
<td>GBLE</td>
<td>Game-Based Learning Environment</td>
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<td>GPA</td>
<td>Grade Point Average</td>
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<tr>
<td>HCI</td>
<td>Human Computer Interaction</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communications Technology</td>
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<tr>
<td>IM</td>
<td>Instant Messaging</td>
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<tr>
<td>IMMS</td>
<td>Instructional Materials Motivational Survey</td>
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<tr>
<td>LCMS</td>
<td>Learning Content Management System</td>
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<tr>
<td>LMS</td>
<td>Learning Management System</td>
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<tr>
<td>LO</td>
<td>Learning Objects</td>
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<tr>
<td>MVP</td>
<td>Motivation, Volition and Performance</td>
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<td>NFC</td>
<td>Need for Cognition</td>
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<td>NPS</td>
<td>Networked Participatory Scholarship</td>
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<tr>
<td>OSN</td>
<td>Online Social Network</td>
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<tr>
<td>OLC</td>
<td>On Line Communities</td>
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<td>ONLE</td>
<td>Open Network Learning Environments</td>
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<tr>
<td>OSN</td>
<td>Online Social Network</td>
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<td>PI</td>
<td>Peer Instruction</td>
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<tr>
<td>PRSN</td>
<td>Positive Reinforcement Social Network</td>
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<tr>
<td>PTU</td>
<td>Pedagogical Technical Unit</td>
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<tr>
<td>RSS</td>
<td>Rich Site Summary</td>
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<tr>
<td>RFID</td>
<td>Radio-Frequency Identification</td>
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<tr>
<td>SNS</td>
<td>Social Network Site</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>---------</td>
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<tr>
<td>SOA</td>
<td>Service-Oriented Architecture</td>
</tr>
<tr>
<td>STEM</td>
<td>Science, Technology, Engineering and Mathematics</td>
</tr>
<tr>
<td>TAC</td>
<td>Teachers Access Centre</td>
</tr>
<tr>
<td>TOUCHE</td>
<td>Task-Oriented and User-Centered Process Model for Developing Interfaces for Human-Computer-Human Environments</td>
</tr>
<tr>
<td>UI</td>
<td>User Interface</td>
</tr>
<tr>
<td>UML</td>
<td>Unified Modelling Language</td>
</tr>
<tr>
<td>WWF</td>
<td>World Wide Fund for Nature</td>
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Chapter 1
Introduction

This first chapter presents an overview of this thesis dissertation and contextualizes the work carried out. First, the scope is presented, and second, the motivation. Third, the statement of the problem is described where some of the most important considerations, initial hypotheses and research goals are presented. Last, the structure of the manuscript is defined.

1.1 Scope of the Research

The efforts to improve the different types of educational systems available today have been the focus of a large body of research in recent years. Experts in fields such as psychology, education, information technologies etc.; have worked on topics related to educational environments. Without doubt, this is one of the most important parts of our society because educational systems provide all kind of professionals for our communities. Hence, these are systems that should be continually improved.

Society is exposed to an increasing number of technological novelties that attract our attention. Furthermore, the visual effects in movies, TV-shows, cartoons etc., are of an increasingly higher standard, reproducing amazing acts and scenarios. The growth of marketing and technological improvements have made commercials really shocking, and some even go viral on Internet. This list of achievements could be longer, with more elements that are changing the ways people perceive their life.

But, what happens when students arrive at their educational environments? Can education professionals compete with marketing or the entertainment world? The main focus of entertainment and marketing
professionals is to make consumers experience strong or extreme feelings and sensations. Moreover, they work in large groups with huge amounts of money available to achieve their goals.

How can this huge entertainment budget be beaten? With a personal and social approach, human groups have an important social focus and characteristics. Would it be possible to get students to focus their attention on learning rather than on celebrities, sportspeople etc.? What resources are going to be needed in order to achieve this goal? Could ICT systems help improve the social scope of educational environments?

In some educational networks the access to a number of potentially highly useful tools is forbidden. For example, Facebook and Twitter are forbidden in some schools, although usually not at University. These tools are used for sharing files or having the same files on different computers (at work and at home). These websites are usually forbidden because of misuse by students or staff. Some students compulsively use their Online Social Networks, especially teenagers. Could some of these forbidden characteristics be used in class activities to improve student engagement?

These are changing times in education, and teachers have a variety of opinions about the integration of the new information technologies in classes. Here are some of the most relevant issues that, as professionals, they find when they arrive at their work places:

- Restrictions from above or the administration, related to the use of certain applications or/and websites. Economic difficulties when acquiring licenses for software or access to e-Learning platforms. The number of computer labs and electronic devices available in each class, because not all the classes have equipment connected to Internet.
- Time is limited, therefore this large amount of data and resources make it more difficult to decide or choose which set of tools is the best to use.
- ICT knowledge limitations, there is a generation gap in the use of new technologies and some teachers are included here. Therefore, if they want to work with the huge amount of data mentioned above, they need tools which facilitate their work.
- Social skills are not usually supported through the curriculum, there are no ICT tools to support social interactions. Not many institutions have procedures in place regarding how to work and channel their students’ social interactions, and nowadays social media and e-Learning platforms give them an excellent opportunity to do so.
- The impact of ICT on students is always present. There are many problems regarding the proper use of mobile devices in educational environments. Platforms used by students generate problems when overused, which affects academic performance negatively.
- Lack of motivation and engagement from students, who are overwhelmed by a huge amount of information. WhatsApp, Facebook, Instagram, YouTube, TV and movies are the ones which generate most attention.
- The role of parents or guardians and their ICT knowledge. There is a major technological gap between parents and children. This gap affects the learning process where parents are one of the main actors.

If some of these challenges need to be addressed, what is the most appropriate way to do so? There are two different type of ICT platforms widely used by students: e-Learning online platforms and Online Social Networks (OSNs). The former one is usually adapted by educational institutions and is of compulsory use (in some cases) by students. OSNs are not officially used, but are increasingly being used by teachers (individually) in their classes.

Social and e-Learning online platforms have been growing in use and number over recent years. The biggest world online companies have adapted some of their important services to educational environments.
They know that the use of these services by students, while learning, makes them become potential users of the same system when they are older. Nevertheless, there are many gaps to fill regarding education.

Nowadays, education is becoming data and grading oriented, although there is still a need to improve the social side of ICT. Humans have been dealing with the social side of relationships since their origins, while ICT systems which process huge amounts of data have only just arrived.

Choosing between e-Learning platforms or Online Social Networks as the channel or the tool to change some of the challenges previously presented will be a difficult decision.

Finally a quote to highlight the importance of education, “The educated differ from the uneducated as much as the living differs from the dead.” Aristotle.

### 1.2 Motivation

The main motivation was to create a new concept based on Online Social Networks; the purpose of this new concept is to enhance education by using social interactions. OSNs were selected due to their widespread use among students and in order to bring their outside world to their educational one. Moreover, OSNs may help education as motivational tools, and provide positive factors when applying them to High Schools.

Enjoyment in learning is being lost to some extent nowadays, as there are many distractors that are more enjoyable than learning in school. When information is needed, most teenagers turn to the Internet for answers. In the past education systems were the main source of answers for teenagers.

There are a huge number of challenges and obstacles to confront in education these days: applying new information systems to education is the way I hope to contribute to solve these issues. As a teacher and Computer Science engineer, it has been a challenge to research while working at a High School, but it has been an advantage as I have had access to real world data and state.

Teaching has been my passion since I first taught a class. I have linked my teaching to my professional field through this thesis, where I have tried to improve educational environments through a new concept: Positive Reinforcement Social Networks. This has been my personal motivation in the last few years. Nelson Mandela said once: “Education is the most powerful weapon which you can use to change the world”. Therefore, what better motivation than to positively impact on education to improve our world?

### 1.3 Research Goal

The approach that was chosen, for the research presented in this thesis, was to attempt to improve educational environments by using, or by improving their use of, information technology systems.

The main goal of this thesis is to work with online social interactions through the use of Positive Reinforcement Social Networks (PRSN) in education to analyse, enhance and predict academic outcomes. This main goal is based on a set of hypotheses:

Social skills are highly important for life, and, therefore, for educational environments. They have not been paid the attention that they deserve, because they are usually learned or taught indirectly. There is little ICT support / attention on social skills. Meanwhile, it has been observed an increasing importance of online social interactions in education, therefore,
Hypothesis 1 (H1): *Students’ online social interactions should play a significant role on information systems used in educational environments.*

Technology is now widely used in education. Social networks and e-Learning online platforms are used for several purposes. However, sometimes these technologies have a negative impact on educational environments. Therefore,

Hypothesis 2 (H2): *ICT impact on educational environments should be monitored and analysed.*

Internet has changed the world and new technologies with it, but with these have come problems in students’ motivation and performance. Although, there is still room for improvement. Therefore,

Hypothesis 3 (H3): *It is possible to use new technologies, specifically Online Social Networks, to improve academic outcomes.*

In order to achieve the main goal the following set of specific goals in defined.

- **Goal 1 (G1):** To study and analyse the impact of ICT on education.
- **Goal 2 (G2):** To carry out field studies to get a better vision of educational environments.
- **Goal 3 (G3):** To develop early prototypes to get initial results in education.
- **Goal 4 (G4):** To create a new Online Social Network concept which helps to measure, analyse and improve and/or support students’ social skills, motivation and academic outcomes.
- **Goal 5 (G5):** To create a platform, based on the Online Social Network concept created, which helps to measure, analyse and improve and/or support students’ online social skills, motivation and academic outcomes.
- **Goal 6 (G6):** To perform experimental research to validate and extract data from the platform and the new Online Social Networks concept.

### 1.4 Document Structure

Finally to end this chapter, the structure of the thesis is presented:

Chapter 1 describes the motivation that has guided this work, its purpose, its key goals and the most important problems related to the objectives.

In Chapter 2, the reader will find the current status of the related work. Public or business projects related to the topics covered by this thesis are reviewed. This information is the basis of all the work presented in Chapters 3, 4 and 5. Furthermore, in this chapter the goal (G1) to study and analyse the impact of ICT on education will be addressed.

Next, Chapter 3 shows different points of view from different educational systems, but the main perspective is internal, trying to show the different realities of three educational systems (from Europe, North America and Centre America). It ends with a case study of a platform which helped to improve academic results in fields such as Science and Mathematics. Its focus is on (G2) to carry out field studies to get a better vision of educational environments.

The early conclusions are presented in Chapter 4. These conclusions helped to focus the following steps taken. The results and the main contribution of this research are shown in Chapter 5. Edmodo was analysed
in depth as a starting point for the later implementation of Tweacher. Finally Tweacher was tested in a real High School. This initiates research goal (G3) to develop early prototypes to get initial results in education.

Chapter 5 shows the main contribution of this research. Positive Reinforcement Social Networks are defined and modelled (G4) to create a new OSN concept which helps to measure, analyse and improve and/or support students’ social skills, motivation and academic outcomes. Following this, a PRSN for education was created (G5) to create a platform, based on the OSN concept created, which helps to measure, analyse and improve and/or support students’ online social skills, motivation and academic outcomes, and an experimental study was conducted to validate all the previous proposals (G6) to perform an experimental research to validate and extract data from the platform and the new OSN concept).

Lastly Chapter 6 describes the conclusions and future work of this thesis, as well as related publications.

Relations between chapters, goals and hypotheses are shown in the table below:

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Goals</th>
<th>Hypotheses</th>
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<tbody>
<tr>
<td>2</td>
<td>G1</td>
<td>H1, H2 and H3</td>
</tr>
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<td>3</td>
<td>G2</td>
<td>H2</td>
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<td>4</td>
<td>G3</td>
<td>H1 and H2</td>
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<tr>
<td>5</td>
<td>G4, G5 and G6</td>
<td>H1, H2 and H3</td>
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</table>
Chapter 2

Study and Analysis of Impact of ICT on Education

To understand the content of this chapter, it is important to remember one of the most important goals of the research: *(G1) To study and analyse the impact of ICT on education.* This is even more important when nowadays some students are starting to think that educational systems treat human beings as numbers.

This chapter will discuss the research in fields related to this thesis, bearing in mind that the state of the art could be extended or reduced depending of the ongoing research. The following lines explain the motives for each section. The structure is as follows:

The chapter starts with information technologies used in educational environments. In this section one of the most widely used types of educational ICT platforms are discussed: e-Learning platforms. It is important to analyse the beginnings of the research field, in order not to repeat errors or to avoid designing something already created.

It continues with Online Social Networks. Without doubt, these are one of the most important technologies to have appeared within the last 10 years. Definition, evolution, perspectives of use and interactions will be discussed in this section.

In Section 2.3 more current trends and research are analysed and discussed. Special attention is paid to the outcomes of these studies, because they have motivated the process of this research. They are important
as the basic concepts of the fields and the current trends which have helped to guide the work. The chapter finishes with the conclusions.

2.1 Educational Environments and Information Technologies

Internet has given us an outstanding opportunity and educational environments need to take advantage of this. Universities were among the first institutions to use the Internet in its beginnings. The main contributions related to the goals of this thesis are now presented.

2.1.1 E-learning

The traditional context of learning is changing radically. Teaching and learning are no longer restricted to traditional classrooms (Wang, 2007). Electronic learning (hereafter e-Learning), referring to the use of electronic devices for learning, including the delivery of content via electronic media including Internet, audio or video, satellite broadcast, interactive TV, radio, CD-ROM (Kaplan-Leiserson, 2000), has become one of the most significant developments in the information systems (hereafter IS) industry. The rapid expansion of the Internet as a delivery platform, combined with trends towards location-independent education and individualization, has motivated universities to invest their resources in developing online programs. However, the development, management and continuous improvement of e-Learning systems are quite challenging for both educational institutions and for the industry. In this, assessment has become an essential requirement of the feedback loop for continuous improvement: “What gets measured, gets attention” (Eccles, 1991).

Robson’s definition, (Robson, 1999), of web-based course support systems is: “A comprehensive software package that supports courses that depend on the Web for some combination of delivery, testing, simulation, discussion, or other significant aspect”. E-Learning systems allow multiple users or applications to download, upload and exchange distributed information in many physical locations simultaneously.

With the evolution of technology, and especially of the Internet, a growing interest has emerged for online education. The many advantages of e-Learning have made this teaching philosophy an ideal partner for teachers, either as a complement to mainstream education or as a substitute for traditional education. The development of an e-Learning system poses extra challenges for software developers.

E-learning is a type of information system which combines several different forms of presentations. In parallel, the success of an e-Learning system can be considered as an emerging concept of presenting a conceptual modelling approach, which utilises the modelling of learners, the modelling of courses, the personalization of courses, and the management of their data. These systems are open systems so they are affected by the environment, and influenced by the people who use them. However, these systems are also goal-driven, so e-Learning systems can be evaluated by focusing on whether the system contributes to the achievement of its goals. Therefore, the e-Learning literature has been reviewed, looking at components used, educational material, learning containers, user interface, and finally e-Learning tools and methodologies are presented in the following paragraphs.

Many learning systems currently available are based on curriculum sequencing, where the learner has to follow a well-defined sequence of learning steps. To some extent, this follows the principles of didactic preparation as described in detail in (Kerres, 2001). This is not always adequate, as learning would better be based on active request, i.e. e-Learning systems should support self-organized learning on demand. Systems should restrain learners as little as possible, and offer instead as much support as possible for their individual...
learning styles. Consequently, it is important to anticipate the behaviour of learners and to design systems according to their needs. This includes outlining courses in such a way that the sequence of learning units and the style of presentation is personalized to the type of learner. More abstractly speaking, for each learner type we have to anticipate how they will navigate through the system. Each possible sequence of learning units followed by a learner corresponds to a particular course outline, so the most challenging problem is to determine these sequences and to describe them in an abstract and integrated way.

The purpose is a very general statement. Here the question is: what is the purpose of the system? In e-Learning systems the major purpose is to teach and provide learning material to students. The second question is related to time-scale. Some of the courses can be long-term while others short-term.

Once the purpose of the e-Learning systems has been obtained, the question arises of by whom and how the system will be used. As a web-based system it is usually open, so it is important to anticipate the behaviour of the learners. Therefore, it is necessary to first obtain an idea of the expected learners. This may lead to certain learner profiles. Such profiles may be determined by the different intentions of the learners, their different behaviour, their information needs, their levels of required support, etc.

So, the activity of learner profiling will lead to a list of profiles of expected learners who are to be supported by the system. This influences the content of the system’s pages, their logical organization, the navigation links enabled between the pages, and maybe even their presentation. More abstractly speaking, for each learner profile we have to anticipate how they will navigate through the system. Each possible sequence of pages followed by a learner corresponds to a particular course outline, so the most challenging problem is to determine these sequences and to describe them in an abstract and integrated way.

The usage of an e-Learning system depends on whether the control of the learning process is left to the learner or the system. In both cases, however, it is assumed that the learners are willing to learn and match the required prerequisites. Learners normally enter the system more than once, continuing a specific learning program. This requires some authentication mechanism, especially if the learning progress is controlled by the system. Quality criteria are set by the teaching quality, and in the end, by the increase in learners’ knowledge.

The content aspect is central to the development of the system, as it concerns the question: What information should be provided?, which is coupled with the problem of designing an adequate database. However, the organization of data that is presented to the learner via the web-interface is significantly different from the organization of data in a database. So, organizing the data content of the system means investigating the decomposition, structuring and classification of data in such a way that the course outline(s) can be adequately supported.

Thus, modelling the content of a system has to be addressed on at least two levels: a logical level leading to databases, and a conceptual level leading to the content of pages. Both levels have to be linked together. Furthermore, in both cases abstraction mechanisms should be used. While such abstraction mechanisms are established in the area of databases, they are still a matter of research for web-based systems and in particular for e-Learning systems.

Modelling content must take into account that information is to be presented in different ways to different learners. This depends on the learner profile, the communication channel, and the available devices. Modelling content has to provide mechanisms to tailor the content automatically according to these parameters.
The *functionality* aspect is coupled with the question of *whether the e-Learning system should be passive or active*. A passive system would only allow a learner to navigate through the pages without any activity. In these cases the major problem associated with functionality is to set up an adequate navigation structure.

In an active system, however, information would also be required from the learner. From a conceptual point of view, the main purpose of functionality modelling is to identify functions that are available to support the activities of the learners, which were identified in the course outline. Such functions can be system-specific functions in order to process learner input or general support functions.

The functionality of e-Learning systems mainly supports navigation through the learning material. In contrast to other types of web-based systems, this navigation is a long-term process, usually with many interruptions. More sophisticated systems would provide system-driven repetition and feedback. Also, personal information needs can be supported by providing an interface to e-mail.

Next, we identify what *components* should be considered when an e-Learning system is developed. Over the past decades, large and small organizations have implemented a variety of e-Learning system components, using either proprietary and/or home grown solutions to serve their individual and diverse learning needs. There are a multitude of isolated and technologically distinct databases containing a wealth of useful information.

![Figure 2-1 Structure and components of an e-Learning system](image)

Learner/Student Information Systems (SISs) are used for admitting learners into programs, course registration, and other administrative functions. More recently, organizations involved in e-Learning have invested in *Learning Management Systems* (LMSs) to deliver content in learning environments that may include a variety of synchronous and asynchronous *communication channels* (e-mail, chat, discussion boards, whiteboards, group-surfing, Voice-Over-IP, etc.) and *instructional support tools* (grade books, student tracking, etc.). Still more recently, e-Learning content is being developed in *Learning Content Management Systems* (LCMSs) or Learning Object Repositories (LORs). These components are represented at Figure 2-1.

### 2.1.2 E-Learning Platforms

Regarding *E-Learning system platforms*, in the category of authoring systems for distance learning, supported by Intranet and Internet, we can highlight the main platforms:
Blackboard Academic Suite (Blackboard, 1997), WebCT (Lu, 2003), Claroline1.8.1 (Claroline, 2008), eCollege (eCollege, 1999), WebStudy Course Management System (WebStudy, 2007), ATutor 1.5.4 (ATutor, 2007), JoomlaLMS (Joomla, 2009) and Moodle 1.9 (Moodle, 2010).

A test developed by the "Centre of Curriculum Transfer and Technology (CCTT)" of Canada (CCTT, 2014) enabled us to identify and define groups of functions considered essential for implementation and use in distance education mode. Below, some of these systems are detailed and their behaviour explained. The development of these systems is also directed at implementation using different programming languages.

- **Blackboard Academic Suite (Blackboard, 1997):** it was formed by the joining of two companies, founded by Michael Chasen and Matthew Pittinsky. Originally, the Blackboard Company began as a consulting firm contracting to the non-profit IMS Global Learning Consortium. The first line of e-Learning products was branded Blackboard. Blackboard went public in June 2004.

- **WebCT (Lu, 2003):** formed in 1997 by Murray Goldberg, was acquired by Universal Learning Technology in 1999. WebCT provides tools such as course content searches, calendar, mail, quizzes, navigation tools, access control, discussion boards, track student progress, etc.

- **Claroline (Claroline, 2008):** is a Web Based Course Management System. It allows teachers (professors, lecturers...) to create and administer course websites through a browser (Internet Explorer, Chrome, FireFox, etc.). Instructors can publish documents in any format (PDF, HTML, Office, Video...), run public or private discussion forums, manage a list of links, create student groups, compose exercises, structure an agenda with tasks and deadlines, make announcements (also via e-mail), have students submit papers, consult statistics of frequenting and success in the exercises.

- **eCollege (eCollege, 1999):** is an on-demand, or Software as a Service (SaaS), provider of e-Learning software and services to secondary and post-secondary learning institutions. eCollege develops and hosts e-Learning software applications and support services for colleges, universities and virtual schools. These institutions use eCollege’s learning management system to deliver and manage online courses for students.

- **WebStudy Course Management System (WebStudy, 2007):** presents educators both synchronous and asynchronous learning, easy, fast and flexible course construction, a graphical user interface (GUI) that simulates a familiar learning environment, a content repository for course material for multiple courses, streaming video that promotes interaction (CourseStream), the ability to create custom audio and video inserts for more dynamic instruction (CourseLive), course materials easily managed by multiple sections, courses or departments.

- **ATutor (ATutor, 2007):** is an Open Source Web-based Learning Content Management System (LCMS/LMS) and social networking environment designed with accessibility and adaptability in mind. Administrators can install or update ATutor in minutes, develop custom themes to give ATutor a new look, and easily extend its functionality with feature modules. Educators can quickly assemble, package, and redistribute Web-based instructional content, easily import pre-packaged content, and conduct their courses online. Students learn in an adaptive, social learning environment.

- **JoomlaLMS (Joomla, 2009):** is a commercial component for Joomla Web content management system. In addition to the standard learning management systems features such as Chat, Discussion, Homework and DropBox, JoomlaLMS offers other features such as a documents management tool, which helps to create, edit, sort, store documents and create links to documents used in other document libraries, quiz maker and Question Pool, which allows the teacher to create quizzes and keep a pool of questions for future use in quizzes or exams.

- **Moodle (Moodle, 2010):** is an ongoing project designed to support a social constructionist framework of education. Moodle is distributed as Free Software (Open Source) (under the GNU Public License). Moodle is copyrighted (copyright), but there some services are free. You can copy, use and modify Moodle provided that you agree to provide the source code to others, do not modify or remove the original license and copyrights, and apply this same license to any derivative work. The design and
Positive Reinforcement Social Networks

development of Moodle is based on a particular learning philosophy, a way of thinking that is often called "social constructionist pedagogy".

E-Learning Systems are large web-based information systems; they share a many similarities with Web information systems. Consequently, these systems are designed using the same principles applied to traditional information systems. Thus, several questions emerge, such as: “Who are the learners?”; “What learner intentions and behaviour will be supported?”; “What technical devices will be used by the learners?”

2.1.3 Edmodo: An e-Learning Platform Based on Social Interactions

Following the emergence of OSNs many teachers have attempted to use these tools as educational resources. Hence, a need emerged and several OSNs oriented to educational environments were created. Edmodo may be seen as bridge between two important fields as e-Learning and Social Networks.

This section discusses the online social network tool Edmodo, (Edmodo, 2014), an education-oriented social network. Edmodo was selected due its similarities with Tuenti (Tuenti, 2014) and Facebook. However, it has limited functionalities for students in order to avoid issues or distractions while using them for educational purposes. In Chapter 4 it is discussed in depth and analysed as a starting point for the creation of a new educational social network.

We describe its implemented functionality, non-permitted points and weaknesses. The focus of this tool is to join informal and academic education in one single tool, and to be used as an educational system. The content is usually related to a number of different subjects.

Main Features of Edmodo

In the following paragraphs we analyse the main features available on the Edmodo platform. Some specific functions of communication, organization, file sharing and educational tasks will be discussed.

The tool offers a similar initial interface for teachers and students, but with some extra functionality for teachers. For example, the first action provided for teachers is to create the class groups as required. Each group has a number of options that can be managed, if the user has the teacher role. The teacher can view the group members (students and teachers), He or she can archive and/or delete a group if necessary. As for what is open to public view, we may highlight that the teacher can decide the comments to be shared with people who are from outside a specific group.

In terms of communication, which is performed by using a board, this can be presented, by the teacher, to an entire group or as a private individual for each student. The teacher has four types of communication functionalities: (1) messages, (2) alerts, (3) assignment (or a task which can be rated later) and (4) vote. It is possible to add to each communication element: a file, a link (URL) or an existing item from the digital library. It has a section called "Who?" Where users can send messages in deferent ways to users: individual (private), students group, teachers and parents.

On the student side, the communication options are more limited than those of the teacher. Students only have the option message, and they can only communicate in two ways: (1) publicly with the entire class (2) privately with the teacher.

Both teachers and students have access to a calendar, depending on the classes they teach, and the students to the classes to which they have joined. Here they can also view the deliverables or dates set by the teachers. These management features make the Edmodo tool an excellent tool for organizing and planning.
For storing and sharing files, there are two views in the Edmodo platform: The teacher view, where they can share folders with material for one or more of their classes. And the student view, where they have the option pack, with a space of 100 MB to store their files and/or class assignments.

Finally, from the user profile, other users can see (if connected) public activity, connections with teachers (if the user has a teacher role) their colleagues, as well as their school and classes they manage or in which they participate.

### 2.2 Online Social Networks

*Online Social Networks*, hereafter OSNs, (Boyd-Ellison, 2007) and (Boyd, 2007), can be considered as a specific example of human-computer interaction (HCI) and collaborative systems.

One of the most recent improvements in HCI is provided by OSNs, where the interaction between people and groups of people reaches its maximum expression in ICT. These platforms could be created with different purposes, but their common communication and interaction mechanisms are the same.

OSNs are increasingly widespread on the Internet, the clearest examples are Facebook (Facebook, 2014) and Twitter (Twitter, 2014). Many people have integrated OSNs in their daily life. The term *Online Social Network Site*, that can be found in other research as *Social Network Site* SNS and will be named as *Online Social Network* OSN in this thesis. Nowadays hundreds of OSNs exist. These platforms are supported or/and created by different types of Web technology. These OSNs have a great variety of interests, practices, hobbies etc. Some of them help to maintain and/or consolidate (already existing) human relationships and focus on letting their users meet strangers. These acquaintances are based on common concerns, activities, hobbies, points of view, etc.

The growth of some OSNs is based on a concrete group of people. Therefore the users of these kinds of OSNs belong to a closed or small group with common characteristics as age, race, sex, religion etc. By contrast, some OSNs have no clear target. These sites could be considered general OSN.

Other important features of OSNs are the tools available for the user to add and share new information with the site or the users and how this can be done (mobile connectivity).

Next, two important terms related to OSNs are explained. These terms are closely interrelated and also have a key relationship to the field of collaborative systems.

OSNs can be classified as *social software*. This term, (Boyd, 2007), appeared in 2002 to describe software systems which support interaction between groups of people and data sharing. Some examples of popular websites that could be considered social software are:

- Some OSNs such as MySpace (MySpace, 2014), Facebook (Facebook, 2014) and Tuenti.
- Video and image-oriented sites, such as YouTube (YouTube, 2014) and Flickr (Flickr, 2014).
- Online shops or trading places, such as Amazon (Amazon, 2014) and eBay (eBay, 2014).

The other important term is *Web 2.0* (Web 2.0, 2014). This term can be used to describe social software, but Web 2.0 is bigger than this. Wikipedia says that Web 2.0 is the second generation of website services based on the Internet. These services allow the users to collaborate, communicate and share information online in ways that did not exist before these services emerged.
Table 2-1 shows the comparison between some Web 1.0 applications and their corresponding Web 2.0 functions or features. This comparison makes it easy to appreciate the leap forward between Web 1.0 and 2.0 functionalities.

<table>
<thead>
<tr>
<th>Web 1.0</th>
<th>Web 2.0</th>
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<tbody>
<tr>
<td>Britannica Online</td>
<td>Wikipedia</td>
</tr>
<tr>
<td>Directories</td>
<td>Tagging</td>
</tr>
<tr>
<td>Ofoto</td>
<td>Flickr</td>
</tr>
<tr>
<td>Content publication</td>
<td>Participation</td>
</tr>
<tr>
<td>Mp3.com</td>
<td>Napster</td>
</tr>
<tr>
<td>Content management sites</td>
<td>Wikis</td>
</tr>
<tr>
<td>Personal websites</td>
<td>Blogging</td>
</tr>
</tbody>
</table>

Apart from the features mentioned above, another important characteristic of Web 2.0 is the richer user experience, with interfaces which are increasingly similar to their equivalent desktop applications. One of the technologies that has allowed this evolution and the creation of this type of websites is AJAX (Asynchronous JavaScript and XML). In some cases there have been a development such as hashtags after directories and tagging. In this line, Instagram can be seen as an evolution of Ofoto and Flickr. Spotify can be seen as a development of Mp3.com and Napster. There are other cases where this evolution is not clear, for example, what is the evolution of Britannica Online and Wikipedia?

After Web 2.0, the concept of Web 3.0 appeared, but its meaning is still a matter of debate. Different approaches are shown in the following paragraphs:

Authors such as (Hendler, 2009), claim that is difficult to be precise about Web 3.0 features. The main items he addresses are a combination between: Web 2.0, semantic Web and linked data.

For (Naik, 2008) the important concepts of Web 3.0 are: adaptation, contextual information, user preferences, and device characteristics: from community Web to semantic Web, from social Web to semantic Web, from interactions to immersion, from connecting people to connect knowledge etc.

In contrast to Web 2.0, where there is a consensus about definition and features, the scientific community is still to agree on a common definition. However, it is clear that the main concept for almost everyone is that of semantic Web.

2.2.1 Definition of Online Social Network

We have found a possible definition for OSNs proposed by (Boyd-Ellison, 2007):

A site (the author prefers to use the term Social Networks Site) which offers services based on Web technologies, and these services allow the users to:

- Build or create public or semi-public profiles within a relationship system.
- Have a list of users with a shared website connection.
- See and navigate the user’s connections list, which has a shared connection with the user.

The form and nomenclature of these connections vary from one Social Network to another, usually depending on the topic or topics of the website.
What makes OSNs unique is not just that they allow users to meet strangers, but they make it possible for the users to manage their own Social Network and make it visible. Usually, connections on OSNs are between individuals who have latent ties and/or have an offline relation. In many OSNs the users do not seek to enlarge their Social Network (counter-example LinkedIn (LinkedIn, 2014)). They usually look for people already known in their offline life.

OSNs have a wide variety of possibilities, the main features are presented below (features or characteristics shared by most of the OSNs):

- **Profiles**, through their profiles users can access a list of their friends who are registered in the same system. The profiles are single pages where the users provide information about themselves. The usual information that appears is name, last name, age, city or hometown, hobbies and a section called “about me” where the users describes themselves in a few lines. The majority of OSNs encourage the user to upload their picture to allow other users see and/or recognize them (this is important above all for the new connections inside the site). Some sites such as Facebook offer the user the possibility of personalizing their profile by adding modules or applications.

- **Profile visibility** varies depending on the OSN and there are different configurations within each website, which depend on the level of privacy preferred by the user. Usually by default, the profiles on most OSNs are available to be searched and found, making them accessible to everyone on the platform. Sometimes, by using a common Web search engines, they are also accessible from outside. However, not all the information on those profiles is public. As previously mentioned, the user has the option to make some information private or make it visible for some users to whom they are connected through the OSN.

- **Identifying other users.** OSNs usually encourage new users to look for other people they already know and are already part of the site. As was said before, the name given to connections varies depending on the site, but there are some popular terms such as: friends, contacts, fans and followers. Most of the connections (or relations) are bi-directional and therefore need to be acknowledged by both parties. Furthermore, it is important to be aware that the term friend is somewhat different on these online sites than in the real offline world, with the original meaning becoming lost or blurred. In the offline world a certain type of connection might not be defined as friendship (e.g. professional relationships or sharing common hobbies etc.).

- **Public visualization of connections between users.** This is one of the most important features of the OSNs. The friends list has links to all the profiles of these friends. Thus, friends are able to see the friends of friends and navigate between relationships (in some OSNs, this depends on the privacy level of the sites and users will not be able to go beyond a certain point).

- **Messages on the profile.** Most OSNs allow their users to write messages on others users’ profiles. Besides this public communication channel, there is usually a private channel of messaging between users, similar to email. However, in this case the users do not need to remember the email, they just need to remember the name or nickname of the user, or navigate on their connections list.

Apart from all the above, the most extended and widely used functionalities on OSNs are: uploading and sharing pictures and videos, commenting on each other’s profiles and private messaging between users. The users of this type of platforms can share documents and communicate in different ways as well.

Not all OSNs started life as OSNs. According to (Boyd-Ellison, 2007), some of them began as regular websites offering a specific kind of content or information to their users. A social group slowly grew up around the website that finally demanded more and more functionalities to be able to interact with the website and between users.

Besides the efforts made by the software developers who created the OSNs, in order to make the sites accessible and attractive for the biggest possible number of users, we can usually find OSN users divided by
nationality, age, educational level or other factors, in the same way as these divisions occur in the offline world. The importance of the type of user that an OSN has is enormous, because the first users are the ones who invite and attract others to become new members to the platform.

Different kinds of approaches can be found regarding how users can join a OSN. A special case is that of Tuenti (Tuenti, 2014), which no longer exists as an OSN, having evolved into a mobile phone company. In its beginnings, Tuenti, instead of giving easy access to the users, the registration was restricted to those who had an invitation. This then changed and registration was open. However, in the early years they were trying to attract a population aged between 16 and 30. The system did not let users’ parents become members, as most users did not want to share an invitation with their father or mother. Thus, they were able to restrict access to their pictures and videos. Consequently, it was hard for those outside the target age group to join the OSN.

Twitter is another special case. Where most OSNs have bi-directional connections, in Twitter a bi-directional connection is not needed. A user decides to follow or not to follow another user. Indeed, it is a status symbol to have more followers than people you are following.

Regarding privacy there are many questions and there will be more in the future as this is a key topic. This importance leads us to the following question: Do OSNs implement their privacy options for their users or do they implement them for their own benefit, in order to grow as much as possible?

The most important features and characteristics have been described during this section. There follows a description of the evolution and first milestones of these remarkable systems that have completely changed our everyday way of life.

2.2.2 Evolution of Online Social Networks

In this section the first milestones and the evolution of OSNs will be discussed, taking as a reference the work by Dannah Boyd (Boyd-Ellison, 2007).

Sixdegrees.com, which started in 1997 but no longer exists, was the first OSN. The platform allowed users to create their own profiles, create lists of friends and navigate these lists. These features and/or functionalities (with some differences) were on other sites before Sixdegrees. For example, the creation of profiles existed on most dating websites, as well as on the main instant messaging tools such as ICQ. Lists of friends were available on ICQ as well, but it was not possible for a user’s friends to see the list. However, it was Sixdegrees which brought these features together.

Sixdegrees defined and promoted itself as a tool for helping people to keep in touch, stay connected and send messages to one other. It had the capacity to attract millions of users, but its business model failed. There are people who say that its main problem was that Sixdegrees was ahead of its time. Moreover, some users complained about the limited features and functionalities (just adding friends) and most users showed no interest in meeting strangers.

Figure 2-2 is shows the SixDegrees.com homepage, where the following options can be found: login, new user and/or visit public parts of the website. This is, in fact, similar to what can be found on today’s OSNs, such as, for example, the Facebook home page (where the user can perform the same actions). The website finally closed in December 2000 because the business model was not viable.
From 1997 to 2001 it was common in the online website community to integrate tools for creating profiles and the navigation of friend lists on their websites. Websites such as AsianAvenue, BlackPlanet and MiGente appeared. These sites allowed their users to create personal and professional profiles and, in some cases, dating options. In these new websites users could mark other users as friends in order to follow their comment activity on the sites.

In 2001 Ryze.com (Ryze, 2014) started. Its main focus was, and is, helping people to promote their professional and/or business networks. The founder introduced his own friends to the website in order to launch it, but not all his friends, just those with technological, entrepreneurial and/or research profiles.

Friendster started in 2002 as a social complement for Ryze. It was designed to compete with Match.com, a dating OSN (Match, 2014). In contrast to most dating websites, where the focus was to meet strangers, Friendster promoted connectivity between friends of friends, based on the fact that friends of friends could be a better match than strangers when people are looking for love.

As Friendster grew and its popularity increased they began to encounter technical and social problems (Boyd, 2006). Friendster’s servers and databases were not ready for this rapid expansion, so the website was often offline. Popularity also brought offline social “problems”, as some of the first users had the “problem” of having their bosses, work mates, family etc., as “friends”.

The original design of Friendster only allowed users to see profiles of four friend levels, friend of a friend of a friend being the maximum. Being able to see more profiles, users began to look for friends among strangers (they began to “collect friends”). This activity was encouraged by a feature of the website called “the most popular”. Finally, the users began to create fake profiles based on famous, celebrities, concepts, ideologies, etc. The users named these fake profiles “Fakesters”. These fake profiles were deleted by Friendster. This situation shows a lack of common interests between the OSN and its users. However, we can now see how two of the most important OSNs, Facebook and Twitter, have a lot of celebrity users, who are the most popular users on these platforms. It should also be noted that Facebook allows users to create groups based on ideologies, concepts etc. By contrast, Friendster had not able to respond adequately to the demands of its users.

The Fakesters issue, together with the technical difficulties and the social problems made some users leave the website. However, while its popularity in the U.S. was declining, in other countries it was increasing.
After 2003 a large number of OSNs appeared. The majority focused on the user profile, trying to replicate the success previously achieved by Friendster. These general OSNs were aiming for huge amounts of standard users, while professional OSNs such as LinkedIn or Xing (Xing, 2014) focused on recruiting business and professional people.

OSNs focused on hobbies such as Dogster (Dogster, 2014) help their users to meet strangers who share similar interests or hobbies. Furthermore, after 2003, websites based on video or photos began to implement the main features or functionalities of the OSNs.

MySpace (MySpace, 2014) began in 2003, and rapidly attracted a large number of users. Most of their first users were ex-Friendster users who had left Friendster for a variety of reasons. At the beginning, Myspace tried to attract music bands to their platform. Growth in this area was supported by the fact that MySpace’s developers contacted with several music bands to see how they could facilitate a response to their needs. Through these contacts the OSN was able to provide a better service for their users and the relations between the fans and the bands improved and collaboration with MySpace expanded.

Finally, the arrival of Facebook in 2004 should be highlighted. It was first a private platform, but public access was set up in 2006. Facebook was designed to support university Social Networks. With a similar purpose but in Spain, Tuenti appeared in January 2006. Currently, no one can doubt the success of OSNs, with an enormous number of users, most of whom use them on a daily basis.

### 2.2.3 User Perspectives

It is important to take into account user perspectives in Online Social Networks. Larsen (Larsen, 2007) made an initial list of thirty-five perspectives: consumer, youth, friendship, identity, body and sex, paedophile and predator, bullying, reassurance, genre, branding, network, love, source critique, sincerity, democratic, materialistic, language, public, surveillance, group work, time consuming, anti-social, social, generation gap, learning, entertainment, communication tool, creative, space and place, nexus of practice, community of practice, collection, fun, technological, and finally, the hard core business perspective.

Larsen says that this first classification may not have all the perspectives, but is quite complete. Although all the perspectives presented may or cannot be agreed upon, this list provides a way to classify OSNs. According to Larsen, all these perspectives could be included in one or more of the following perspectives:

- **Research perspectives**: Perspectives that can be researched, such as the identity perspective, youth, language, genre, materialistic, learning, creative, etc.

- **User perspectives**: This category includes OSN users’ approach. The perspectives in this classification are: social, friendship, democratic, love, reassurance, public, sincerity etc. In this case, it can be seen that all these perspectives are reasons for users to access this kind of platforms.

- **Professional and learning perspectives**: In this category we can find perspectives related to learning and professional life (current or future). Perspectives fitting in these criteria are: network, group, source critique, technological, learning, creative, community etc.

- **Adult and parental perspective**: This category includes the worried voices of adults, parents and guardians, who are concerned about the amount of time their child spend in front of the monitor, connected to the OSNs. Here we find perspectives such as: time consuming, antisocial, generation gap, language, consumer, public, etc.

- **Ethic and news perspectives**: On OSNs some topics become public and these topics are wide-ranging conversational topics. This includes perspectives such as: paedophile and predator, bullying, network, youth, sexual and public etc.
• Marketing perspectives: This classification includes perspectives such as: consumer, materialistic, branding, surveillance and the hard core business perspective.

Some of these thirty five initial perspectives can be classified in one or several of these six broader classifications. Without doubts the user perspective is the one shared by most OSN users.

2.2.4 Interactions in Online Social Networks

Christo Wilson et al. (Wilson, 2009), consider the implications of the interactions performed by and between users while navigating on their OSN. In this case, their work focuses on Facebook users and how they interact through the events they create on the platform.

Wilson highlights privacy and security, and above all, the improvement in these fields, as one of the key points OSN software developers and engineers have tried to address on these platforms. It should be noted that the main problems found in these fields are spam, Internet searches and phishing or impersonation problems. These weak points are related with the interactions and connections a user has with others OSN users.

However most OSNs support one connection level: friendship; there are research works that show and support the hypothesis of certain users’ links or connections connecting users without any, or with a low level of relations of trust. So, these authors asked themselves: Are social links a good or valid indicator for the real interactions between users? If the answer is no, what can be used to create a model to measure and evaluate the connections between OSN users?

Finally, Wilson came up with these three important contributions:

• A complete study of Facebook. A detailed analysis is presented, highlighting the data related to user interactions. The study shows that the main interaction of a single user is with a small group of their friends, having almost no interaction with fifty percent of their connections (connections that this user has as friends on the platform). This led the authors to affirm that the relations graph based on the friend connections graph does not have a complete meaning. They suggested an alternative model, which is one of their key contributions.

• An interaction graph is proposed, based on the representation of relations across the common interactions between users. This graph shows all the nodes based on Facebook users, but has a sub-group of links between nodes.

• Finally, they authors applied the graph to address the three problems that were listed previously: spam, Internet searches and phishing. They found lower levels of these problems when the real connection list is the one with the “real” friends of the user.

More current research and trends in OSNs and educational environments are presented in the following section. A large number of new OSNs have appeared recently, based on the main concepts presented in this section.

2.3 Social Research in Educational Environments

In this section Online Social Networks (OSNs) and other ICT platforms in educational research are analysed. It continues with academic performance-oriented research. Thirdly, research focused on motivation, engagement and rewards is presented. Next, games for educational environments are presented. Finally, there is a miscellaneous section presenting interesting research which did not fit in the other categories.
Several papers can be categorized in several sections, in these cases the articles are discussed and analysed on their first appearance.

Since 2004, Horizon Report has been releasing data concerning the most promising technologies and their impact on education, based on three items: short term (1 year), mid-term (2 years) and long term (4 years). All these data are analysed by (Martin, 2011). The success of the predictions was achieved through the use of bibliometric analysis. It is also important to highlight that this research underlines that the maturity of some technologies increases the expectations for other related technologies.

After the analysis, in the words of the authors: “The bibliometric analysis over the predictions highlights that some of the predictions were right, e.g., social networks, user-created content, games, virtual worlds and mobile devices. Other predictions did not have the expected impact, e.g., knowledge Web, learning objects and open content, context-awareness and ubiquitous computing. However, other predictions were successful, although their impact was delayed one or two years, e.g., grassroots videos and collaborative Web”. This study has helped to decide about some of the content analysed within this section.

2.3.1 Online Social Networks in Education

Once the theoretical part of Online Social Networks has been presented in Section 2.2, it is time to expose the applied and practical one. This section discusses OSN research works related to education. Several studies are analysed, presented by date of publication.

In the following table the most important research works analysed are presented. The importance of those works is due to the fact that they are related to other important fields for this research that are exposed in other sections of this chapter.

<table>
<thead>
<tr>
<th>Article</th>
<th>Related to:</th>
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</thead>
<tbody>
<tr>
<td>(Kirschner 2010)</td>
<td>2.3.2 Academic Performance</td>
</tr>
<tr>
<td>(Junco, 2011 A)</td>
<td>2.3.2 Academic Performance; 2.3.3 Motivation and Engagement</td>
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<tr>
<td>(Lin, 2011)</td>
<td>2.3.3 Motivation and Engagement</td>
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<tr>
<td>(Junco 2012 A)</td>
<td>2.3.3 Motivation and Engagement</td>
</tr>
<tr>
<td>(Junco, 2012 B)</td>
<td>2.3.2 Academic Performance</td>
</tr>
<tr>
<td>(Rosen, 2013)</td>
<td>2.3.2 Academic Performance</td>
</tr>
</tbody>
</table>

The first paper analyzed is the one presented by (Ebner, 2010), who conducted a research study on microblogging in a University environment. Some of the basic functions addressed were: giving opinions, asking questions, sharing resources, changing ideas and reflection.

A high number of posts were shared by each student; on average, they wrote 315 posts over a period of 70 days: around 4.5 posts per day. If holidays are not taken into account there were 42 days and the posts per day increases to 7.5 per working day.

The authors summarize the uses of microblogging as: (1) Informal learning; (2) Support collaboration; (3) Feedback; (4) Suggestions; (5) Collaboration independent of time and place. These five could be considered important for students.
The key factors for teachers are: (1) Information on the status of learning; (2) Intervention in the learning process; (3) Direct feedback; (4) Facilitate student group work; (5) Get an impression about the learning climate.

The most commonly used post is the “reply post”. A total of 60% were of this type: This indicates robust communication between students and teachers.

It is not just the exchange of information or status change that are important factors. The importance of this type of tools is that they give the opportunity to be part of someone else’s learning process by reading, commenting, discussing etc. Microblogging helps users to be partially and virtually present, without restrictions of time and place. As principal results of the research, the authors found that microblogging, as well as being a new form of communication, can also be used to support the informal learning process.

An exploratory survey study was conducted by (Kirschner 2010). It considers the use of Facebook, a tool that is often used simultaneously with study activities and the relationship of its use to academic performance. This relationship to academic performance was measured by self-reported Grade Point Average (GPA) and the hours that a student spent studying per week. The sample comprised 102 undergraduates and 117 graduate students from a public Midwestern university (N = 219).

The main finding of this research was that on average Facebook users reported worse GPAs than non-users. Non-users reported spending more hours per week studying and higher GPAs.

The two research questions that guided the work (Thelwall, 2010) were:

- “How common are positive and negative emotions in social network comments?”
- “Are there gender and age differences in the extent to which emotions are expressed in public MySpace comments?”

They analysed which emotions are part of MySpace comments, by using a combination of data mining and content analysis. They used a random sample of 819 public comments. More than two thirds expressed positive emotions but a minority of 20% contained negative emotions. While females are more open to giving and receiving positive comments, there are no differences between the negative ones. Mean results can be seen in Table 2-3.

<table>
<thead>
<tr>
<th>Destination</th>
<th>From female</th>
<th>From male</th>
</tr>
</thead>
<tbody>
<tr>
<td>female (Positive)</td>
<td>2.41</td>
<td>1.98</td>
</tr>
<tr>
<td>female (Negative)</td>
<td>1.32</td>
<td>1.31</td>
</tr>
<tr>
<td>male (Positive)</td>
<td>2.22</td>
<td>1.67</td>
</tr>
<tr>
<td>male (Negative)</td>
<td>1.32</td>
<td>1.50</td>
</tr>
</tbody>
</table>

As outcomes, the authors concluded that emotions are apparently the norm in OSNs. Their work shows that positive emotions are present in two third of the MySpace comments. The higher female use supports offline research showing where women are more open to expressing emotions than males.

The factors that drive students to use OSNs are explored (Cheung, 2011). An analysis is made of the social influence, social presence, and the five key values from the uses and gratification paradigm on Web-Intention to use online social networks. A total of 182 Facebook users took part; results say that the use of OSN is strongly related to social presence. Among the other values and factors, social factors had the most significant impact on the intention to use.
One of the most important concepts is *We-Intention*, defined as follows: We-Intention is defined as a “commitment of an individual to engage in joint action and involves an implicit or explicit agreement between the participants to engage in that joint action” (Tuomela, 1995, p.9). We-Intention (Cheung, 2011) focuses on the presence of “we” together in the intention that we will continue to use an online social networking site in the future.

![Figure 2-3 We-Intention related items](image)

List of items related to We-Intention (in the figure above):

- A stronger subjective norm leads to a higher level of We-Intention to participate in an online social networking site.
- Stronger group norms lead to a higher level of We-Intention to participate in an online social networking site.
- A stronger social identity leads to a higher level of We-Intention to participate in an online social networking site.
- The level of purposive value of using online social networking sites positively affects We-Intention to use online social networking sites.
- The level of self-discovery of using online social networking sites positively affects We-Intention to use online social networking sites.
- The level of maintaining interpersonal interconnectivity of using online social networking sites positively affects We-Intention to use online social networking sites.
- The level of social enhancement of using online social networking sites positively affects We-Intention to use online social networking sites.
- The level of entertainment value of using online social networking sites positively affects We-Intention to use online social networking sites.
- A higher level of social presence leads to a higher level of We-Intention to participate in an online social networking site.

It is interesting to note how the authors refer to (Tajfel, 1978) and explain: “The third mode of social influence, identification, refers to the self-awareness of one’s membership in a group, as well as the emotional and evaluative significance of this membership”.

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As the most important outcome of this research it is worth highlighting something already mentioned: social factors had the most significant impact on the intention to use. OSN use is also related to social presence.

(Junco, 2011 A) describes a semester-long experimental study to determine if Twitter can have a positive impact on college student grades and engagement. A sample of 125 students was taken into account: 70 of them were assigned to the experimental group and 55 to the control group. The experimental group participants used twitter for academic and co-curricular discussions.

An interesting finding is that no students in the control group reported using Twitter during the study period. The percentage of students sending tweets and the number of tweets sent by using the Twitter Application Programming Interface were collected to be analysed. An average of 48.20 messages per student were sent during the study.

The data analysis found that the experimental group had better grades and more enhanced engagement than the control group. Hence, it can be concluded that Twitter is able to have a positive impact on educational environments. Twitter used as an educational tool can help engage students and encourage teachers to take a more participative role.

The authors of (Lin, 2011) aim to answer the question: Why do people use OSNs? They combine network externalities theory and motivation theory to analyse why people join OSN. The results show that network externalities such as number of members, number of peers, perceived complementarity and perceived benefit: usefulness and enjoyment, are the key factors for continued intention to use (see figure below).

This study proposes a theoretical framework to investigate factors related to OSN use and proposes factors to understand why users continue using platforms. The model shown (Figure 2-4) is able to predict users’ continued intention to use OSN.

![Figure 2-4 Path analysis results](image)

*** p < 0.001, ** p < 0.01, * p < 0.05, ns = not significant
Associations between OSN use and personality traits are explored in (Zhong, 2011). The data was collected from a sample of 436 students at an American university in 2010. The sample comprised 318 females and 118 males. The average age was 20. Freshmen accounted for 50.3%, juniors, 26.6%, sophomores, 16.7% and seniors, 6.4%.

Most of the participants (72.2%) reported three or fewer hours of OSN use per day, while 27.8% reported more. More than half (51.7%) reported being online for hours with no particular purpose. It is important to note that 84.4% spent five or fewer hours on the Internet on a daily basis. In addition, 15.6% spent 5.1 or more hours online per day.

Some of the findings and outcomes of this research are listed below:

- OSN use had a negative impact on need for cognition (NFC) and a positive impact on communication technology (ICT) innovativeness.
- Those who spent more time on OSNs were more likely to be multitaskers.
- Those who spent more time on OSNs spent more time on Internet as well.
- The main conclusion is that there is evidence for the associations between social media use and personality traits.

(Bachrach, 2012) shows how activity on Facebook is related to the offline personality of the users. The study was conducted with over 180.000 Facebook profiles. The main data used for measuring this correlation between offline and online social characteristics are: size and density of their friendship network, number uploaded photos, number of events attended, number of group memberships, and number of times user has been tagged in photos.

The social support for this research was the big five personality model (Costa, 1992), (Goldberg, 1993) and (Russell, 1994). This measures factors such as:

- **Agreeableness** measures the extent to which a person is focused on maintaining positive social relations.
- **Conscientiousness** measures preference for an organized versus spontaneous approach in life.
- **Extraversion** measures a person’s tendency to seek stimulation in the external world, company of others, and express positive emotions.
- **Neuroticism**, often referred to as emotional instability, is a tendency to experience mood swings and negative emotions such as guilt, anger, anxiety, and depression.
- **Openness** to experience measures a person’s imagination, curiosity, seeking of new experiences and interest in culture, ideas, and aesthetics.

The main Facebook profile features used for this research were: likes, statuses, groups, photos and friends. By using several of these features and the factors previously mentioned the authors are able to obtain relatively accurate predictions about user personality characteristics.

The results show the relationship between offline and online factors and the authors propose a possible way to predict personality factors by using Facebook profiles. It shows that personality traits are correlated with patterns of social network use, which is a finding of great interest.

Open Network Learning Environments (ONLE) are presented in (Blocher, 2012). It gives the learners the opportunity to participate in creative, personalized, networked, and effective collaborative communities by applying Web 2.0 tools in their environments, which is the authors’ focus. To this end, they support social interaction by User-Generated Content, Participatory websites, digital identities and networking linkages.
which allow the students to manage their social presence on the network. The four main dimensions of ONLE are: cognitive, social, networking and integration.

Their results show that while social presence can be used as a predictor for networking and integration, it does not work for the other two ONLE’s dimensions: social and networking dimension. The authors highlight that social interactions in CMC and ONLE work differently and that ONLE is better for group learning.

The research conducted by (Hughes, 2012) tries to go further into the relationship between user personality and OSN use by analysing and examining the personality correlation of social and informational use of Twitter and Facebook. Social factors taken into account were: neuroticism, extraversion, openness-to-experience, agreeableness, conscientiousness, sociability and need-for-cognition.

The hypotheses proposed in the aforementioned study are:

- H.H 1: Neuroticism will be positively correlated with social use of both Facebook and Twitter.
- H.H 2: Extraversion will be positively correlated with use of Facebook.
- H.H 3: Extraversion will be negatively related to use of Twitter.
- H.H 4: Openness will be correlated with both social and informational use of both Facebook and Twitter.
- H.H 5: Agreeableness will be unrelated to social network use.
- H.H 6: Conscientiousness will be negatively correlated with social use of both Facebook and Twitter.
- H.H 7: Conscientiousness will be positively correlated with informational use of OSN.
- H.H 8: NFC will be positively correlated with informational use of Facebook and Twitter, but will be unrelated to social use.
- H.H 9: Sociability will positively correlate with the social use of Facebook and Twitter, but will be unrelated to informational use.

The sample had the following numbers: N=300, 31% males and 69% females, ages from 18 to 63, from different continents. 55% of the participants were employed, 41% were students and 4% unemployed.

Three different personality measures were used:

- The big five: neuroticism, extraversion, openness, agreeableness and conscientiousness (described before in this section).
- Sociability measured by the IPIP Sociability scale (Goldberg, 1999).
- Need for Cognition, assessed using the IPIP as well and a version of the Need for Cognition scale (Cacioppo, 1984).

The outcomes of this research showed that personality is related to online socializing, but this is not as influential as previous research has suggested. Personality is also an influential factor in online information. It is important to highlight that a preference between Facebook and Twitter is related to certain types of personalities.

Frequency of Facebook use, participation in Facebook activities and student engagement is analysed in (Junco 2012 A). Although previous works had examined the positive outcomes of Facebook use, these authors claimed that one of the limitations of these studies was the small sample size. In this experiment data from 2368 college students was analysed.
Research by (Pascarella, 2005) highlighted the relationship between student engagement, student development and success in six points: College environments that emphasize interactions, on-campus friendships, college environments that emphasize engagement, extracurricular involvement, and knowledge acquisition related to engagement level and finally interaction with peers.

Student engagement was measured in three ways: a national survey of student engagement (U.S.), time spent preparing for class and time spent on co-curricular activities.

The research questions which guided this research were:

- “Is there a relationship between frequency of Facebook use and student engagement? Is there a relationship between frequency of Facebook activities and student engagement?” FBTime and FBcheck are found to be negative predictors of engagement.
- “Is there a relationship between frequency of Facebook use and time spent preparing for class? Is there a relationship between frequency of Facebook activities and time spent preparing for class?” There is no relationship between frequency of use and time spent preparing for class, although there is a negative relationship between Facebook engagement and time spent preparing for class.
- “Is there a relationship between frequency of Facebook use and time spent on co-curricular activities? Is there a relationship between frequency of Facebook activities and time spent on co-curricular activities?” Time on Facebook relates positively to the time spent on co-curricular activities.

As regards outcomes, it is worth highlighting a quotation from the authors: “These results are congruent with others that have found that using the Internet and Facebook in certain ways leads to better psychosocial outcomes and that using Twitter in certain ways leads to better academic outcomes”.

Again Facebook, but in (Junco, 2012 B), the focus is how Facebook use is related to academic performance. The sample group N =1839 is of college students. The relationship between multiple measures of frequency of use, participation in Facebook activities and time spent preparing for class and the actual GPA, were the factors taken into account during the research. It is important to clarify that using Facebook for collecting and sharing information was a positive predictor of the outcomes but using it for socializing was a negative predictor.

The participants were United States residents, who were sent a link to a survey via their university email accounts. The Facebook activities taken into account were: playing games; posting status updates; sharing links; sending private messages; commenting; chatting on Facebook chat; checking to see what someone is up to; creating or RSVPing to events; posting photos; tagging photos; viewing photos; posting videos; tagging videos.

The most interesting outcome is that time spent on Facebook was strongly and negatively related to GPA while weakly related to time spent preparing for class.

In (Colazzo, 2013) the authors present their experience as designers, developers and administrator of a virtual platform called On Line Communities (OLC) used since 2002. Different approaches in learning settings with regard to ICT platforms that support educational environments are discussed.

The three categories or approaches are:

- LMSs are “course” related.
- Web 2.0 (Facebook, Twitter, Flickr etc.) are related to “the individual with its social networks”.
- Virtual communities, with a participant who accepts the rules of the community, duties, rights, tasks and objectives to achieve.
The different levels of applicability of these three categories are discussed and presented. The experimentation and data collected during the last 10 years is presented (prior to the publication of this paper 2013). This platform was used as a replacement for the LMS previously used. The path from a LMS based on the concept of course to a platform based on the concept of virtual community OLC is explained.

One of their main goals is the integration of social networks logics in the academic environment. A “bridge” platform to join both worlds is proposed (see figure below).

![Diagram of Traditional LMS, On Line Communities, and Social Networks]

**Figure 2-5 On Line communities**

The OLC are based on at least these four basic concepts:

- A new definition of collaboration as a virtual space, more generalized than what traditional LMS were offering for educational settings.
- A new definition of the users’ role in a community, based on the concept of duties and rights inside the virtual space.
- The virtual space thus created should be generalized, suitable to support not just strict educational activities (like a “lecture” or a “course”), but more extended and complex processes such as cooperation and collaboration.
- The capability of modelling and preserving organizational structure and the roles of the educational institution, for example in hierarchical structures such as university faculty-degree-course hierarchy, or any other organizational, network-based structure (like social communities).

The intention is to take advantage of the new tools the student community is using in order to improve their educational system.

Summarizing the three approaches presented:

- First, a “course-centric” vision related to and located around the course, where LMSs play a vital role.
- Second, the use of tools and services available online (Web 2.0). These platforms are used as virtual spaces for student-teacher interaction and sharing.
- Finally the authors’ approach, the OLC “On Line Communities” which is “community-centred”. It provides a virtual space where interaction, communication and collaboration take place. It provides learning-specific tools and services that are available for the participant in the community. It seems that they aim to combine the best of the first two approaches by uniting some of their more important characteristics and features.

The main objective of (Rosen, 2013) is to answer the question: Do technological distractions impact academic learning? These authors conducted a study where 263 middle school, High School and university students were observed during 15 minutes at their homes.
It is worth noting that the participants averaged less than six minutes on task before switching to other activities. Most of these distractions were technology-related, including social media and texting which were the most popular ones.

Those who task-switched had access to more technologies. This study provides important findings about GPA, which support previous works analysed in this section. Those who avoid Facebook use had better GPAs than those who accessed it.

Authors proposed allowing students short technology breaks in order to reduce distractions and to try to teach students metacognitive strategies regarding when interruptions affect them negatively.

*Machiavellianism* is a completely contrasting characteristic, which is studied in (Abell, 2014). It is defined by words such as cynicism, social manipulation and emotional detachment. In this research conducted on OSNs, with 54 men and 189 women, the authors discovered social relations between the offline and online world. The results of the analysis reveal that women who are high in Machiavellianism, in their offline world, tend to take part in more dishonest self-promotion and social aggression towards a close friend on Facebook. Men, on the other hand, are more self-promotion oriented.

Measurement was conducted using a self-monitoring scale which contains 25 statements for behaviour in *social interactions* (offline). Aggression in Facebook activity was measured by using 19 statements developed by the researchers. The authors used another tool to measure cynicism, morality and manipulative behaviour. Before taking part in the study, participants were asked to complete a preliminary demographic information questionnaire (age, gender, etc.).

Other interesting results were obtained about Facebook activity, in this order: posting status updates, posting photographs, changing profile picture, tagging pictures and updating profile information. These activities lead to the conclusion that people oriented to Machiavellianism have a tendency to create a facade of themselves.

In the discussion section, the authors interestingly state that *social offline behaviour* have been demonstrated to influence *online activity and behaviour*. The authors also recognise that the study was limited by the self-report data and the local and small group of people who participated in the research.

**Summary of Outcomes**

In Table 2-2 were presented papers related to other sections, 40% of the papers within this section are also related to other sections. These relationships are to Sections 2.3.2 Academic and Performance and 2.3.3 Motivation and Engagement. This shows that the research efforts (of the papers analysed) are oriented to the use of OSNs in addressing these two important elements of educational systems.

To end the OSN section, the main outcomes are listed below:

- Microblogging, besides being a new form of communication, can be used to support the informal learning process (Ebner, 2010).
- On average Facebook users reported worse GPAs than non-users (Kirschner 2010). Furthermore, non-users spend more hours per week studying. Academic performance is negatively related to Facebook use.
- Positive emotions are present in two third of MySpace comments (Thelwall, 2010), therefore emotion is present on OSNs.
- Social factors had the most significant impact on the intention to use. OSN use is also related to social presence (Cheung, 2011).
• Twitter can increase student engagement and improve grades (college students) (Junco, 2011 A).
• A model has been proposed to predict factors and intention to use within OSNs (Lin, 2011).
• There is evidence for the associations between social media use and personality traits (Zhong, 2011).
• Personality traits are correlated with patterns of social network use (Bachrach, 2012).
• Open Network Learning Environments (ONLE) are presented in (Blocher, 2012).
• Personality is related to online socializing, but is not as influential as some previous research suggested (Hughes, 2012).
• Certain uses of the Internet and Facebook lead to better psychosocial outcomes and Twitter use leads to better academic outcomes (Junco, 2012 A).
• Time spent on Facebook was strongly and negatively related to GPA while weakly related to time spent preparing for class (Junco 2012 B).
• A virtual platform called “On Line Communities” (OLC) used since 2002 is presented and analysed (Colazzo, 2013).
• Students who accessed Facebook one or more times during the short study period (15 minutes) had lower GPAs (Rosen, 2013).
• It is demonstrated that social offline behaviours has an impact on online activity and behaviour (Abell, 2014).

2.3.2 Academic Performance

An accepted definition is: “Academic achievement or (academic) performance is the outcome of education - the extent to which a student, teacher or institution has achieved their educational goals.

Academic achievement is commonly measured by examinations or continuous assessment but there is no general agreement on how it is best tested or which aspects are most important - procedural knowledge such as skills or declarative knowledge such as facts”. Several works are analysed here in order of year of publication. In Table 2-4 the most relevant works, as they are related to several sections, are presented.

### Table 2-4 Academic performance research relations

<table>
<thead>
<tr>
<th>Article</th>
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<td>(Shen, 2009)</td>
<td>2.3.3 Motivation and Engagement</td>
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<td>(Burguillo, 2010)</td>
<td>2.3.3 Motivation and Engagement; 2.3.4 Games</td>
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<td>(Kirschner, 2010)</td>
<td>2.3.1 OSNs</td>
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<td>(Junco, 2011 A)</td>
<td>2.3.1 OSNs; 2.3.3 Motivation and Engagement</td>
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<tr>
<td>(Junco, 2012 B)</td>
<td>2.3.1 OSNs</td>
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<td>(Ventura, 2012)</td>
<td>2.3.4 Games</td>
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<tr>
<td>(Yang, 2012)</td>
<td>2.3.3 Motivation and Engagement</td>
</tr>
<tr>
<td>(Rosen, 2013)</td>
<td>2.3.1 OSNs</td>
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</table>

A theoretical model linking emotions and goals and linking them to academic performance is proposed in (Pekrun, 2009). The model was tested with undergraduate students (N=213) during a psychology course. The proposal can be seen in the figure below:
Seven of the eight emotions were documented as mediators of the relations between achievement goals and the performance obtained. The authors used three initial statuses based on knowledge: Mastery goals, performance-approach goals and performance-avoidance goals. They tested how emotions affect final performance; some of the results can be seen in the figure below:

As a result of the analysis, the authors claimed that *emotions* and *goals* affect students’ *academic performance*, with emotions being mediators in the link between goals and performance. The model is consistent with *achievement motivation* theories published before.

It is worth highlighting that hope and pride were positive predictors of performance, while boredom, anger, hopelessness, anxiety were negative. Therefore, it can be concluded that some positive emotions improve performance.

*Emotions* during the *learning process* were explored in (Shen, 2009). Detection technologies from biophysical signals were used to get emotions. One of the main goals of this research is to evaluate how emotion feedback could be used to improve learning environments.
A basic learning emotion space is presented (see figure below). Further similar classifications are presented and analysed during the study. An affective learning model is proposed, where the main elements are Biosensors, Emotions, User Profile, Goals and Events.

![Image of the basic learning emotion space]

**Figure 2-8 Example of the basic learning emotion space**

Although several emotions such as interest, boredom, engagement, hopefulness, satisfaction, confusion, frustration, disappointment were taken into account, some were more common than others. The table below shows the distribution for the most common emotional transitions taking place during the study:

<table>
<thead>
<tr>
<th>Transitions</th>
<th>To engagement</th>
<th>To confusion</th>
<th>To boredom</th>
<th>To hopefulness</th>
</tr>
</thead>
<tbody>
<tr>
<td>From engagement</td>
<td>X</td>
<td>32</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>From confusion</td>
<td>18</td>
<td>X</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>From boredom</td>
<td>1</td>
<td>5</td>
<td>X</td>
<td>6</td>
</tr>
<tr>
<td>From hopefulness</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>X</td>
</tr>
</tbody>
</table>

Accuracy in the detection of the four types of learning emotions was 86.3%. It should be noted that the most important and recurrent emotions while studying were engagement and confusion. In the words of the authors: “Experiments indicated the superiority of emotion-aware over non-emotion-aware with a performance increase of 91%”. Therefore being aware of the emotions helps students to improve their performance through the improvement of their learning process.

(Burguillo, 2010) introduces the concept of *Competition-based Learning* (CnBL) through a framework for using *game theory tournaments* for the implementation of CnBL platforms. It is suggested that the combination of game theory with friendly competitions provides motivation.

Students’ results in the competition are not related to class grades. Their performance in the competition is only used to obtain extra points and does not affect them negatively. This is used as positive reinforcement to make students compete for these extra points. Collaboration is encouraged in the competition but there are no tools to support it.
The research was conducted a long time before publication of the study (ten years before) and the data collected was used by the authors. Interesting outcomes are:

- CnBL does not create overload in the learning environment from a teacher or student perspective.
- However, it does involve overload for the teacher the first time this strategy is implemented in the laboratory.
- It is modifiable to a certain degree when adapted to other subjects or courses.

The authors highlight that CnBL can easily be integrated into other learning techniques, thus complementing them. Although competitions give rise to ethical issues about applying these techniques in educational environments, research shows positive results. A number of experiments have been conducted to consider competitive games in programming to promote learning in secondary and higher education, (Lawrence, 2004), (Wallace, 2007), (Ebner, 2007) and (Ribeiro, 2009).

The main contribution is the framework for implementing game theory tournaments, and to support competition-based learning.

In (Lee, 2010), the authors reviewed a large body of literature about educational, social and cognitive psychology looking for links to K-12 academic performance. The four major categories identified during this study were: learning strategies, student engagement, social-familiar influences and school climate. The first two were categorized as personal factors and the last two as social-contextual factors.

The following psychological constructs can be highlighted:

- Learning strategies, which involve cognition, metacognition and behaviours.
- Student engagement, which consists of behavioural, cognitive, and emotional components.
- Social-familial influences, which can be exerted by motivation, affect, and behaviours of parents and peers.
- School climate, which includes cognition, metacognition, motivation, and affection of school community members.

The intention of the study conducted by (Paechter, 2010), was to obtain a general view of expectations and experiences that students had while using e-Learning platforms. Some 60% of the student participants interviewed claimed to use e-Learning platforms sometimes or frequently.

“Which aspects of e-Learning do students consider important for their learning achievements and course satisfaction?” This question was answered by 2196 students from 29 universities in Austria. Students’ evaluation in four fields and their relationship with the course outcomes were investigated. These four fields were: course structure, interaction between instructor and students, interaction with peer students and individual learning.

Expectations and students’ achievement goals were positive predictors for success. Instructor’s expertise and involvement was the best predictor for course satisfaction and learning achievement.

The main results obtained can be seen in Figure 2-9. These results are related to satisfaction, personal competence, knowledge, skills and media competence.
This research underlines that the main characteristics of an e-Learning course and learning behaviours are important for performance, achievements and satisfaction. In students’ perceptions the instructor was a key factor; counselling and support was especially important in order to facilitate the construction of knowledge, media competence and satisfaction.

To conclude, in the words of the authors: “In our study, two aspects contribute strongly to learning achievements and course satisfaction: students’ achievement goals and the instructor. Students who considered gains in competencies as especially important, experienced higher achievements. Furthermore, the results of our study emphasize the instructor’s expertise and role as a counsellor and facilitator in learning. The instructor does not become less important in e-Learning”.

The negative impact of Instant Messaging (IM) on students’ performance is highlighted in (Junco, 2011 B). Although several studies had previously been conducted on the relationship between technologies, multitasking and performance, in this study the authors’ intention is to validate these results with a larger sample. The survey was emailed to 38,345 students. The final number of participants who answered was 4,491.

College students responded to a Web-based survey on technology usage in order to analyse how IM and multitasking affect educational outcomes. Information overload was one of the main focuses of this research.

Results show that students use instant messaging frequently on several platforms, and multitask while using IM: Over half of them reported that IM had negative effects on their educational outcomes. As the main conclusion authors highlight the negative relationship between IM and the academic performance.

The relationship between online participation and e-Learning performance is analysed in (Huang, 2012). Learning style is one of the predictors taken into account when analysing learning performance. The authors propose and test a model for the relationship between learning style and e-Learning performance and the moderating effects of prior knowledge.
Data about online participation was extracted from the students’ academic records (a function offered by the e-Learning platform that was used). Data were evaluated by means of several indicators as: number of discussion board posts, number of file views, session duration and total number of pages read. This participation was classified into two dimensions: active participation and passive participation.

The results (see figure below) show that the sensory dimension of learning style predicts performance through online participation. However, in other types of learning styles, online participation does not affect performance.

Figure 2-10 Coefficients of the final model

In the words of the authors: “An important practical implication of these findings is the possibility that students’ e-Learning performance could be enhanced by improving online participation. Although it is difficult to determine the degree of influence of the mediating construct, educational institutions should take action to boost students’ online participation in e-Learning courses”.

The positive effects of playing video games are analysed in (Ventura, 2012). These positive effects are supported when specific questions about styles of video gameplay and additional variables and outcomes are studied.

GPA, video gameplay, video game genre preference and personality are analysed in an online study with university students. The participants self-reported their GPA and personality. They were also asked three questions regarding styles of video gameplay:

- The average time spent playing video games per week (looking for habitual players)
- The second one was for selective players; total time spent playing their favourite video game.
- The last one, the number of different video games played in a year was asked, focused on the diverse style of players.

The sample group comprised 319 students; a total of 252 completed the survey sent by email. The mean age of the students was 23. Students who had a selective player style had better GPAs than students who were low in this style of playing. Habitual players showed lower levels of conscientiousness than non-habitual ones. Students with a high level of diverse style showed higher openness scores. The results were modelled within the positive implications. The relationship proposed can be seen in the figure below:
In the words of the authors: “This study sheds light on some of the positive effects of playing video games when more specific questions are asked about styles of video gameplay and additional outcome variables are investigated (e.g., personality). Students with medium levels of selective player style have higher GPAs compared to students with low selective style”.

The impact of Digital storytelling (DST) on academic achievement is explored in (Yang, 2012). Academic achievement, critical thinking and learning motivation were the important points taken into account. The study was conducted with senior High School students who were learning English as a foreign language.

A one-year study with 110 10th-grade students was conducted in two English classes. The authors used a control group and an experimental group. A pre-test and a post-test were designed for the research to compare results between the control and the experimental groups. The model proposed for their research can be seen in Figure 2-12.

It was concluded that DST participants had significantly better performance than the ones in the control group. These results were analysed in terms of English achievement, critical thinking and learning motivation. The results after personal interviews highlight the important role of DST, instructor and students. DST increased students’ understanding of the course, engagement and ability to think critically.

The three different types of analytical data based on forum activity are:

- Quantitative information, statistical information.
- Qualitative information, evaluation or score of the content given by the teacher.
- Social networks information, relationships between students.

Forum participation indicators used:
- Messages: number of messages written by the student (quantitative).
- Threads: number of new threads created by the student (quantitative).
- Words: number of words written by the student (quantitative).
- Sentences: number of sentences written by the student (quantitative).
- Reads: number of messages read on the forum by the student (quantitative).
- Time: total time, in minutes, spent on forum by the student (quantitative).
- AvgScoreMsg: average score on the instructor’s evaluation of the student’s messages (qualitative).

Centrality and prestige are measures of the importance of an actor in a social network (Aggarwal, 2011). Central actors are those that are widely linked or involved with other actors; they could be considered leaders. Prestige is a more refined type of measurement than centrality. The authors claim that this could be used for identifying hub and authority students (see figure below).

![Figure 2-13 Hub and authority node/student]

The models to predict fail and pass scores can be seen in the figure below:

<table>
<thead>
<tr>
<th>First Model, value PASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Messages &gt; 4]: 50 =&gt; [FinalMarkCourse = PASS]: 50 conf: (1)</td>
</tr>
<tr>
<td>[Words &gt; 285]: 45 =&gt; [FinalMarkCourse = PASS]: 45 conf: (1)</td>
</tr>
<tr>
<td>[Prestige &gt; 0.010]: 43 =&gt; [FinalMarkCourse = =PASS]: 43 conf: (1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Second Model, value FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Words &lt;= 18]: 28 =&gt; [FinalMarkCourse = FAIL]: 28 conf: (1)</td>
</tr>
<tr>
<td>[Messages &lt;= 1]: 27 =&gt; [FinalMarkCourse = FAIL]: 27 conf: (1)</td>
</tr>
<tr>
<td>[Words &lt;= 18, Centrality &lt;= 0.054]: 24 =&gt; [Mark = FAIL]: 24 conf: (1)</td>
</tr>
<tr>
<td>[Words &lt;= 18, Messages &lt;= 1]: 23 =&gt; [Mark = FAIL]: 23 conf: (1)</td>
</tr>
<tr>
<td>[Words &lt;= 18, AvgScoreMsg = 0]: 23 =&gt; [FinalMarkCourse = FAIL]: 23 conf: (1)</td>
</tr>
</tbody>
</table>

![Figure 2-14 Fail and pass models]

The main findings of this research is that two quantitative measures are the most important to predict the final result of the students. These two items are: the number of messages sent and the number of words written. The two social network measures were the most important to predict final student performance.
The information and strategic Internet skills of secondary students were measured through a performance test (Van Deursen, 2013). Participants had to complete assignments on the Internet. The main Internet skills taken into account were: operational Internet skills, formal Internet skills, information Internet skills and strategic Internet skills.

Some of the research questions were:

- There are no gender differences in information and strategic Internet skills. Results say that there is room for improvement.
- With increasing age, secondary students will possess better information and strategic Internet skills. The most important factor is found to be educational attainment.
- With increasing educational levels, secondary students will possess better information and strategic Internet skills. In this regard, defining search queries is one of the main problems of this group of students.

In the words of the authors: “Overall, the secondary students’ performance calls into question whether they possess a sufficient level of information and strategic skills for using the Internet for homework or school projects”.

The main contribution of research by (Zingaro, 2014) is a measurement of peer learning and instructor–led learning in computer science classes. It is demonstrated that Peer Instruction (PI) is a possible strategy for computer science classes. It reduces failure rates, increases retention and is positively valued by students. Other contributions made in this paper are: (1) Evidence that instructor-led discussion is valuable for all the students regardless of whether they have weak, average or strong skills; (2) Difficult questions are particularly valuable for student learning.

Summary of Outcomes

Half of the papers in or related to this section are related to other sections (relations shown in Table 2-4). The relations are with Sections 2.3.1 OSNs, 2.3.3 Motivation and Engagement and 2.3.4 Games. While 4 articles are related to motivation and engagement and 4 related to OSNs, it could be said that these are the fields most closely related to academic performance when researchers are looking at improving students’ performance.

To end this section on academic performance the main outcomes are listed below:

- Emotions and goals affect student’s academic performance, with emotions being mediators in the link between goals and performance. (Pekrun, 2009).
- Being aware of emotions help students to improve their performance through the improvement of their learning process (Shen, 2009). Engagement and confusion were the most common emotions during the study.
- A framework is proposed for implementing game theory tournaments, and to support competition-based learning (Burguillo, 2010).
- The four major categories identified in this study were: learning strategies, student engagement, social-familiar influences and school climate. (Lee, 2010)
- Two elements have a robust contribution to learning achievements and course satisfaction: students’ achievement goals and the instructor (Paechter, 2010).
- Instant messaging has a negative impact on students’ performance (Junco, 2011 B).
• The possibility that e-Learning performance could be enhanced by improving online participation (Huang 2012).

• Some of the positive effects of playing video games are shown and their relationship to GPA (Ventura, 2012).

• Digital Storytelling to improve learning achievement, critical thinking and motivation (Yang, 2012).

• Forum participation and social measures are useful to predict students’ final performance (Romero C., 2013).

• Secondary students’ performance of information and strategic skills for using the Internet for homework or school projects have room for improvement (Van Deursen, 2013).

• Peer discussion in combination with teacher intervention achieves better results. (Zingaro, 2014)

2.3.3 Motivation and Engagement

An accepted definition for motivation is: “Motivation is a theoretical construct, used to explain behaviour. Motives are hypothetical constructs, used to explain why people do what they do, for example, when they use some strategy to achieve a goal”.

Student engagement occurs, “when students make a psychological investment in learning. They try hard to learn what school offers. They take pride not simply in earning the formal indicators of success (grades), but in understanding the material and incorporating or internalizing it in their lives.”

In Table 2-6 the most relevant works, as they are related to several sections, are presented.

<table>
<thead>
<tr>
<th>Article</th>
<th>Related to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Shen, 2009)</td>
<td>2.3.2 Academic Performance</td>
</tr>
<tr>
<td>(Burguillo, 2010)</td>
<td>2.3.2 Academic Performance; 2.3.4 Games</td>
</tr>
<tr>
<td>(Huang 2010)</td>
<td>2.3.4 Games</td>
</tr>
<tr>
<td>(Huang, 2011)</td>
<td>2.3.4 Games</td>
</tr>
<tr>
<td>(Junco, 2011 A)</td>
<td>2.3.1 OSNs; 2.3.2 Academic Performance</td>
</tr>
<tr>
<td>(Lin, 2011)</td>
<td>2.3.1 OSNs</td>
</tr>
<tr>
<td>(Vos 2011)</td>
<td>2.3.4 Games</td>
</tr>
<tr>
<td>(Junco 2012 A)</td>
<td>2.3.1 OSNs</td>
</tr>
<tr>
<td>(Yang 2012)</td>
<td>2.3.2 Academic Performance</td>
</tr>
</tbody>
</table>

Digital game-based learning (DGBL) and motivation and outcomes are analysed in (Huang, 2010). The limitations of previous studies were: the motivational process in DGBL was not analysed and outcome processing was not taken into account as a possible motivational component.

The authors used the integrative theory of Motivation, Volition and Performance (MVP) (Keller, 2008). The motivational process has been measured by using the Instructional Materials Motivational Survey (IMMS). This scale consists of 36 items: 12 measure attention, 9 measure relevance, 9 confidence and 6 satisfaction.

As a main finding the authors confirm the relationship between the motivational process and the outcome process in DGBL environments. The design of DGBL needs to take into account motivational processing, cognitive impact and extrinsic reward for learners’ motivation.
In the next study, the focus is on the cognitive process while using a game-based learning environment (GBLE) (Huang, 2011). The goal is to analyse how online GBLE might support learner's cognitive process through the use of goal-setting.

A survey was conducted with 144 undergraduate students after independent participation. The MVP theory (Keller, 2008) is used again. Participants’ perceived self-confidence in learning the subject was positive. However, satisfaction was lower than for the rest of the motivational components.

The results for four of the most important characteristics such as attention, relevance, confidence and satisfaction can be seen in the table below:

Table 2-7 ARCS Levels by components

<table>
<thead>
<tr>
<th>ARCS components</th>
<th>Mean score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>5.68</td>
</tr>
<tr>
<td>Relevance</td>
<td>5.51</td>
</tr>
<tr>
<td>Confidence</td>
<td>6.20</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>5.28</td>
</tr>
</tbody>
</table>

In their first study the authors confirm the relationship between the motivational process and the outcomes process. In this case, they confirm the relationship between learners’ motivational process and the cognitive process in online GBLE.

The main finding of (Vos 2011) is that Constructing while learning impacts positively on motivation and the learning process. Two different interactive learning tasks were used to analyse motivation and strategy use while learning.

The study sample comprised 235 participants, all students from four elementary schools in the Netherlands. Students were divided into two groups (almost half and half). One group constructed their own drag and drop game while the other group played an existing drag and drop game.

The positive effects on motivation and deep strategy use were higher for the drag and drop game constructed by the students. Results suggest that constructing is a better way to improve student motivation than just playing. The low complexity level of the games used is suggested as a limitation of the study.

Effectiveness and satisfaction while learning supported by technology is examined in (Hu, 2012). The study sample comprised 652 students taking the target course. (Hu, 2012) propose hypotheses and the research model is presented below:

- H.H2. Learning engagement has a positive effect on learning effectiveness, regardless of the medium of learning.
- H.H 4. The medium of learning moderates the effects of computer self-efficacy on learning engagement.
- H.H 5. The medium of learning moderates the effects of computer self-efficacy on learning effectiveness.
Figure 2-15 Research model

Hypotheses H.H 1, H.H 2 and H.H 3 are supported by their results, while H.H 4 is marginally supported and H.H 5 is not supported. In the words of the authors: “According to our results, technology-mediated learning has a significant effect on students’ engagement in learning activities (i.e., learning engagement); its impact on learning effectiveness seems fully mediated by learning engagement, and its influence on learning satisfaction appears fully mediated by both learning engagement and learning effectiveness. Our results also suggest that educators might improve students’ learning effectiveness and satisfaction in technology-mediated learning by designing systems and using teaching strategies that encourage, facilitate, and reward their active engagement”.

An analysis of social and participation models is conducted in (Vassileva, 2012). The study features an overview of different approaches to promote participation. These approaches come from different fields such as: social psychology, behavioural economics, rewards mechanisms, reputation, open group user modelling and social visualization. The figure below shows a summary of the theories and models presented in the research:

“Super-theories”:
Self-determination theory (competence, autonomy, relatedness) (Deci & Ryan)
Theory of Planned behavior (Aizen)

Needs-based theories:
Maslow’s hierarchy
Alderfer’s ERG theory
Acquired needs theory
Cognitive evaluation (Deci)
Self-efficacy (Bandura)
Goal setting theory

Social, Intrinsic, Extrinsic
Cognitive dissonance (Festinger)
Two-factor theory
Equity theory

Rewards-based:
Reinforcement theory
Expectancy theory

Figure 2-16 A Spectrum of motivation theories in psychology
Following an analysis of possible future influences, the following areas of application were proposed, as can be seen in Figure 2-17.

Regarding the *rewards process* it is worth highlighting: “While it was implicitly assumed that motivational and incentive mechanisms are designed for “good” purposes, nothing prevents their exploitation for commercial purpose”.

![Figure 2-17 Existing and possible future influences between areas](image)

Motivating to get particular behaviours or goals has gained importance in fields such as the design of: online community infrastructures, persuasive systems and learning environments. User modelling can play a key role in these areas.

Based on a 36-question questionnaire on *motivation in e-Learning* the authors of (Gutiérrez, 2013) aimed to identify the items which promote success in e-Learning. Two of the most important *barriers* found during e-Learning are: the progressive *discouragement* process and the *lack of real commitment* to the formative process. Some of their results can be seen in Figure 2-18.

![Figure 2-18 Categories of motivating factors](image)

The most interesting outcomes of this research are:

- How *content* is presented will improve grades and levels of satisfaction.
- Integrating a *motivational system* (egalitarian) will increase engagement and retention.
- *Accessibility* is a key point.
Summary of Outcomes

Several studies are now analysed in order of year of publication. A total of 75% of the papers in or related to this section are also related to other sections (relationships shown in Table 2-6). The relationships are with the following sections: 2.3.1 OSNs, 2.3.2 Academic Performance and 2.3.4 Games. This is the category with the highest percentage of relationships. It could be said that this is currently one of the biggest concerns in education.

To end the motivation and engagement section the main outcomes are listed below:

- The relationship between the motivational process and the outcome process within DGBL environments is confirmed (Huang, 2010)
- The relationship between learners’ motivational process and the cognitive process in online GBLE is confirmed. (Huang, 2011)
- Constructing while learning impacts positively on motivation and the learning process (Vos 2011).
- Technology-mediated learning has a significant effect on student engagement in learning activities (Hu, 2012).
- The importance of motivation for particular behaviours or goals has been recognised in fields such as the design of: online community infrastructures, persuasive systems and learning environments. User modelling can play a key role in these areas (Vassileva, 2012).
- Integrating a motivational system will increase engagement and retention (Gutiérrez, 2013).

2.3.4 Games in Education

An accepted definition for video game is: “an electronic game that involves human interaction with a user interface to generate visual feedback on a video device. The word video in video game traditionally referred to a raster display device, but it now implies any type of display device that can produce two- or three-dimensional images. The electronic systems used to play video games are known as platforms; examples of these are personal computers and video game consoles. These platforms range from large mainframe computers to small handheld devices. Specialized video games such as arcade games, while previously common, have gradually declined in use. Video games have gone on to become an art form and industry”.

Several researches are analysed ordered by year of publication. Although there is a large body of research in this field, only papers related to motivation or education have been selected. In Table 2-8 the most relevant research, as they are related to several sections, is presented.

<table>
<thead>
<tr>
<th>Article</th>
<th>Related to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Burguillo, 2010)</td>
<td>2.3.2 Academic Performance; 2.3.3 Motivation and Engagement</td>
</tr>
<tr>
<td>(Huang 2010)</td>
<td>2.3.3 Motivation and Engagement</td>
</tr>
<tr>
<td>(Huang, 2011)</td>
<td>2.3.3 Motivation and Engagement</td>
</tr>
<tr>
<td>(Vos 2011)</td>
<td>2.3.3 Motivation and Engagement</td>
</tr>
<tr>
<td>(Ventura 2012)</td>
<td>2.3.2 Academic Performance</td>
</tr>
</tbody>
</table>

In (Arnab 2013), the authors aim to find an engaging and pedagogical tool for a didactic approach to relationships and sex education. Their approach is to explore how game technology might facilitate this learning process. The main outcome is called PREPARE (Positive Relationships: Eliminating Coercion and Pressure in Adolescent Relationships).
The design process was guided by the use of the Four-Dimensional Framework of Learning (De Freitas, 2006). The Intervention Mapping approach (Bartholomew, 1998), for health intervention, was used as well. The study sample comprised 505 participants, 253 men and 247 females, ages between 13 and 14 years old. Measurement was conducted using self-report questionnaires.

The research shows positive feedback from most of the classes where it was used. Game play mechanics was developed to achieve engagement and novelty. Teacher participation and student involvement are key factors this type of platform provides for users. In their conclusions the authors underline that the 4DF model (De Freitas, 2006) was crucial to develop a game involving a participatory-driven context.

Gamification is the use of game elements and mechanics in non-game environments. The authors aimed to verify whether gamification can be used in educational environments (Domínguez 2013). The same paper states: “According to (Lee, 2011), games are motivating because of their impact on the cognitive, emotional and social areas of players; and so, gamification in education should also focus on those three areas.”

While designing the platform the main three areas taken into account were:

- The cognitive aspect.
- The emotional aspect. “According to Wang and Sun’s work on game reward systems, there are eight forms of rewards: score systems, experience points, items, resources, achievements, instant feedback messages, plot animations, and game content (Wang & Sun, 2011).”
- The social aspect. Where there are different interactions between users. Cooperative, competitive and social.

Students’ reasons for not using gamified learning (see Table 2-9):

There are positive and negative results. On the negative side, the students following the gamified subject performed worst on written assignments and participated less on class activities. However, on the positive side they got better scores on practical assignments. Also, the initial motivation when using gamification is high. The cognitive impact is not very significant, gamified and non-gamified students performed similarly on overall scores. Although gamification in e-Learning appears to increase student motivation, the authors claimed that achieving this effect requires much effort while designing and implementing the experience.

Table 2-9 Reasons for not using the gamified version

<table>
<thead>
<tr>
<th>Answer</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don’t know about them</td>
<td>9</td>
</tr>
<tr>
<td>I’m not interested in them</td>
<td>6</td>
</tr>
<tr>
<td>I don’t have time to complete the activities</td>
<td>34</td>
</tr>
<tr>
<td>I find technical problems</td>
<td>13</td>
</tr>
<tr>
<td>The system is difficult to use/understand</td>
<td>3</td>
</tr>
<tr>
<td>Other reasons</td>
<td>17</td>
</tr>
</tbody>
</table>

Gamification is again the theme of (Simões, 2013). These authors proposed that education is an area with high potential for applying this concept. They aimed to apply social gamification in education through the creation of a gamification framework to be applied in an existing social learning environment.

They classify game elements into game mechanics and game dynamics pairs, as follows: points-rewards; levels-status; trophies, badges, achievements-achievement; virtual goods self-expression; leaderboards-competition; virtual gifts-altruism.
The structure of the framework is shown below:

![Diagram showing the social gamification framework](image)

**Figure 2-19 Social gamification framework: Context of use**

The gamification framework will help the teacher to:

- Create challenges.
- Set up multiple ways to successfully achieve the same objective.
- Set goals and provide immediate feedback as rewards.
- Choose the proper game mechanics depending on the activity.
- Consider the failure as part of the learning process.
- Allow students to practice different roles, allowing them to explore aspects of their personality.
- Recognition of the student progress by peers.
- Use competition to promote positive behaviours.

These functionalities have been added to an existing social learning platform: schooolss.com (Schooolss, 2014).

<table>
<thead>
<tr>
<th>User</th>
<th>Gamification features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>- Receive immediate feedback and rewards when performing learning activities</td>
</tr>
<tr>
<td></td>
<td>- Reward peers and appraise their academic achievements</td>
</tr>
<tr>
<td></td>
<td>- Publish academic achievements in the private social network’s personal profile</td>
</tr>
<tr>
<td></td>
<td>- Share and gift rewards to other students</td>
</tr>
<tr>
<td></td>
<td>- Build teams with other students to accomplish a task</td>
</tr>
<tr>
<td></td>
<td>- Notification of other students’ achievements</td>
</tr>
<tr>
<td></td>
<td>- Invite other students to perform an activity</td>
</tr>
</tbody>
</table>
Teachers

- Create, manage and assess gamified learning project using the existing tools and the new gamification tools
- Recognize and reward students’ work (with intangible rewards like badges, points, trophies or with some tangible goods)
- Access statistics about student’s progress and achievements
- Notification of students’ achievements: comment on those achievements

Parents/relatives

- Recognize and reward their children’s work
- Get recognition and rewards for involvement and participation in the platform
- Notification of other parents or relatives’ achievements
- Invite other parents/relatives to participate

Even after creating the new gamified functionalities (shown in the table above), schoool.com has not, as yet, been validated. However, the authors intend to validate it through the participation of students, parents and teachers (the three main actors in educational environments).

The main objective of the study by (Allaire, 2013) was to underscore the social differences (well-being, depression, affect, and social functioning) between adults who play digital games and those who do not. The study sample analysed comprised 140 adults with a mean age of 77.5 years. Participants were divided into three groups: non-gamers, occasional and regular-gamers. The regular gamers performed better (on average) in all the social behaviours analysed.

While most previous studies have focused on cognitive functioning and the learning associated with the benefits of video gaming, in this research the focus was on psychological and social behaviours.

The most interesting outcome of this research is that findings suggest that playing digital games is positively related to successful aging. The study shows the impact of ICT on social behaviours in the offline world. Results can be seen in Figure 2-20 (Allaire, 2013).

The authors concluded their work suggests this positive impact on offline life produced by digital gaming could be wider-ranging than previously thought. It is worth noting that occasional gamers have good results and if this means they have more time for other kind of activities not covered in the study they could achieve better social-outcomes than regular gamers.
Summary of Outcomes

A total of 55.6% of the papers in or related to this section are also related to other sections (relationships shown in Table 2-8). The relationships are to Sections 2.3.2 Academic Performance and 2.3.3 Motivation and Engagement. It should be noted that there are no relationships to Section 2.3.1 OSNs, even though there are studies that link both worlds. This could be because both are used in similar ways in the field of education, therefore researchers chose one or another, but not both at the same time.

To end the Games section, the main outcomes are listed below:

- Positive feedback from most of the classes where they were used (Arnab 2013).
- Students following the gamified subject performed worse on written assignments and participated less in class activities. However, the positive side is that they achieved better scores in practical assignments. Also, the initial motivation when using gamification is high. (Domínguez 2013)
- A social gamification framework that can be integrated into social learning sites (Simões, 2013)
- There is a positive impact on offline life produced by digital gaming which could be wider-ranging than previously thought (Allaire, 2013).

2.3.5 Miscellaneous

This section presents papers whose focus is close to the objectives of this thesis, but which are not strongly related to educational environments. Several studies are analysed in order of year of publication.

Analysing and identifying factors that affect the *sociability of social software* is the focus of (Gao, 2010). The authors do this from the user perspective. A first study with 35 users was conducted and seven important factors for social software design emerged. The second step was a survey where 246 participants had to rank ten popular Web social platforms based on these factors. Their initial hypothesis is shown in the figure below:

![Hypothesized relationship](image)

**Figure 2-21 Hypothesized relationship**
Results show that social climate, people, benefits and purposes, self-presentation, interaction richness and support for formal interaction are factors impacting on the sociability perception of final users. An interesting analysis of the factors influencing online social interactions can be seen in the table below:

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Factors/items influencing online interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>To identify a set of minimum conditions for a virtual community</td>
<td>Interactivity, communicators, sustained membership, virtual space</td>
</tr>
<tr>
<td>To identify basic factors necessary to become an online community</td>
<td>Clear purposes of visitors, flexible and small-scale places, members’ role, leadership of community moderators, online/offline events</td>
</tr>
<tr>
<td>To identify factors which affect individual’s decision to join a virtual community</td>
<td>Technology factors: infrastructure and service issues, Internet-specific and general computing issues, Motivation factors: users’ perception of benefits, user conservatism, and resistance to change, Task factors: the perceived appropriateness of using technology to support their communication, System factors: the fit between users’ traditional ways of doing things and that of the virtual community</td>
</tr>
<tr>
<td>To propose strategies for successful online community development</td>
<td>Member development, community asset management, community relationship management</td>
</tr>
<tr>
<td>To improve the success of online communities</td>
<td>People: people interacting with each other, measured by the number of participants, the type of participants, the roles participants plays, their ages, gender, expertise and special needs, etc. Purpose: a shared focus of interests, measured by the number of messages, the kinds of messages, interactivity, reciprocity, quality of contributions, etc.</td>
</tr>
</tbody>
</table>

An analysis of the effects surrounding e-Learning in professionals was conducted in (Ho, 2010). Attitudes towards computers are the key point of the study. While other studies have focused on effectiveness and benefits of e-Learning platforms, this study aims to analyse the effect of users’ attitudes. The study sample comprised 239 participants from 50 technological companies located in Taiwan.

The three research hypotheses in (Gao, 2010) are:

- G.H1: Computer attitude positively influences flow experience
- G.H2: Computer attitude positively influences learning outcomes
- G.H3: Flow experience positively influences learning outcomes

In the words of the authors: “Computer attitude has a positive direct influence on both flow experience and learning outcome (G.H1 and G.H2 are supported). Secondly, the learners’ flow experience of e-Learning has a positive and direct impact on their learning outcome as well (G.H3 is supported). Thirdly, the results also show that the indirect effect of computer attitude on learning outcome (through experience of flow, G.H1 and G.H3) is greater than the direct effect of computer attitude on learning outcome (G.H2)”.

The Family Story Play system is presented in (Raffle, 2010). This system helps family to read books together with their children over the Internet. It is designed to support communication over a distance and across generations if necessary. The interface is designed to allow child participation during the reading experience. It combines a paper book, video conference technology, sensor-enhanced frame and video content of Sesame Street Muppet.
The results show that the system improves child engagement during long-distance communication and increases participation and interaction between family members who are separated by distance. This research addresses the hypothesis that a long distance family can have an important role in child education.

Learning leadership through a simulated environment is the focus of (Siewiorek, 2012). Game simulation has many possibilities for active learning. In this study, authors use a simulated environment to facilitate the emergence of leadership skills while playing as teams inside the simulator.

Simulated sessions provide students with beneficial opportunities for the development or practice of leadership skills. A group of N=41 multicultural graduate business students participated. The participants played the game in virtual teams. The data analysed was based on team’s observations during the game and reflective essays written after the sessions.

In the words of the authors: “The results indicate that in the business simulation gaming environment, certain leadership characteristics emerged spontaneously. Experiences about leadership varied between the teams and were dependent on the role individual students had in their team. However, it can be concluded that simulation gaming environment has the potential to be used in higher education to exercise the leadership skills relevant in real-world work contexts”.

Their study provides an interesting leadership-style classification, which is shown below:

**Table 2-12 Leadership-style classification**

<table>
<thead>
<tr>
<th>Type</th>
<th>Gamification features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transactional</td>
<td>• Cost-benefit exchange between leaders and their followers</td>
</tr>
<tr>
<td></td>
<td>• Contingent rewards</td>
</tr>
<tr>
<td></td>
<td>• Active management by exception</td>
</tr>
<tr>
<td>Transformational</td>
<td>• Inspiring and stimulating followers</td>
</tr>
<tr>
<td></td>
<td>• Idealized influence</td>
</tr>
<tr>
<td></td>
<td>• Inspirational motivation</td>
</tr>
<tr>
<td></td>
<td>• Intellectual stimulation</td>
</tr>
<tr>
<td></td>
<td>• Individual consideration</td>
</tr>
<tr>
<td>Heroic</td>
<td>• Omnipotence</td>
</tr>
<tr>
<td></td>
<td>• Rightness</td>
</tr>
<tr>
<td></td>
<td>• Face-saving</td>
</tr>
<tr>
<td></td>
<td>• Co-dependency</td>
</tr>
<tr>
<td>Heroic Authoritarian</td>
<td>• High degree of control</td>
</tr>
<tr>
<td></td>
<td>• Leader determines all policies, activity steps and work tasks—gives orders</td>
</tr>
<tr>
<td></td>
<td>• No active group participation, leader mostly makes decisions alone</td>
</tr>
<tr>
<td>Heroic Coercive</td>
<td>• Leader demands immediate compliance with his orders</td>
</tr>
<tr>
<td></td>
<td>• Leaders dictates each step taken</td>
</tr>
<tr>
<td></td>
<td>• Drive to achieve, initiate, self-control</td>
</tr>
<tr>
<td>Post-heroic</td>
<td>• Empowerment of members</td>
</tr>
<tr>
<td></td>
<td>• Risk taking</td>
</tr>
<tr>
<td></td>
<td>• Participation</td>
</tr>
<tr>
<td></td>
<td>• Development of members</td>
</tr>
</tbody>
</table>
The relationship between scholarly practice and participatory technologies is explored in (Veletsianos, 2012). The authors discuss how these technologies are used to create a new form of scholarship they call Networked Participatory Scholarship (NPS). Techno-cultural emergent pressures and influence on higher education students are discussed. They highlight how new tools associated with participatory technologies facilitate changes in social and cultural behaviours.

The term Networked Participatory Scholarship (NPS) is defined as: “the emergent practice of scholars’ use of participatory technologies and online social networks to share, reflect upon, critique, improve, validate, and further their scholarship”.

(Keller, 2013) analyses the relationship between the Big Five personality (Goldberg, 1992) dimensions and five types of online impressions (within courses) such as: engagement, overall evaluation, value to career, anxiety/frustration, and preference for online courses.

Two hundred and fifty online students participated; ages ranged from 19 to 57. Assessment was conducted using the 50 question version of the Big-Five factor structure.

Results show that conscientiousness is the most important and consistent predictor of individual’s impressions of online courses. Undergraduates showed greater preference for online courses than graduate students. Married students reported lower anxiety/frustration with online courses.

In (Warlaumont, 2013) Learning Reinforcement (for a machine) is shown through vocalization. Social reinforcement shapes the vocalizations produce by infants. A neural network model for vocal learning is provided within this research. If vocalization meets certain criteria it is reinforced and the parameters are adjusted to make similar muscle activations.

As a main outcome, the model presented confirms that reinforcement is important in human vocalization development. This new approach combines selective reinforcement with self-organization.

**Summary of Outcomes**

The main outcomes of this section are listed below:

- Social climate, people, benefits and purposes, self-presentation, interaction richness and support for formal interaction are the factors that impact the sociability perception of final users (Gao, 2010).
- The effect of personal computer attitude is enhanced in learning outcomes through experience of flow in e-Learning environments (Ho, 2010).
- This system improves child engagement during long-distance communication and increases participation and interaction between family members separated by distance (Raffle, 2010).
• Learning leadership through a simulated environment is a possibility for students to improve leadership skills (Siewiorek, 2012).
• The term Networked Participatory Scholarship (NPS) is defined (Veletsianos, 2012).
• Conscientiousness is the most important and consistent predictor of individual’s impressions of online courses (Keller, 2013).
• A model is presented to verify how reinforcement is important in human vocalization development (Warlaumont, 2013).

2.4 Conclusions

This chapter has described the main fields related to the work presented in this thesis: e-Learning, Online Social Networks and Social Research in Educational Environments.

An important question emerges at the end of this chapter, which is: *Are social skills less important than academic performance, motivation, engagement etc.?* While most of the research analysed in Section 2.3 shows a relation with these social skills, just one of the studies (Siewiorek, 2012) focuses on providing users with leadership experience. However, although the study has this focus, it does not create a specific tool or activity for teaching/learning these skills, rather the authors just leave the participants to work in groups in order for leadership skills to emerge naturally.

The intention is for the summaries of outcomes in Section 2.3 to be used as map for future steps. They are the basis of this research since they represent current trends and discoveries in the fields related to the goals of the thesis.

The initial hypotheses are supported by several studies presented in Section 2.3. There now follows a list with each hypothesis (defined in Section 1.3) and its support:

**H1. Students’ online social interactions play a significant role on information systems used in educational environments.**

• Social factors had the most significant impact on the intention to use. OSN use is also related to social presence (Cheung, 2011).
• There is evidence for the associations between social media use and personality traits (Zhong, 2011).
• Personality traits are shown to be correlated to patterns of social network use (Bachrach, 2012).
• Social offline behaviours are demonstrated to have an impact on online activity and behaviour (Abell, 2014).
• Two aspects contribute strongly to learning achievements and course satisfaction: students’ achievement goals and the instructor (Paechter, 2010).
• The possibility that e-Learning performance could be enhanced by improving online participation (Huang 2012). (Support H2).
• Forum participation and social measures are useful to predict students’ final performance (Romero C., 2013). (Support H2).
• Peer discussion combined with teacher intervention enhances results. (Zingaro, 2014)
• Social climate, people, benefits and purposes, self-presentation, interaction richness and support for formal interaction are the factors that affect the perception of sociability of end users (Gao, 2010).
• Learning leadership through a simulated environment is a possibility for students to improve leadership skills (Siewiorek, 2012).
H2. ICT impact on educational environments should be monitored and analysed.

- Microblogging besides being a new means of communication, can be used to support the informal learning process (Ebner, 2010).
- Open Network Learning Environments (ONLE) are presented in (Blocher, 2012).
- A framework for implementing game theory tournaments, and supporting competition-based learning is presented in (Burguillo, 2010).
- The four major categories identified in this study were: learning strategies, student engagement, social-familiar influences and school climate. (Lee, 2010)
- Twitter can enhance student engagement and improve grades (college students) (Junco, 2011 A). (Support H3)
- The use of Internet and Facebook in certain ways leads to better psychosocial outcomes. Twitter use leads to better academic outcomes (Junco 2012 A). (Support H3)
- Some of the positive effects of playing video games and the relationship with GPAs are shown (Ventura, 2012). (Support H3)
- Digital Storytelling to improve learning achievement, critical thinking and motivation (Yang, 2012). (Support H3)
- Secondary students’ performance of information and strategic skills for using the Internet for homework or school projects have room for improvement (Van Deursen, 2013)
- The relationship between learners’ motivational process and the cognitive process within online GBLE is confirmed. (Huang, 2011). (Support H3).
- Technology-mediated learning has a significant effect on students’ engagement in learning activities (Hu, 2012).
- Broadly speaking, Facebook users reported worst GPAs than non-users (Kirschner 2010). Non-users also spend more hours per week studying. Academic performance is negatively related to Facebook use.
- Time spent on Facebook was strongly and negatively related to GPA while weakly related to time spent preparing for class (Junco 2012 B).
- Students who accessed Facebook one or more times during the short study period (15 minutes) had lower GPAs (Rosen, 2013).
- Instant messaging has a negative impact on students’ performance (Junco, 2011 B).

H3. It is possible to use new technologies, specifically Online Social Networks, to improve academic outcomes.

- Emotions and goals affect student’s academic performance, with emotions being mediators in the link between goals and performance. (Pekrun, 2009).
- Being aware of emotions helps students to improve their performance through the improvement of their learning process (Shen, 2009). Engagement and confusion were the most common emotions during the study.
- The relationship between the motivational process and the outcome process in DGBL environments is confirmed. (Huang, 2010)
- Constructing while learning impacts positively on motivation and the learning process (Vos 2011).
• Motivating to achieve particular behaviours or goals has gained importance in fields such as the design of: online community infrastructures, persuasive systems and learning environments. User modelling can play a key role in these areas (Vassileva, 2012).

• Integrating a motivational system will increase engagement and retention (Gutiérrez, 2013).

• Students who followed the gamified subject performed worse on written assignments and participated less in class activities. However, on the positive side they obtained better scores in practical assignments. In addition, initial motivation when using gamification is high. (Dominguez 2013)

• A social gamification framework that can be integrated into social learning sites (Simões, 2013)

• There is a positive impact on offline life produced by digital gaming which could be wider-ranging than was originally thought (Allaire, 2013).

• This system improves child engagement during long-distance communication and increases participation and interaction between family members who are separated by distance (Raffle, 2010).

Some ideas or outcomes from the research analysed support more than one hypothesis. This means that these three hypotheses are connected. The figure below shows these relationships and in which part of the research these relationships are found.

![Hypotheses visual representation](image)

**Figure 2-22 Hypotheses visual representation**

Different social ICT approaches in educational environments have been shown in this last section. This research has helped to find ways to solve social deficits detected educational environments by using Online Social Networks. The aim is to take advantage of one of the most popular ICT environments, in order to support the most important actor in the educational system: the student.

Therefore, following this systematic review of the available literature, it can be concluded that the three initial hypotheses are validated by the research presented in this chapter: In addition, goal (G1) to study and analyse the impact of ICT on education, has been achieved. The next chapters focuses on successfully accomplishing the remaining research goals.
Chapter 3
Researching from the Inside

One privilege that the author had during his research was to experience educational settings as a High School teacher. Teachers have one of the most important roles in education, so all the information presented in this chapter, is from an educator’s perspective.

This chapter intends to achieve research goal (G2) to carry out field studies to get a better approach to educational environments. Moreover, it highlights some of the gaps found in the research field of this thesis. First, the fieldwork conducted during the first two years is presented. Second, the analysis of the three different local education systems is presented. Third, AgileMind is presented as a case study: it is the main content ICT resources for the subjects of Science and Mathematics in one of the educational environments analysed. Finally, the conclusions bring the chapter to an end.

3.1 Fieldwork

During this section the first steps of the fieldwork research are presented. This initial work helped to guide and take decisions during the research process. For a better understanding of this process, Table 3-1 shows the activities that took place by academic year.

The main objective of these fieldworks was to obtained information about the real state of ICT and concretely the state of the use of Online Social Networks in secondary education environments. To accomplish it students (Section 3.1.1 and 3.1.3), parents (Section 3.1.1) and teachers (Section 3.2.2) participated in volunteer activities that took place in different educative environments. Regarding procedure,
it was similar in all the fieldworks, first the activities were planned and it was offer to the educative community, second activities were developed, third gather data during and after the sessions of the activity. Finalizing the process by writing down the results, analysing and discussing them.

The first talks (Section 3.1.1) started during the academic year 2009/2010. During the following academic year the first work group (Section 3.1.2) was created. The talks were maintained, but with other approaches such as talks for parents. And during that year some Edmodo tests were also done (Section 3.1.3). Finally during 2011/2012 a second work group was created, the talks continued and a final data analysis and publication of results took place (Fardoun, 2012-D). The results and data collected during the activities from Sections 3.1.1 and 3.1.2 are presented in Section 3.1.3.

Table 3-1 Fieldwork activities by academic year

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>First Talks (3.1.1)</td>
<td>Talks (3.1.1)</td>
<td>Talks (3.1.1)</td>
<td></td>
</tr>
<tr>
<td>First Work Group (3.1.2)</td>
<td>Second Work Group (3.1.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edmodo Test (3.1.3)</td>
<td>Data Analysis and Publication (3.1.3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.1.1 Talks

The first idea was to collect information about teenagers’ OSN use. The most important results are presented in Section 3.1.3. The talks started in the first High School were the author worked. What started as data collection became a general talk for all the students in the High School, since the head teacher and counsellors wanted all the students to be aware of the problems related to OSNs. Figure 3-1 shows one of these talks where the students were watching a video about privacy.

![Figure 3-1 OSN talks in High School classes](image)

The general structure of the talks was as follows: first, the students completed an anonymous questionnaire about their use of OSNs. This made the students begin to think about how they use these tools. The talk then started.

Tuenti was the OSN we spoke about, as it was the OSN that most of the students were using at that time. The problems related to the use of these platforms were discussed and some videos were shown.
Before starting each talk a questionnaire was given to each student, in order to collect data without giving them previous knowledge about what was wrong or right regarding OSNs. At the end of each academic year, the results were submitted to the Counselling team of the High School in order to inform them of possible risks or issues arising from their students’ use of OSNs.

Some of the initial questions in these questionnaires were:

- Do you have Tuenti?
- How long have you been using Tuenti?
- How many friends do you have on Tuenti?
- How many hours a day do you spend on Tuenti?
- Have you ever been subject to harassment on Tuenti?
- Have your parents ever asked you about your Online Social Networks? Are they interested in how you use them?
- Do you have Facebook?

The most important results and the data analysis conducted regarding these questionnaires are presented in Section 3.1.3.

One of the most important aspects was to discuss sharing private information in private messages, and not on the board or in groups. Figure 3-2 shows an example of misuse of OSNs, where someone is inviting a friend to a party and is writing the address and time on his public board, so uninvited people could possibly attend. These talks usually showed real examples to make the students think about real problems related to their offline life.

![Figure 3-2 OSN misuse](image)

The talks ended by sharing opinions and answering students’ questions about the topic. Other problematic subjects discussed included, for example, sharing phone numbers on public timelines.

The main talks conducted from 2010 to 2012 were:

- Talk in Iniesta (Spain), to all the students in the High School and parents.
- Talk in Mota del Cuervo (Spain), to all the secondary students in the High School.
- Talk in Minglanilla (Spain), to the classes of 4th E.S.O. (Compulsory Secondary Education)
- Talk in Herencia (Spain), to 5th and 6th primary students and parents.
3.1.2 Work Groups

This section presents part of the work carried out during two consecutive academic years in work groups at High Schools. Scenario: The work groups in Castilla-La Mancha are groups of teachers receiving training formation in a field they are interested in. One of the teachers usually leads this training.

The author of the thesis was in charge of leading two work groups in two different schools. There follows a summary of the main aspects:

2010-11 Online Social Networks Work Group

The participants were all teachers from the same High School (N=9), most of whom were computer science teacher, which led the group to pursue complex and challenging objectives.

The objectives of this work group were:

- To collect news and information about OSNs.
- To acquire or create material (related to OSNs) for the classroom.
- To create guidelines for the use of OSNs at the school.
- To give talks on OSNs to the students of the school (Section 3.1.1).
- To create questionnaires to detect OSN-related problems in the school (presented in Section 3.1.3).
- To analyse the questionnaires (presented in Section 3.1.3).
- To collect all the information related to the ICT platforms used by the teachers and provided by the administration (presented in Section 3.2.1).
- The outcomes and the work carried out was considered sufficiently innovative for the group to be invited to a regional workshop to present their work to other teachers were working on other innovative activities.

2011-12 Online Social Networks and tools 2.0 in the classroom Work Group

The participants were almost all the teachers from the school (N=8), but it was a different kind of group to the first work group. There was just one computer science teacher, the group leader. This led to the group being more about teachers learning and sharing. However, it did not create as many outputs as the first one.

The objectives of this work group were:

- To acquire or create updated material about OSNs.
- To improve teacher-student communication; the school was an adult-learning centre and some students were working and had less time to go to the centre to pick up the material.
- To understand and learn about the most used Web 2.0 tools for educative environments.

The experience of these work groups allowed the author to understand the reality for teacher in the field of ICT, especially in the second group, which was more heterogeneous than the first one (where most of the participants were computer science teachers). The reality is that there is a generation gap in the use of the new technologies among teachers as well. Younger teachers usually have better ICT skills, while older teachers usually have more problems with ICT.

The main results obtained in these work groups are presented in the next sections of this chapter.
3.1.3 Students’ use of Online Social Networks

This section presents a field study, which reflects the widespread use of new technologies and Social Networks by High School students. All data were collected during talks (Section 3.1.1), group work (Section 3.1.2) and tests implemented during the academic years of 2009/2010, 2010/2011 and 2011/2012. It also highlights a set of advantages for their application in teaching. The field study is focused on Tuenti and Facebook. First, we present the results obtained through an anonymous questionnaire given at three schools in the Autonomous Community of Castilla-La Mancha, Spain (two secondary schools and one primary school). Next, we discuss the main findings of this field study conducted over the last two academic years and applied to 445 students (381 secondary and 64 primary). This information was published in (Fardoun, 2012-D).

Anonymous questionnaires on the use of Social Networks

First we address the results of talks in secondary education (12 to 18 years, questionnaires to students from 1º to 4º of E.S.O):

In the 2009/2010 academic year, 282 questionnaires were completed by students. A total of 88% were found to use the online social network Tuenti. It should be noted that according to Spanish law it is illegal for children under 14 to use this network. However, the surveys were conducted at the beginning of 2010 and 44.7% of the respondents were born in 1996 and 1997. Taking this into account, a total of 86.7% of these minors were registered on the social network Tuenti and were thus violating its terms of use.

From this 88% of the students using the Tuenti social network, we were able to extract interesting findings, such as: the average number of "friends" on students’ profiles is 198.9. The average time spent connected to the Tuenti social network is 1 and a half hours a day. With regard to Facebook, we found 43.4% of respondents were registered on this social network.

We can highlight that of the 88% of respondents who used the social network Tuenti, 61% of them had been connected to the social network for more than one year and 70% had more than 140 "friends".

![Figure 3-3 Hours per day using Tuenti, course 2010 / 2011](image)

A total of 17.2% reported spending 3 hours a day using Tuenti (Figure 3-3 left). However, with regard to harassment, the data is not too worrying with only 3% having felt bullied at some point. With regard to Facebook, 63% of the students were registered, and the average number of friends was smaller than on Tuenti. The most alarming finding, which was not taken into consideration in the study conducted in the previous academic year, is regards whether parents are concerned about what their children do when using
Positive Reinforcement Social Networks

OSNs (Figure 3-4 left). An affirmative response was given by 55% of parents. This indicates that 45% of parents are not interested and do not ask their children about why they use these new communication environments.

![Figure 3-4 Interest of parents in the use of ONSs, course 2.010/11](image)

For primary education, the questionnaires were presented to 64 students in various classes in year 5 and 6 of the primary school, during the academic year 2011. We obtained the following results: 43.5% of students used Tuenti, which is a very high number, given that Spanish law prohibits use of these Social Networks by minors. Furthermore, 52% of parents worry about what their children do on OSNs (Figure 3-4 right), a slightly lower percentage than for parents of secondary students. This slight difference would probably be because some of the children were not yet interested in registering on OSNs. Statistics showed that 1.8% of respondents felt harassed when using OSNs. Finally, we found that the number of "friends" and hours of use per day is significantly lower than the results obtained in secondary education. Only 25% have more than 140 "friends" and 68% spend less than an hour online per day (Figure 3-3 right).

We can say that this trend of interaction through online Social Networks will continue in the future as new generations make greater use of these networks as they are already an important part of their lives.

Analysis results of anonymous questionnaires on Social Networks

The reason for this analysis is that there are many cases in which students do not use online Social Networks because of parental control, and also because Spanish law does not allow access to such services for under 14-year-olds.

After analysing this data, we can say that it is obvious where adolescents spend their time and what habits they have. Therefore, use of these networks as an educational tool by students who have a deep knowledge of them and make use of them in their free time can raise motivation levels in certain subjects. Although the learning curve of using educational tools would be very quick, it would not reach level demonstrated in their use of Social Networks.

Edmodo in a real environment

This section describes an empirical research performed using Edmodo. The sample comprised a group of 20 students in the Information Technology and Communication class in the first year of Baccalaureate, and 38 students in the Year 4 secondary class of Computers during the months of February and March 2011. With regard to the students of first year of Baccalaureate, the following can be highlighted: Using skilled tasks dedicated to
learning on the platform, there was informal communication between student-teacher and student-student. It was also proposed to share information with the rest of the year group. The study was very successful. Teachers were offered the option of working with students using Edmodo. Only 14.3% seemed interested and responded positively (a possible weakness of this type of platform is that some teachers feel unprepared or uninterested).

We conducted a survey with students, obtaining the following data: Is it interesting to use OSNs for educational purposes? 68.75% answered yes, 25% No and 6.25% indifferent. Would you like to work with Edmodo in other subjects? 66.7% said yes, 33.3% indifferent and 0% No. Finally, we highlight three pieces of data: 95% of students participated in Edmodo, 70% actively and continuously (at least one publication a week), and 50% of students used the platform in non-lecture hours.

The results obtained in year 4 of secondary were not as positive as those in first year of Baccalaureate as the use by students was not as expected and their collaboration proved to be far below expectations. While Baccalaureate students added all kinds of news and discussed them with classmates in an educated way, secondary students just uploaded contents to the wall of Edmodo when requested to do so by the teacher. Considering the data in this section, the low participation of year 4 secondary students was unexpected. What is the main problem? The difference in age is just one year. Year 4 of secondary education is compulsory education while Baccalaureate is not.

As a consequence of this field research, the next year five teachers used Edmodo in their classes. Despite the results, year 4 secondary students wanted to use the new tools in their lessons. In this process we are learning how to teach using these new platforms provided by research in e-Learning.

**Other High Schools a Click Away**

In addition to what was mentioned in the previous section, work with Edmodo was conducted with two first year of Baccalaureate classes in two different High Schools in Castilla-La Mancha. A new Edmodo group was created and was supervised by two teachers (one in each High School). A set of rules of good use was established. If not followed, teachers could use the option “reader” for students with bad behaviour. The group comprised 41 students in the Information Technology and Communication class of first year of Baccalaureate. Students were allowed to choose a name for the group so as to feel a sense of identification. The main use was to share news and discuss technology between students from both High Schools. The High School students who had been working longer with Edmodo were more active while their counterparts from the other school were less so (with certain exceptions).

Perhaps this extra motivation of being able to interact with peers from another part of their region, was what allowed us to obtain better results with these Baccalaureate students.

**Conclusions**

A possible future improvement could be to use counters to warn parents and teachers about overuse of ICT platforms by students. Some important data were obtained from questionnaires: A large amount of parents did not ask about what their children were doing on OSNs. The majority of students now use OSNs. An ICT platform, which works similarly to OSNs is easy for students to learn to use. Almost 70% of the sample answered positively about the use of OSNs in educational environments.

The parental control features available on Edmodo were not analysed. It would be interesting to analyse and make a formal proposal on the possible forms of parental control. With the data presented above, it can
be said that the use of OSNs in educational environments can be positive. Implementation of OSNs as an educational tool takes time and requires commitment from the teaching team.

### 3.2 Overview: ICT platforms in different educative environments

In this section an overview of the ICT platforms used in two different educational systems is presented: Castilla-La Mancha (Spain) and Texas (United States). Another system is touched on briefly (Solola, Guatemala). This analysis comes from the inside, based on the author’s work in these educative environments. The figure below shows when the analyses were conducted.

The main objective of these fieldworks was to obtained information about the use of ICT platforms in different educative systems. The participants were teachers who used the platforms. Regarding procedure, it was similar in the three different educative systems, first talk with teachers who may help in the process, second gather data during as long as possible period of time. Finalizing the process by writing down the results (Sections 3.2.1, 3.2.2 and 3.2.3) and analysing and discussing them (Section 3.2.4).

![Figure 3-5](image_url)  
**Figure 3-5 Educational environments analysed**

#### 3.2.1 Castilla-La Mancha, Spain

This section presents the main ICT possibilities available to the teachers provided by the administration in Castilla-La Mancha between 2009 and 2012.

Table 3-2 shows the main ICT-related platforms and programs used in primary and secondary education in the Spanish region of Castilla-La Mancha.

<table>
<thead>
<tr>
<th>Name</th>
<th>Objective/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphos</td>
<td>Academic Administration</td>
</tr>
<tr>
<td>Papas 2.0</td>
<td>Academic Administration and family, students, teachers communication</td>
</tr>
<tr>
<td>Papas PDA</td>
<td>Academic Administration and family, students, teachers communication</td>
</tr>
<tr>
<td>Web IES</td>
<td>Communication</td>
</tr>
<tr>
<td>PDC Generator</td>
<td>Didactic program generator by competencies</td>
</tr>
<tr>
<td>Escuela 2.0</td>
<td>ICT integration in educational environments. Each student is provided with a laptop. It is not implemented in year groups, and not in all schools.</td>
</tr>
<tr>
<td>EduBlogs</td>
<td>Website which allows information sharing between teachers. It contains education-related blogs from around the region</td>
</tr>
</tbody>
</table>
Cuadernia 2.0 Tool for creating digital materials and sharing them with the community

Intranet JCCM for Teachers An Intranet were teachers have access to different information and functionalities regarding their professional career as employees of the Regional Educational Authority.

The table below shows the Online Social Networks and learning process functionalities or activities implemented in public and private platforms used by teachers.

Table 3-3 also provides an analysis of some of the platforms listed in Table 3-2. First, the tools provided by the administration are analysed; later private platforms will also be analysed. Some of the functionalities considered are: communication (public and private), curriculum, classroom activities, evaluation and tutoring.

<table>
<thead>
<tr>
<th>Table 3-3 Features analysis of the main public platforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functionality</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Is a private platform?</td>
</tr>
<tr>
<td>Communication</td>
</tr>
<tr>
<td>Teacher-Student Messages</td>
</tr>
<tr>
<td>Teacher-Family Messages</td>
</tr>
<tr>
<td>Teacher-Teacher Messages</td>
</tr>
<tr>
<td>Email Alerts</td>
</tr>
<tr>
<td>Internal Board for teachers</td>
</tr>
<tr>
<td>A forum for each class</td>
</tr>
<tr>
<td>Chat</td>
</tr>
<tr>
<td>General board</td>
</tr>
<tr>
<td>Blogs</td>
</tr>
<tr>
<td>Work day calendar</td>
</tr>
<tr>
<td>Curriculum</td>
</tr>
<tr>
<td>Publishing resources</td>
</tr>
<tr>
<td>Topics covered by subject</td>
</tr>
<tr>
<td>Subject descriptions</td>
</tr>
<tr>
<td>Classroom Activities</td>
</tr>
<tr>
<td>Private Agenda</td>
</tr>
<tr>
<td>Students’ Attendance</td>
</tr>
<tr>
<td>Justified Attendance</td>
</tr>
<tr>
<td>Documents</td>
</tr>
<tr>
<td>Consulting Attendance</td>
</tr>
<tr>
<td>Attendance Summary</td>
</tr>
<tr>
<td>Communicating a future absence</td>
</tr>
<tr>
<td>Generating Attendance pdfs</td>
</tr>
<tr>
<td>Upload class material</td>
</tr>
<tr>
<td>Create Assignments</td>
</tr>
<tr>
<td>Create Online Assignments</td>
</tr>
<tr>
<td>Consult Tasks</td>
</tr>
</tbody>
</table>
The most special case presented in the tables above is Cuadernia. This is an excellent tool for teachers to create and share digital resources for their classes. Although it does not allow structuring a complete subject on the platform, the platform is similar to a digital library. However, Cuadernia does not implement communication channels or Online Social Networks features within the application. For that reason it is not analysed in Table 3-3. While Cuadernia is the most relevant tool for supporting the learning process inside the classroom, the remaining platforms cannot be used to guide or support teaching.

“Aula Virtual Papas 2.0” is the most complete tool provided by the administration. It covers almost all the functionalities that are analysed. The main problem found while trying to use it is that many of the students did not know their username and password, so the teacher had to request them. It was, however, a newly implemented tool (running since 2011).

Edmodo was clearly more appropriate than Facebook and Twitter for supporting the learning process in class.

Thus, it can be concluded that there was a lack of platforms for learning, provided by the administration in Castilla-La Mancha. By contrast, a good number of these platforms are provided in the Texas system described in Section 3.2.3.

### 3.2.2 Solola, Guatemala

During the summer of 2011 the author spent the summer as a volunteer teacher at a High School in Atitlan (Solola, Guatemala). The findings of this experience in the Guatemalan educational system are described below. The volunteer program was run by *Educación por un Mundo Igualitario y Sostenible* (EMIS), (Education for an Egalitarian and Sustainable World).

The author’s task during this period was to help train teachers at the Teacher Training Centre (created a few years before). The author also observed and mentored other teachers from the region who were teaching computing.
There was no Internet at the school, but there was a computer lab with sixteen computers. Students were mainly learning to use the Office package and offline encyclopaedias (previously installed on computers).

Clearly, there are parts of our world where students do not have as many possibilities as others. However, it is also true that there were not as many discipline issues as in the other two first-world systems described in this chapter.

In view of this section the main question, which remains unanswered, and which should be addressed in future works and research is: How is it possible to use ICT in places where the Internet is not available?

A related question is: How is it possible to continue the learning process in communities that have been victims of a natural disaster and still do not have good communication networks (no, or low, accessibility to the Internet)?

### 3.2.3 Texas, United States

An analysis of the Texan educational environment was conducted and is presented below. An ICT program used in one independent school district in the state of Texas is analysed. It is taken as a specific scenario guiding the research process.

From August 2012 to June 2015 the author of this thesis taught Mathematics in a Texan High School. This led to the main perspective of this analysis, to summarize what are the main ICT platforms used by an educator during the academic year.

Table 3-4 shows a summary of the ICT platforms presented in this section and includes a short description.

<table>
<thead>
<tr>
<th>Name</th>
<th>Objective/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAC (Teacher/Student Access Centre)</td>
<td>Academic Administration. Attendance, grading, consulting students’ personal information etc. Student can login into the same system but with a different interface to check their grades and attendance</td>
</tr>
<tr>
<td>DMAC</td>
<td>Academic data analysis and support, local and state level</td>
</tr>
<tr>
<td>Substitute Smart Find Express System</td>
<td>This system allows teachers to call for substitutes if they are going to be unable to give class. The teacher can add a description and a file with work for the students</td>
</tr>
<tr>
<td>High School Website</td>
<td>Communication, pictures, contact information etc.</td>
</tr>
<tr>
<td>ERO, Electronic Register Online</td>
<td>To keep track of training for teachers and their lifelong training, evaluation of training, calendars and teacher’s reports on past training</td>
</tr>
<tr>
<td>AgileMind</td>
<td>A platform focusing on equity and high achievement in mathematics and science</td>
</tr>
<tr>
<td>Employee Access Centre</td>
<td>On this platform employees can consult all human resource information, payslips, data etc.</td>
</tr>
<tr>
<td>MCREl Evaluation Tool</td>
<td>This platform supports the teacher evaluation process conducted by administrators</td>
</tr>
</tbody>
</table>

While some of these tools are used on a daily basis, such as: TAC, the High School website and Agile Mind, other tools are just used as necessary.
The analysis of Agile Mind is covered in Section 3.3, because it deserves a more complete analysis as the tool that helps the teacher during the teaching-learning process.

The Teacher access centre (TAC) is equivalent to DELPHOS. Both High School websites have equivalent functionalities. The other platforms are not related to the kind of functionalities analysed within Table 3-3. However, important aspects or needs regarding the Texan educational system are covered by the other platforms in Table 3-4. Some of these platforms do not have an equivalent in the Castilla-La Mancha system or are not the responsibility of the teacher as is the case of the substitute calling system. In the Texas district this is responsibility of the teacher, while in Castilla-La Mancha other teachers cover the teacher who is absent (for short periods). For long periods of absence the administration is responsible for naming the replacement. The platforms which do not exist in the system in Castilla-La Mancha are analysed below.

In most schools in Spain, when a teacher is absent, a colleague at the same school covers for him or her. Consequently, an electronic system for substituting teachers is not required.

The American educational system includes many sports and extra-curricular activities in the daily life of their schools. Therefore, there are more absences than in Spain, where these activities are usually after class.

Figure 3-6 Substitute smart find express system

Figure 3-6 shows the user interface for requesting a substitute teacher. The teacher can add a description and electronic files for the substitute to use during the absence. Teachers have to introduce the work absence, the system automatically begins to call the substitute teachers at 6 A.M.

Next, Figure 3-7 shows DMAC (DMAC, 2014), DMAC describes itself on its website as follows:

“DMAC offers a suite of Web-based tools developed at the Region 7 Education Service Centre. The applications provided by DMAC exist to supply Texas educators with the tools and services necessary to develop and improve the quality of education provided to students.”

“Our software is developed and maintained entirely in-house by a team of software engineers and education content specialists. Support and training for our software is also provided by DMAC and a network of regional partners. For this reason, DMAC Solutions really is software designed for educators by educators.”
This platform can be used for: data disaggregation, local assessments, student achievement, progress monitoring, curriculum mapping and planning. Some of these functionalities can be found in Figure 3-7.

![DMAC teacher home page](image)

**Figure 3-7 DMAC teacher home page**

It is important for teachers to know students’ past academic performance, shown in Figure 3-8. The teacher can choose to see the local (school district) results or the state results (STAAR). The results of the core content subjects are shown for each student in their profile.

Regular teachers have access to their students’ profile, while administrators and counsellors have access to all their High School students’ profiles.

Figure 3-8 shows the different grades obtained by a student from 2012 to 2014. The subjects recorded by the system are: Mathematics, English, Reading, Writing, Social Science and Science. The graphs provided by the application help to understand the past and present performance of an individual student. For example the Social Science teacher might need to know a student’s previous assessment.

![DMAC student portfolio example](image)

**Figure 3-8 DMAC student portfolio example**

Being able to analyse huge amounts of data is one of the best functionalities on DMAC. Figure 3-9 shows the webpage for generating instructional reports.
Some of the most important characteristics or options the teacher has when creating this reports are:

- The report could be at district or campus level, or teacher, group or even student level, which facilitates the understanding of the different groups.

- Reports can be filtered by demographics (Figure 3-9 left central part)

- All the tests, the data for which is on the platform, can be consulted, even last year’s tests. It is highly useful when, for example, in the case of a student who did not pass the Mathematics state test last year. DMAC allows the teacher to consult the grades and see who was close to passing and to know the students that need more help.

- A huge variety of reports are provided by the system, including item analysis, item analysis by demographic, reporting category comparison, student reporting category performance, student quintile, student responses etc. The complete list is shown in Figure 3-9 (bottom right-hand section).
Figure 3-10 shows the McRel teacher evaluation home page. All teachers are evaluated by their administrators every year. This tool supports this process. The most important elements of the platform are: self-assessment, observation(s), the professional development plan and the summary evaluation rating.

In addition, the tool provides a list of the recorded activities carried out by or for a user. This makes it easier for the user to search for a specific event, deadline or document.

**Teachers' Trainings**

Some concepts which guide teacher training in Texas are presented below:

Which is most effective? (1) Laptops for all/Smart boards in every classroom. (2) Common, Content-rich curriculum. (3) Any among the hundreds of Math/literacy “programs”. (4) Differentiated instruction. (5) Smaller groups. (6) Cold calling (and other “check for understanding”). (7) Various small/school-within-a-school “Academies”. (8) 90-120 minutes of purposeful reading & writing per day. (9) “Turnaround” strategies (new faculty; school design, etc.). (10) Cognitive/concept mapping; graphic representations.

Figure 3-11 (Hattie, 2003) shows the enormous importance of teachers in the achievement percentage of their students:

![Figure 3-11 Percentage of achievement variance](image)

Figure 3-11 highlights one of the keys to this research, the main actors to improve educational environments are students and teachers, in this order.

The platform supporting school district training is called ERO (Electronic Registrar Online), the teacher home page of which is shown in Figure 3-12. The most important functionalities regarding this system are listed below:

- Consult the trainings calendar
- Consult the user transcripts; all the training performed by the user.
- Create a personal training plan.
- Evaluate past training
- Consult the personal training schedule
Figure 3-12 Electronic register online tool home page

Figure 3-13 shows an example of a teacher’s transcripts from the previous academic year, automatically recorded by the platform.

Figure 3-13 Training transcript

### 3.2.4 Comparing Education Systems

This section presents a comparison of the information presented in the different parts of Section 3.2. The table below shows a comparison between Castilla-La Mancha and Texas ICT platforms. Solola has not been taken into account (for this comparison) as it is a special case.

Some of these platforms (Table 3-5) are discussed and compared below:

**Table 3-5 ICT platforms: Castilla-La Mancha versus Texas**

<table>
<thead>
<tr>
<th></th>
<th>Castilla-La Mancha</th>
<th>Texas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delphos</td>
<td>Teacher/Student Access Centre</td>
<td></td>
</tr>
<tr>
<td>Papas 2.0</td>
<td>Teacher/Student Access Centre</td>
<td></td>
</tr>
<tr>
<td>Papas PDA</td>
<td>Teacher/Student Access Centre</td>
<td></td>
</tr>
<tr>
<td>High School Web</td>
<td>High School Web</td>
<td></td>
</tr>
<tr>
<td>PDC Generator</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Escuela 2.0</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>EduBlogs</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>
While PAPAS 2.0 (Castilla-La Mancha) includes a large amount of communication functionalities for teachers and families, these functionalities have not been implemented yet by systems analysed in Texas. Both systems use webpages for their schools. Both use Web platforms for attendance and grades.

Regarding training for teachers, the Texas system is much more effective, with two platforms devoted to this: McRel for teacher evaluation and ERO for registering and obtaining transcripts for the training performed by the teachers. Castilla-La Mancha teachers have other ICT platforms but none provided by the Castilla-La Mancha administration.

Teachers in the Texas system have greater access to data analysis and its important possibilities as they have access to DMAC, a tool to facilitate the data analysis process. This is required in Texas school districts as they have standard tests for their students. In Castilla-La Mancha, however, there is only one standard test, which is the same one for all Spanish regions; the University Entrance Exam called Selectividad.

Nevertheless, Castilla-La Mancha has more tools for communication purposes. Depending on the needs of the educational systems detected by administration, the teachers have access to different kinds of ICT platforms.

As an educational more similar ICT platform to Edmodo, Castilla-La Mancha has PAPAS 2.0 and Aula Virtual PAPAS 2.0, while Texas school districts use their teacher access centre to inform parents and students about assignments but the communication between them is more limited. In addition, AgileMind is used for assignments and regular mathematics and science classes.

This section has reviewed the most important ICT platforms used by teachers in Texas school districts. Next, Agile Mind, a platform deserving a more in-depth analysis, is presented.

### 3.3 Agile Mind: A Case Study

This section analyses a tool, that is a mix between ebook and LCMS, widely used in the United States for High School classes in Science and Mathematics. Of all the tools presented in Section 3.2, this one has been selected because due to a history of successful implementation. The use of this ICT platform has had a positive impact on measurable academic performance (Section 3.3).

#### 3.3.1 Description

Agile Mind (Agile Mind, 2014) was founded to enhance opportunities for learning. It focuses on equity and high achievement in Mathematics and Science because of their importance to both the lives of students and to the future of their nation (United States).
Agile Mind describes its strong points as follows:

- **Proven Results:** Help students, schools, and districts meet and exceed expectations in mathematics and science. See the facts.
- **Transform the Teaching and Learning of Mathematics and Science:** Agile Mind dramatically improves achievement in middle and high schools by fostering classrooms that embrace engagement, collaboration, and perseverance.
- **Every Teacher at the Heart of Instruction:** Agile Mind’s online programs keep the teacher squarely at the centre of instruction, supported by the highest calibre curriculum, assessments, and professional development.
- **Comprehensive Connected. Classroom-based:** Agile Mind mathematics and science programs include comprehensive classroom lessons and planning tools, student activities, quizzes, feedback, and more.
- **Motivation, Self-Belief, and Productive Persistence:** Academic Youth Development weaves lessons in non-cognitive skills with mathematical problem-solving, resulting in improved student engagement and achievement.

The process for the teacher to implement when using this platform is shown in Figure 3-14:

![Figure 3-14 Key elements of the Charlotte Danielson framework](image)

Agile Mind states that the four strong points of (Danielson, 2007) Danielson Framework are covered by its platform. These four points are:

- Planning for successful teaching.
- Creating a productive classroom environment.
- Improving Instruction.
- Meeting professional responsibilities.

### 3.3.2 Platform

During the following paragraphs several parts of the platform are discussed. Each school district using the platform has its own domain. It enables using the school district students’ IDs for the login process.

A typical Agile Mind “slide” has an animation: It is presented in sequence so the students can easily understand the main mathematical concepts related to the topic. Animations are one of the strong points of the system. They can be played as many times as necessary until everyone understands the concept.

Another important part is professional support on the application. This professional support can be consulted for each topic in a course. The main parts of the professional support section are:
- **Prepare instruction**, which has the following sections: goals and objectives, topic at a glance, prerequisite skills, resources and language support.

- **Deliver instruction**, each instructional block (1 hour of instruction) is composed of Agile Mind materials, opening the lesson, framing questions, lesson activities and further questions.

- **Activity sheets**, where the activity sheets for the students and the key for these activities can be found in order to be used by the teacher during e instruction.

The teacher has three main possibilities for interacting with the students:

- **Announcement**, something the teacher needs to tell to the students.

- **Assignment**, the teacher can select a number of slides from one or several topics and send the task with a start and finish time. The students can access this task in the computer lab with the teacher or from home.

- **Quiz**, a number of questions can be selected and sent to the students as a Quiz. The teacher can monitor the process and check the results at the end.

The results can be analysed by student and question, after or during a quiz or a test session. This is very useful when there are students who are behind and accessing these data in real time helps the teacher to help them.

The system has a tack feature in order to allow teachers, students and administrators to see the number of hours teachers spend preparing their material (professional support) or teaching a subject (course content), how many assignments or quizzes have been assigned by the teacher and the last date of access to a certain course.

There are other types of reports that can be generated by using this tool: class reports, assignment reports, quiz reports, teacher’s usage by course, teacher’s topic breakdown, student’s reports etc.

Teachers can create and edit their own tests, which can be private, public to the campus or public to the district. They can share the tests they have done at school, district or campus level or choose not to share them by making them private. A drawback of the test list is that is ordered alphabetically and can be very extensive. There are no filter options, which makes it complicated to locate a specific test.

Although the platform is complete, there is an issue that needs to be highlighted; some functions are “hidden”, which makes them difficult for users to find.

### 3.3.3 Case Study of Agile Mind

The Agile Mind website claims that: “Agile Mind’s system for teaching and learning, developed in collaboration with some of the nation’s leading experts in STEM education (Science, Technology, Engineering and Mathematics), supports key research-based concepts of teacher effectiveness that have been demonstrated to contribute to significant gains in student learning.”

The main objective of this case study was to obtained information about how the use of an ICT platform for Mathematics and Science class may impact academic results in secondary education environments. The use of this platform was compulsory for a cohort of approximately 400 students and their 9 Mathematics and Science teachers (in one Texan High School). Regarding procedure, first a study of the platform was realized (Sections 3.3.1 and 3.3.2). Second the academic year started, almost at the end students took a state exam of these two subjects and finally results come up. Due the importance of the process, as these results affect the evaluation of the High School there were not access to all data about the process,
there was access only to public information. Finally results, analysis and discussion are shown in the following paragraphs.

It would have been useful for this section to have had access to more results, and also results from other school districts. A data petition was sent to Agile Mind but no reply was received. Consequently, access to data was only available from a single High School.

Furthermore, there are other factors which should have been considered, but for which data are not easily accessible, so the results shown below cannot be explained only on the basis of Agile Mind use. This includes data such as previous years’ grades for each year group, data on changes of teachers, etc. Other important information that should be taken into account refers to trainings carried out by teachers over the last two academic years which could have impacted on their teaching styles or resources.

Although, as previously mentioned, these results have limitations, they provide evidence that the selection of ICT platforms in educational environments impact on academic performance.

Figure 3-15 shows that after intensive use of Agile Mind (it was previously used as only a secondary tool) and even more intensive use during the academic year 2013-14 in one of the district High Schools, growth totalled 19% in Algebra I and 16% in Biology. These are two of the most important state tests in Texas, and which High Schools are evaluated in accordance with.

![Figure 3-15 Biology and algebra I STAAR growth](image)

Is this growth in students passes the result of using Agile Mind, or could there be other reasons? The ICT platform previously used was more a repository with material for the teacher to download and use than an e-Learning platform for the students, which is the case of Agile Mind. Hence, Agile Mind must logically be one of the many reasons which might have led to this improvement. In order to have a more robust answer, access to all raw data and experimental research with a control group and an experimental group is needed.

### 3.4 Conclusions

This chapter has presented fieldwork on OSNs (Section 3.1). Educational environments from three different countries have been analysed from a teacher’s perspective (Section 3.2). The tools analysed are mostly the ones provided by the authorities and the ones teachers are obligated to use on a daily basis. Finally, a case study on AgileMind, with measurable results, was conducted (Section 3.3). The main conclusions are listed below.
As important outcomes of the fieldworks carried out from 2009 to 2012, the following are worth highlighting:

- A large number of parents did not ask their child what they used OSNs for.
- The majority of students now use OSNs. It is noted that an ICT platform in a similar format to OSNs would be easy for students to learn to use.
- Almost 70% of students were positive about the use of OSNs in educational environments.
- In Edmodo tests, almost half of the students used the platform during non-class time. This means that they were spending time using a tool related to their academic life rather than using other personal OSNs.

Taking into account that the system in Castilla-La Mancha was analysed before the last two years, new tools or platforms could have been implemented in the educational educative system. Solola was not been taken into account for this comparison due to its special nature. Comparing Castilla-La Mancha and Texas, the most important conclusions are:

- While PAPAS 2.0 (Castilla-La Mancha) includes a large amount of communication functionalities for teachers and families, these functionalities have not been implemented yet in the Texas system analysed.
- Regarding training for teachers the Texas system is more effective as it has two platforms in this regard; McRel for teacher evaluation and ERO for registering and generating transcripts for the training carried out by teachers. Castilla-La Mancha teachers have access to other ICT platforms but these are not provided by the Castilla-La Mancha administration.
- Both systems use webpages for their schools. Both use Web platforms for attendance and grades.
- Teachers in Texas have greater access to data analysis and its important possibilities since they have access to DMAC, a tool which facilitates the data analysis process. This is required in Texas school districts as they have standard tests for their students. In Castilla-La Mancha, however, there is only one standard test that is the same one for all Spanish regions; the University Entrance Exam called Selectividad.
- Nevertheless, Castilla-La Mancha has more tools for communication purposes. Depending on the needs of the educational systems detected by the administration, the teachers have access to different kinds of ICT platforms.
- As an educational ICT platform more similar to Edmodo, Castilla-La Mancha has PAPAS 2.0 and Aula Virtual PAPAS 2.0, while Texas school districts use their teacher access centre to inform parents and students about assignments but the communication between them is more limited. In addition, AgileMind is used for assignments and regular Maths and science classes.

While AgileMind appears to be an excellent tool for teachers and students and the results presented are very positive, there is a notable lack of data which is required to determine whether it really has a wide-ranging positive effect on academic performance. Statistical analysis could have made this possible if access to raw data had provided, but this was not the case. The case study (Section 3.3) notes that not many elements are measurable from the teacher perspective. Could the teacher’s role be facilitated by providing tools for monitoring and measuring different aspects related to the academic environments?

One of the main obstacles found during this research from inside has been that for a regular teacher it is very difficult to obtain private information. Even when information is requested for research purposes the educational authorities are not very cooperative.

Another important conclusion is that the administration provides basic ICT platforms for general use and teachers are responsible for choosing extra technology to adapt their classes to students’ needs. Both have responsibilities related to the selection of ICT platforms.
However, the most important conclusion is that goal (G2) *to carry out field studies to get a better approach to educational environments*, was achieved. These field studies analysed teacher and student perspectives. Educational environments from different countries were examined and finally, a case study was presented to highlight the current importance of ICT platforms in education. Regarding the thesis hypotheses, this chapter supports H2 *ICT impact on educational environments should be monitored and analysed.*
Chapter 4
Tweacher: First Results and Early Conclusions

There is currently a wide range of tools online for teaching. Teachers can use general Web platforms for their teaching. These online tools include newspapers, blogs, wikis, online office packages, e-Learning platforms, Online Social Networks (Facebook and Twitter) etc.

However, the focus of this research is on tools specifically designed for educational environments. In order to achieve the first results and not only have the support of data from previous research, the following process is implemented: first, Edmodo, an online educational social network used by teachers, is presented. This is followed by an analysis of Edmodo in order to identify weaknesses that may help in the implementation of a new platform. There follows a presentation of Tweacher, one of the first creations of this research. This implementation, followed by the testing process, helps to collect interesting data and draw early conclusions. The chapter ends with an analysis of the results of Tweacher (tested in a Spanish High School), and a summary of early conclusions.

This chapter is focused on (G3) to develop early prototypes to get initial results in education. Furthermore, a deeper understanding of this type of systems and the extraction of the first data and conclusions will be expected from the work presented in this chapter. This represents a turning point, a before and after Tweacher (Romero, 2013).
4.1 Edmodo

Edmodo (Edmodo, 2014), the user interface of which is shown in Figure 4-1, is an online social network specifically designed and created for educational environments. The following paragraphs describe the implemented functionalities, the non-implemented ones and its weaknesses.

Although Edmodo was previously briefly presented in Section 2.1.3 and some of the fieldwork related to the platform was conducted during the fieldwork presented in the previous chapter (Section 3.1.3), in this section it is analysed from the perspective of facilitating the implementation of a new platform: Tweacher. In this fieldwork 48 K-12 students from the same High School participated in the first activities while a total of 41 students from two different High Schools were involved in the second activity. These two activities highlight that Edmodo was positively accepted by students and represents the first milestone in our developmental process.

It might be thought that Edmodo focuses on informal education. However, it also has all the features required for basic academic education; data, tests, tasks etc. of a subject can be managed on this platform.
Regarding the visual interface, it is important to note that it closely resembles two of the most popular OSNs, Tuenti (in Spain, which now has, in fact, decreased in popularity) and Facebook. The similar visual aspects of these three platforms are shown in Figure 4-2.

4.1.1 Analysing Edmodo

This OSN includes three roles: teachers, students (who need a code to join the class) and parents (who need a parent’s code to monitor their child). When a new user joins the platform, they have to choose their role. The teacher interface is similar to the student one. However, teachers have extra functionalities required to manage their classes and groups.

After joining Edmodo, the next step for teachers is to create their class groups. Each of these groups has a number of functionalities such as: the configuration can be changed, the members of the group can be seen, the RSSs (RSS, 2014) of the group can be read, the group can be marked as inactive and finally, if necessary, the group can be deleted.

It is worth highlighting two teacher functions included within the ones mentioned in the previous paragraph:

- In the changing the group configuration section, there is an option where the group code can be consulted or/and changed if necessary. This code is used by students to join the class created by the teacher.

- Regarding the RSSs of the group, the teacher can decide which comments or information shared can be uploaded to the public area of the RSSs. This means that if a teacher thinks it could be useful to share information publically, it can be done. Each class has its own RSS.

Deeper analysis of the group “Members” section shows one group can have one or more teachers, and there are specific roles for the students. To avoid problems when this tool is used in class there is a “read only student role”, which teachers can assign, permanently or temporally, to students who are not using the tool properly. The members’ page provides the option of changing a student’s password, consulting the parental code of each student so as to give it to the parents and the option of deleting users.

The board is the main channel for communication. Each user has a board and so does each group. An example of communication is shown in Figure 4-3. In order to send a private message to someone the user needs to write his/her name or the group’s name if the message is for a group. The messages for groups are public for all the group members. The user name or group name must be written in the to whom section.

![Figure 4-3 Communication example](attachment:image.png)
The teacher has six options when wanting to communicate something with the class: message, alert, assignment (or task), quiz, pool and snapshot (these options can be seen in Figure 4-3). An URL or a file can be added to these communication items.

The communication options for the students are more limited than the teacher’s options. The students have just the message option, from where they can send public messages to the group or private messages to the teacher. The students cannot send private messages to one another, but the teacher is able to monitor all the comments made by students.

As in most ONSs, Edmodo has a section which shows the last time the user logged in on the platform. The content seen by the teacher can be filtered by: subject or group, alerts, assignments, quizzes, polls or snapshots.

Students and teachers have access to a calendar, depending on the classes they have, they will see the key dates for their assignments. This calendar is a highly effective tool for planning and organize a class or a group.

Regarding file sharing there are two different options. The teacher, who can share material by folders with one or several classes, and the student, who has the backpack option, with a space of 100 MB to save their files or class work.

Students can create their own folders, although these folders cannot be shared with their peers. Students can also navigate between the folders that a teacher has assigned to each of the classes they teach.

The user profile pages (if a connection is shared with this user), provides access to the user’s public activity, as well as connections with other OSN users. In the case of students, they can see their classes, classmates and teachers.

Lastly, the professional connectivity between teachers and merits are shown in Figure 4-5. The most important features are:

- **Connections** (bottom left Figure 4-5), where connections with other teachers can be consulted.
- **Merits** (bottom central Figure 4-5), where the merits obtained by using Edmodo are displayed. In the example in the figure, the teacher has seven merits. One of them is a connection hub, which means the teacher has more than 20 connections with other teachers.
- **General information** (top central section, Figure 4-5), general information is shared, such as current school, the number of students, teacher connections, library items and the sharing score.

![Figure 4-4 Teacher’s professional profile on Edmodo](image-url)
All these functionalities and others are shown in Figure 4-4 (Haro, 2011).

![Figure 4-5 Analysis diagram of Edmodo functionalities](image)

### 4.1.2 Weaknesses and non implemented features

This section discusses the weaknesses and non-implemented features of Edmodo. Some of the weaknesses inspired the design of Tweacher.

Regarding communication, one of the functionalities not implemented is private messaging between students, it could be interpreted as a way to avoid students wasting time. It does not have a chat tool either, although most major OSNs have one (for example Facebook).

There are no picture-oriented features, no tags for pictures, no albums either, as is the case on other Social Networks. Edmodo allows working with almost any kind of file, but tagging is not implemented. Teachers and students are able to share files with their classes.

There is no a page where the structure or the overview of a subject can be consulted. This can create more problems for students wanting to consult class materials. However, Edmodo does facilitate the informal education process. The content, files or materials of a class are on its board, with the only option of filtering results by type (alert, message, assignment, pool etc.). There is no section where the general view of a subject can be consulted.

It would, therefore, be useful to have an outline or a diagram for each subject, as, for example, Moodle has. This would give the teacher the opportunity to keep all the material organized in chapters or topics. It would also be easier if students wanted to get the whole picture of the subject.
The backpack feature, where students can save files which cannot be consulted by the teacher could be considered a weak point, as students could use it to save inappropriate files.

In summary, there are two main weak points of Edmodo as an online social network and as e-Learning platform. The implementation of these features could considerably enhance this type of system. They are:

- Private messages between students
- A page where the structure and all the information of each subject can be consulted.

As an OSN, Edmodo resembles Facebook, while the tool to be described in the following section is more similar to Twitter. Hence, a chat tool could be redundant in the design of a micro-blogging-oriented tool, where minimalism and simplicity are the keys.

4.2 Tweacher Design and Implementation

The process of creation of Tweacher (Romero, 2013) is presented in this section. First, the decision making process is discussed, second, it is defined, and third, the implementation process is described. Finally, the platform is presented. As was said before to accomplish G3 was the objective of the work presented in this chapter, and Tweacher is the tool that will give us our own initial results in an education environment.

4.2.1 Decision Making

The following paragraphs describe the most important ideas and considerations taken into account during design and implementation of Tweacher.

There are two types of OSN integration in educational environments: vertical and horizontal. As an example, Twitter is a horizontal integration, a OSN used to share general information, which, in some classrooms, is used as an educational tool to keep students informed of the latest news. Sometimes, students also need to follow a profile to access material or participate in a certain class or subject. There are also OSNs which have been created with a solely educational focus: these sites have specific information-sharing tools. These are vertical OSNs, where a group is created by the teachers and the students share educational information (class materials, task calendar, assignments, grades, etc.). Edmodo is an example of this kind of OSN. In horizontal integration, all users (students and teachers) have the same type of user profile and features. By contrast, vertical integration differentiates between features for teachers and features for students.

A social application for educational use has been designed; Tweacher. The starting point of the tool is micro-blogging to which LMS functionalities are added, such as: joining subjects, managing tasks done by the students, grading and a board with the announcements and course material, etc.

The main advantages of micro-blogging are the short texts, which eliminate superfluous information and the irrelevant content. As regards privacy, it is a not invasive media; the user can share just what is necessary. It brings students and teachers closer together in an informal manner. It helps students to improve their capacity for synthesis while writing as they need to put the information in under one hundred and forty characters.

A story competition is an example of a possible class activity example for the use of a micro-blogging application in educational settings. The literature teacher encourages the students to participate in the contest in order to improve their creative and summarising capacities.
One of the most important elements of Tweacher is student-teacher communication, as well as teacher-teacher communication. It is a social network, so the different types of users need to have functionalities for sending private or public messages to other individuals or to the groups they belong to. Furthermore, the teacher needs the option of restricting communication between students who have been problematic in the groups where this teacher is the creator.

Lastly, a non-centralized model for the platform is used, where each school centre can install its own Tweacher platform and use it for communication and the learning process without having to be concerned about outside interferences. Similarly to other LMSs, such as Moodle, each school has the platform on a server and the students and teachers can access this platform to interact with the OSN.

Regarding the main differences between Tweacher and Edmodo, the communication model in Facebook or Edmodo for nested messages, is not replicated by Tweacher, so the messages cannot be answered in a hierarchical order. Tweacher offers the possibility of creating messages where all the users interact and answer each other by writing the others’ names. It was decided to implement messaging in this way to attempt to keep the communication as simple and minimalistic as possible.

Tweacher is intended to be a complementary tool for educational settings: It is not designed or conceived of as the central tool to be used in the learning process. The process explained above has assisted the implementation process and the design of the best possible platform.

4.2.2 Description

Tweacher is an OSN which shares a number of micro-blogging concepts with Twitter. These concepts are: simplicity and minimalism regarding to communication, interface and real time. It adds other concepts which are closer to the field of education, such as: uploading material, tasks or resources to the platform and joining classes or groups.

It is a social platform where students and teachers can register and share information. It can be installed in a server and used by any education centre. It has a similar timeline to Twitter, where besides text, files can also be added. It allows academic material to be easily shared.

Users can register on the platform as a student or as a teacher. Apart from these two roles, one (at least) or several system administrators manage misuse of the platform and its correct functioning. The teacher’s role is similar to the student’s, but has extra functionalities such as: creating groups, creating or assigning tasks and restricting communication in a group. Thus, the three main roles in the system are: administrator, teacher and student.

Communication

It has already been mentioned that communication is one of the key factors of the application. All the users can communicate with each other through the different timelines, the global timeline or the ones which for their own groups. The private message option can also be used.

Another important part of the platform is that each group has its own is the timeline. This timeline is ordered and has the messages sent by the users. A special timeline for each group where the group messages are included with an attached file is also accessible, in order to facilitate sharing, consulting and downloading material.

Twitter asks its users “What are you doing?” in order to encourage them to publish on their timelines. This question can have an infinite number of answers, because it is not just about personal activity. It also includes
user environments in real time, such as reading an interesting news item and feeling the need to share it with contacts.

On Tweacher, the sentence which encourages users to publish on general timeline is: “Share your knowledge”. Thus, it does not seek news of any activity, but rather activity related to knowledge that can be shared and learned by other users. So, the main objective is learning and working as a community, not just uploading information, as well as sharing and solving doubts concerning the complete process.

Groups

*Teachers* can create *groups*. These groups will often be for *subjects*, while other times they may be used to organize matters concerning a club (for example the chess club) or for field trips or extra-curricular activities. Teachers who create a group automatically become the administrator, being able to create *tasks* or modify the group’s *board*.

The *board* is the part of the *group* where the creator of group can add information in order to highlight the most relevant elements of the subject, elements such as: *alerts, notifications, related news, class material, syllabus* etc.

The main motive of these functionalities is to provide a fixed space dedicated to each group, since if a teacher uploads a file to the main timeline, when more messages are sent, an important file could be forgotten. Avoiding wasting time looking for material is a key priority.

A global *group* exists on the platform, to which every user registering will have automatic access. This public area timeline will be overseen by the system administrators. This is where general information could be shared.

Once a *group* has been created, users have the option of asking permission to join. The teacher who has created it can accept or reject the application. The group creator can assign *tasks* to the group (to all the users who belong to it) with a deadline date for submission and the students are able to deliver their tasks to the teacher through the platform. Finally, the *grading process* can also be done through Tweacher if the teacher considers it is necessary or it can be omitted.

Features and characteristics

There follows a description of the main functionalities and characteristics of the platform:

- There are three main roles: *administrator, teacher* and *student*.
- A user with a teacher role can create one or several *groups*. This user then becomes the main teacher and administrator of the group created.
- Each group has its own *timeline*.
- Users can apply to join one or several groups. The creators of these groups have the final decision of accepting or rejecting applications.
- The information sharing process is similar to that of Twitter, using short messages and optionally attaching a file.
- Each group has a *board*, where all the information highlighted (by the teacher) will appear, as in Moodle.
- All groups have a section where all the messages with a file attached can be found by the users.
- Communication is a key factor; teachers can intervene in this process by restricting the communication functionality of some users if they misuse the platform.
- Users can navigate and use all the material shared in a subject (group) and they have access to the general material shared by their school.
- Private messages between users are implemented.
- Teachers can create tasks that students should complete before a deadline established by the teacher.
- Students can upload their task privately, so only the teacher will have access to the file.
- Each centre or district or region could have its own Tweacher.
- The platform allows informal communication between students and teachers.
- It allows showing as a timeline all the contributions made by users.
- Teachers can track students’ activities and can evaluate and grade them by using the tool.
- Groups are not just for subjects, they can be used to host or support extra-curricular activities. With special permission from the administrator some of them can even be managed and maintained by the students.

4.2.3 The Implementation Process

This section presents the most important parts of the implementation process. The data model and architecture of Tweacher are presented in the following paragraphs.

Data Model

The conceptual structure of the system and the most important types of application and their relations are shown in the diagram in Figure 4-6.

![Figure 4-6 Tweacher diagram of entities](image-url)
This data model shows all the database tables required for the platform and their corresponding relations. Apart from the relations shown in the diagram of entities Figure 4-6, other important relations are included in the data model. The tables are similar to the class diagram tables. They are:

- **Group**: with id_group (a unique group identifier), name (must be unique), type, id_creator (user ID of the creator) and url_board. The last table indicates the link where the group board can be accessed. A group has several tasks and micro-posts.

- **User**: with the following attributes id_user (unique user identifier), role (administrator, teacher or student), name, surname, email, password, information, avatar and last_access. This last attribute reflects the date of the last access to the system and is used to alert user about platform news. After being away for a while a user could have several pending tasks, micro-posts and private messages.

- **Micro-post**: The message sent to a determined group having the following attributes: id_micropost (unique identifier of the message), text, file, id_group (group identification number), id_user_microp (sender user identification number) and time. A micro-post belongs to one user and to one group.

- **Message**: with these attributes: id_message (unique identifier number for the message), id_sender (sender user ID), id_recipient (recipient user ID), content and date.

- **Task**: with id_task (unique task ID), name, deadline_date (to submit the task), file, id_task_user (task ID ), grade, start_date and upload_date. The task has two relations: Group and User, where a group and a user can have several tasks.

- **User_Group**: In this table the groups users belong to are saved, the relation is many to many. It has the foreign keys id_user_per and id_group_pert, where each pair shows if a user belongs to a group.

- **Restriction**: The communication restrictions applied to a user can be found in this table. It may or may not have an end time. The attributes of this table are id_user_res and id_group_res (foreign keys for user and group) and the time when the user will have complete access to communication functionalities again.

- **Request**: Lastly, in this table all the users’ requests to join groups will be saved. It has the following attributes: id_user_request, id_group_request, id_group_creator and request_date.

The design of Tweacher design is based on all these data. Next, the architecture required to support the platform is discussed.

**Architecture**

The architecture of the application has a client/server model and is shown in Figure 4-7. For the proper function of the platform a Web server and a data base are necessary. In this case, both servers can be in the same machine. The Web server resolves the Web requests and interprets the code for generating the Web pages.

The system has three types of users, the same number of user roles as in the application: administrator, teacher and student. These users can log on to the system through Internet, and their navigator will send requests to the server, and the server will connect to the data base when necessary.
For the platform, software implementation ASP.NET C# (Microsoft) has been used. It allows dynamic web site creation. The data base technology used is SQL server (Microsoft).

The following sub-systems can be found in Tweacher:

- **Login**: Responsible for managing login and user registration. It is necessary to be registered in order to use the application.

- **User**: Responsible for managing user personal information, giving users the option to change or update their information.

- **Messages**: It handles the private messages between users. The users have the option of creating a new message or consulting the ones sent to him/her.

- **Groups**: This is the largest sub-system, as groups are one of the main features of Tweacher. Each group has a timeline that can be visualized. All users are also able to visualize the group members, the board and messages with a file attached. Another option handled by this sub-system is to change the active group for each user at a certain time. It allows the creation of new groups by a teacher or an administrator. It also manages requests to join groups.

- **Tasks**: Responsible for managing the tasks of each groups, and all related functionalities from the task creation process to their final grading.

### 4.2.4 The Platform

The platform has been implemented using C#. The language chosen is Spanish, because evaluation and first deployment took place in Spanish educational settings. Consequently, the figures in this section are in Spanish.

Firstly, Figure 4-8 shows the login page of Tweacher. There are two different links for registration, as teacher or as student; the user will, accordingly, have one or other role on the website. The background colour and the logo chosen are fundamental design factors that will help to create an identity for the platform.
Positive Reinforcement Social Networks

The *colour* choice is because blue is a colour which transmits trust and so is a logical choice for a platform that is unknown by the user when they come to the site to register for the first time. In fact, the majority of the most popular social sites use blue, sites such as: Facebook, Twitter, LinkedIn, hi5 etc. These sites use different shades of blue for their interfaces.

Once the user logs in to the site they will see something similar to what is shown in Figure 4-9.

This screenshot (Figure 4-9) is from the home page of a student on Tweacher. The details and the most important functionalities are now explained. Firstly, the header, where the logo gives the site its personality. This features on all the pages of the platform to let the user know that they are still navigating inside the system. It is located in the top left-hand part of the pages.

![Figure 4-8 Tweacher login page](image)

![Figure 4-9 Tweacher user’s home page](image)
The control buttons for the user account are located in the right-hand part of the header, where the user has access to their profile configuration page, messages and where they can log off or close session. Thus far, nothing different from other OSNs has been presented. This is because, as mentioned, the design is based on the most popular and widely used OSNs. This similarity can be seen in Figure 4-10 which shows headers from several OSNs.

In the left-hand part of the body of Figure 4-9 there are two main parts:

- The first part is a menu (marked 1 in the Figure 4-11). This depends on the group where the user is located at that moment. By using this button the list of group members can be consulted, or the user can go to the board, to the tasks or to the group configuration (this is a special case only for group creators or administrators).

- On the other hand, the changing part (marked 2 in Figure 4-11) varies depending on what the users click on in the top menu (number 1 Figure 4-11). In this case, the group timeline can be seen and the textbox where the user can write their own messages to be shared with the group and attach a file if necessary.

In the right-hand part of the home page (Figure 4-9) there is a general navigation menu. It allows the user to access features that do not depend on the group the user is navigating at that exact moment. Figure 4-12 shows an example of this part; the teacher (left) and student menu (right) can be consulted.

![Figure 4-10 Twitter, Identi.ca, Facebook and LinkedIn headers](image)

**Figure 4-10 Twitter, Identi.ca, Facebook and LinkedIn headers**

**Figure 4-11 Tweacher website body**
Positive Reinforcement Social Networks

The shared part of the profiles is located in the top part of both menus, in order to remind the user with which user they have logged into the system and so they can see the information that he or she is sharing. It includes name, surname, avatar and personal data.

As in most ONSs, alerts about recent activity are sent to users. Thus, once the user logs into the system the recent activity regarding profiles and groups will be included as an alert on his/her home page. These alerts include: new messages, new tasks and new requests to join.

The section Groups shows the user in which groups they are registered. The user can navigate through these groups by clicking on the name of the group. The last element or functionality that can be found on this right side menu is: Request access to a group, an action that can be performed by students and teachers.

![Figure 4-12 Side navigation menu: teacher (left) and student (right)](image)

The teachers have extra options, as can be seen in Figure 4-12:

- Create a new group and become its administrator.
- Consult the access requests to the groups they manage.
- Create a new task for the groups they have created.

Once the platform was created, real activity was required, and this comes with data collection and the evaluation of the platform created. All the main features integrated in Tweacher were tested in trials in a real environment. In the next section presents the evaluation process of Tweacher.

### 4.3 Evaluation of Tweacher

As part of the design and implementation iterations Tweacher was evaluated with students, the results of which led to the introduction of enhancements. This section describes the context and preparation of the evaluation and highlights the importance of a user-centred design in this type of applications. Next, the results are discussed and analysed in order to draw conclusions which help to improve the platform.
In Table 4-1 shows a comparison between Tweacher and Edmodo. In this table the most representative factors are discussed.

### Table 4-1 Comparing Tweacher and Edmodo.

<table>
<thead>
<tr>
<th></th>
<th>Tweacher</th>
<th>Edmodo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Messages</td>
<td>Teachers and students can send messages to a group. They can send private messages to each other. It allows sharing files within the messages</td>
<td>Teachers and students can send messages to a group. The teachers can send private messages to everyone. However, students cannot send messages to each other. It allows sharing files within the messages</td>
</tr>
<tr>
<td>Groups</td>
<td>Created by teachers. Students or/and other teachers can request to join. The creator decides who can or cannot join to the group</td>
<td>Created by teachers. Students or teachers can join by introducing an unique code the platform generates for the creator</td>
</tr>
<tr>
<td>Group structure</td>
<td>The group creator is in charge, through the use of an editable HTML board. The platform also facilitates the option to access a section where the timeline shows all the messages with a file attached</td>
<td>The files are structured, by use of a library where links or files can be added or shared by the teachers</td>
</tr>
</tbody>
</table>

As has been seen in this chapter Edmodo and Tweacher have similarities, but they sometimes take different approaches. It should be highlighted that the main goal of creating this platform was not to extend Edmodo, but to create a similar application without the weaknesses of Edmodo.

### 4.3.1 Evaluation Design

The **user-centred design** plays an important role in the creation of an application, because it makes the developers focus on user needs. In Tweacher's case, the student is the main end user since the learning process is now squarely focused on the students. Hence, acceptance from these users will make the platform succeed or fail.

As design and implementation was user-centred, an evaluation of the application was conducted by letting real High School students work and interact with the platform. The main objective of this evaluation was to detect the usability level of the main functionalities in order to improve them before the final deployment of Tweacher. Moreover, the aim was to obtain real data from OSN use in an educational setting.

The evaluation was conducted with eleven students of first year of Baccalaureate (15-16 years old). These students had been using Edmodo in their classes during the academic year and at the end of the year they were assessed. The evaluation method chosen was questionnaires. The answers show agreement on a scale from 1 to 5, with 1 being the lowest and 5 the highest. Finally after all this process, results were obtained and analysed and are presented in Section 4.3.2.

Tasks assigned to the students were:

- Register on the application.
- Request to join to a group.
- Write messages on a group timeline.
- Consult pending tasks.
- Consult private messages.
• Close the session.

After these tasks, a questionnaire was administered, with questions such as:

• How difficult was it to create a new user?
• Do you consider the platform useful for the student-teacher relation?
• Is it useful to have a message functionality similar to Twitter’s?
• Do you think it is useful to be able to send private messages between users?
• Did you know which group you were in at all times?
• Was it easy to navigate through the website?
• Do you think the application is useful in the learning process?

4.3.2 Results and Analysis

The questions and their answers are presented using bar graphs for better visualization and comprehension. As the graph in Figure 4-13 shows, in general, the students think that the level of difficulty of creating a new user is low. Tweacher has only two types of registration, both clearly identified. It has tags in every box with help to input properly the first information provided to the site.

![Figure 4-13 How difficult was it to create a new user?](Image)

The objective of the question shown in Figure 4-14 was to have a guided answer about whether students think that OSNs could be useful to improve student-teacher communication. The results show that 55% think that these tools are positive for communication. However, it should be noted that 27% are indifferent. A possible explanation for this is arguably that the students considered that the informal relation with teachers should be face to face. It is important to stress that the tool is a complement, not a substitute.

![Figure 4-14 Do you consider the platform useful for the student-teacher relation?](Image)

Figure 4-15 shows that 45% of the students are indifferent regarding the similarities with Twitter. It should be taken into account that the average age of Twitter users is 30 to 35 years, while the users in this evaluation are under 18. Users under 18 are more likely to use general OSNs, such as Facebook. Thus, the
indifference shown in the answers to the last two questions is predictable since they are more interested in chatting with friends, and sharing pictures and videos.

**Figure 4-15 Is it useful to have a message functionality similar to Twitter’s?**

The next question addressed a key difference between Edmodo and Tweacher, the introduction of private messaging between students. The results are shown in Figure 4-16. If the scenario of the evaluation is interpreted carefully: a small class where everyone knows each other with high possibilities that the students are already connected on other OSNs, it is normal that just 45% think that this new feature is important. For this reason, it would be of interest to ask the same question to students from different places and unconnected with each other on other OSNs.

**Figure 4-16 Do you think it is useful to be able to send private messages between users?**

Tweacher allows the user to know the group they are in by means of a label situated in the top left-hand part of the webpage. Figure 4-17 shows 45% of users knew exactly where they were, and 36% almost always knew where they were. However, 18% did not care or did not know where they were while navigating on the platform.

**Figure 4-17 Did you know which group you were in at all times?**

Another point to take into account, which is directly related with question in Figure 4-17, is the simplicity and the user interface intuitiveness when a user is navigating through the application. This simplicity is also related to the next question.
The answers to the question shown in Figure 4-18 support one of the main objectives of the design process: Is it easy to navigate through the website. These results are highly positive. Generally speaking, users are less likely to leave ONSs where they feel good and find it easy to navigate.

Figure 4-19 shows that 45% of the students think that Tweacher is useful to support their learning process. Once more, it should be remembered that Tweacher is a support tool for educators, it has not been developed as the main tool for one subject. Therefore, it will sometimes be used as a support tool and other times it will be used as an additional communication channel.

As previously mentioned, the context where the platform is evaluated is key. For example, if there is a subject where the class material is easily managed and provided by the teacher or they already have textbooks, they will probably not need to add extra files or material to the tool to support the subject. On the other hand, if there is a subject with a large bibliography, this tool can facilitate the students sharing online links and materials online, and doubts which arise can be solved by peers or by the teacher.

The last question of the evaluation was an open-ended question in order to learn students’ personal opinion about the tool. Some of these opinions are presented below:

- “It’s easy to use, because it’s really similar to Edmodo”. It is clear that in the design of an OSN other sites are used as a reference, as it will be easier for new users to use if they already have used a similar platform. This is much easier than adapting to a completely new environment.
- Another opinion was: “It’s really good because it looks like Tuenti and Twitter, pretty young-looking. Although I’ve only used the network for a short time, I feel it could be really good”. This comment is also positive, and demonstrates that the objective of making a user-friendly tool has been achieved.
- “In my opinion this online social network is more interesting than Edmodo”. This is a subjective opinion, so could not be considered for improving or supporting any of the implementation objectives. Competing with a commercial tool such as Edmodo was not an objective.
To conclude, it was highly positive to collect positive comments from students who could be the future users of the platform. All the comments and the results were taken into account in order to improve the final version of Tweacher.

### 4.4 First Results and Early Conclusions

This chapter has analysed Edmodo in order to guide the implementation of a new tool called Tweacher. It is highly complex to create a generic OSN which can compete with commercial ones. There is an enormous difference between one or two people working together and big teams with big budgets.

In summary, the most important results and conclusions are:

- The **positive results** of the evaluation show that the approach is the correct one. OSNs are an excellent tool to create a positive impact on educational settings.
- The majority of the students consider the tool positive for the **student-teacher relation** (Figure 4-14), as communication improves due to the extra channel provided by use of Tweacher.
- Although when students were asked about **private messaging** (Figure 4-16) results were positive regarding this feature, it is recommended not to implement or control it when working with students of secondary education.
- Students considered **Tweacher useful for the learning process** (Figure 4-19). The results obtained are, however, similar to those that would have been obtained using Edmodo. Moreover, a different approach to social interactions has not been used. Tweacher may be considered an improvement on Edmodo, but not a completely new approach.
- **Monitoring, ranking, leadership** are features (as will be seen in the next table) that were not implemented in Tweacher, and should be taken into account in future steps.
- **Friends and/or connections**, are not considered in Edmodo and Tweacher, while Facebook and Twitter have this feature. In future prototypes or platforms, this figure should be taken into account.

The next table shows a comparison between Tweacher and commercial platforms. Edmodo (Edm.), Facebook (FB) and Twitter (TW) share some functionalities with Tweacher, although there are other features that not implemented or considered by any of them. An attempt to fill these gaps will be made in the following chapter.

<table>
<thead>
<tr>
<th></th>
<th>Tweacher</th>
<th>Edmodo</th>
<th>Facebook</th>
<th>Twitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Voting</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Leadership Functionalities (*)</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Connections</td>
<td>No</td>
<td>No (*)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sharing Documents</td>
<td>Yes</td>
<td>Yes</td>
<td>No (*)</td>
<td>No (*)</td>
</tr>
<tr>
<td>Monitoring Options</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Rankings Options</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Academic Oriented</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Friends</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Private Messages</td>
<td>Yes (*)</td>
<td>Yes (*)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
After these first results, a decision was taken; the next steps in the research will attempt to address $G_4$, $G_5$ and $G_6$ from another perspective, in order to create a new OSN model. This is because extending an existing model or platform may yield results which are similar to those of the original platform, as happened in this case. The most important results presented above have helped to guide the work described in the next chapter. Therefore, it can be said that goal $(G_3)$ to develop early prototypes to get initial results in education, was achieved and this helps to develop the work presented in the next chapter. Regarding the thesis hypotheses, this chapter supports H1 Students’ online social interactions play a significant role on information systems used in educational environments and H2 ICT impact on educational environments should be monitored and analysed.
In this chapter the final part of the research is described, and the global objectives mentioned in Chapter 1 will be addressed: \( G4 \), \( G5 \) and \( G6 \). It is also important to highlight the relation between the three initial research hypotheses, namely H1 (ICT and social skills), H2 (ICT impact on educational environments), and finally H3 (academic outcomes).

First of all Moods and Looking for Leaders, the first conceptual steps, and the prototypes which led to the final platform are presented. Moods is a tool that allows teachers and administrators to measure the moods of the students and be able to compare these results with the academic results. Looking for Leaders is a platform that supports and tries to encourage students to become leaders.

This is followed by the definition and the theoretical framework of Positive Reinforcement Social Networks (PRSNs), which are Social Networks in which individuals interact with each other and their environment, receiving a reward based on the number and type of interactions performed through it.

Then the BeingExample platform is presented. This online platform brings together all the work and effort described in Chapters 3 and 4, and in Sections 5.1 and 5.2. It is a specific case of PRSN, adapted to an educational environment.
Finally, the BeingExample platform was tested in a real High School. For six weeks an experimental study was conducted, and the final results within this real environment are presented.

The main goals of this chapter are:

- **PSR.G1.** To discover patterns between interactions shown/tracked by using ICT platforms and academic outcomes obtained by students.
- **PSR.G2.** To positively impact students’ academic outcomes.
- **PSR.G3.** To increase students’ participation, initiative/leadership and collaboration through the use of technology.
- **PSR.G4.** To find positive and committed leaders or students with initiative, who could contribute positively to their communities.

**Table 5-1 Hypotheses, goals and Chapter 5 goals relations**

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Thesis Goals</th>
<th>Chapter 5 Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>G1, G3, G4, G5 and G6</td>
<td>PSR.G1</td>
</tr>
<tr>
<td>H2</td>
<td>G1, G2, G3 and G4</td>
<td>PSR.G2, PSR.G3 and PSR.G4</td>
</tr>
<tr>
<td>H3</td>
<td>G3, G4, G5 and G6</td>
<td>PSR.G2, PSR.G3 and PSR.G4</td>
</tr>
</tbody>
</table>

### 5.1 Main Outlines of Work Towards PRSNs

The first conceptual steps which proved important concepts when one wants to have a positive impact on educational systems are shown in this section. Firstly, Moods is described, followed by Looking for Leaders, and finally Looking for Examples. After Teweacher (Chapter 4), a different approach was taken; we tried to bring something new to the table.

Furthermore, some of the ideas and concepts introduced by these platforms were taken into account when it was time to set up a new OSN concept (G4). They were also taken into account for the development of the platform presented in Section 5.3 (G5).

The main objective of platforms presented in this section was to look for functionalities that may positively impact in educational environments towards the creation of PRSNs.

#### 5.1.1 Moods: Students’ Feedback

Educational systems have always been challenged by their limited capacity to adapt to today’s reality. In Spain, almost all schools have a so-called PTU (Pedagogical Technical Unit), whose role is, along with the teachers, to monitor, evaluate and correct any academic teaching (Sanchez, 2010). Thus, a PTU represents one of the most important agents in leading change. However, the PTU rarely provides the integration of new teaching practices to encourage students to participate in the teaching / learning process. In this section is discussed the ways of improving the classes and schedules through the mood analysis of students by making use of RFID (radio-frequency identification) technologies (Tesoriero, 2008).

The idea is to create a platform that is able to collect information about students' moods, using RFID tags which represent three different moods. Students can click on them to express how they feel. Students express their mood by pressing the active RFID tags. This signal is captured by an RFID reader which is installed at every point where this information needs to be collected. Each student registered in the system can press the button that best expresses his mood once the class has ended or when the teacher considers it
necessary. In this way, the system gathers statistics that can be analysed at the end of each semester to analyse the teachers’ work and the content of their classes.

**RFID and Moods**

The measuring system of moods, in the classroom, is part of the RFID system to work with; there will be a system for measuring students per classroom, so that they can express their mood when entering and/or leaving the classroom, so every classroom will have a panel as shown in Figure 5-1. Under each of the three slides there is an active RFID tag to be selected by pushing it. The system communication is supported by a client-server application. This communication is based on SOA architecture (Service-Oriented Architecture) that allows users to store and retrieve information. Thus, when a RFID tag identification (ID) is read by the RFID reader in the client device (the student has pressed the slide), the ID is sent to the server to be processed via a Web service. The server then turns this ID into a command or tool, accordingly. Then, a command is executed on the tool, resulting in a resource that is stored in the system database.

![Figure 5-1 Student interaction](image1)

The configuration after installation in the classroom is as follows: installation of the software on the mobile device, input of the codes of each Active RFID tag and assignation of each code to its corresponding mood. In this way the central system is independent of any sub-systems to be installed in the classrooms, and thus the system only needs to know the three mood identifiers (tag identifiers).

![Figure 5-2 Classroom distribution](image2)
The application on the mobile device is connected to the central system and passes the data via a Web service. There will be one device per class, and the information of the classroom is loaded on it. Figure 5-2 shows an example of the distribution.

**The platform, functionality and architecture**

Below the platform is presented. One of the goals of the platform is to improve the education system based on the students’ mood. It especially improves the weak points which will be associated with negative moods. The system has three states of mood: positive, neutral and negative. The central part of the system is a server where all data is stored. This server can be in the same place where the system is implemented or in another physical location and access is implemented via the Internet. This server will contain all the information gathered by the system and its Web interface. Its architecture is shown at Figure 5-3.

In the platform, it is not necessary to store the personal data of students, because their votes are anonymous (as surveys are usually performed from the quality departments of schools).

![Figure 5-3 System architecture](image)

There are three types of users in the system, namely *administrators*, *teachers* and *participants* (students):

- **Administrators** or directors are responsible for placing the measurement systems for the mood of the students in the respective classes (system described above). These systems send the information to a central server in charge of managing this information.

- **Teachers** have a user profile in the system and can check the data generated in their classes. The administration staff of the High School are users with special permissions and have access to all data generated by the system. In addition, each teacher will be added to each of their teaching hours (lessons), so that he can insert comments in the system about the type of lessons given: theoretical, exercises, examination and so on, as shown in Figure 5-4. Checking the type of lessons taught will help to better understand and interpret the mood of the students. When teachers start their lessons, they must check that the system is working correctly (active). This checking process is carried out via a Web interface that is accessed by the teacher with his/her user and password credentials. Teachers can set the type of lesson that they are giving and comment on it (at the beginning and at the end), if they deem it necessary.
• Participants (students) use the mood measurement systems when entering and leaving the classroom, or when they will continue in the same classroom. They must do this at the beginning and at the end of each lesson with a particular teacher.

![Figure 5-4 Teacher interface](image)

There is an information collection system for each classroom, as described in the previous section. The classroom is one of the main parts of the system, and it can be said that the mood of each student is the basic unit of it.

**Processing the collected information**

The administration Web application is used to consult the results and to insert the initial information in the system. Also, teachers can view the evolution of the students’ mood according to the timeline (daily, weekly, monthly and annually).

It is not up to students or teachers to say whether the use of this tool must be applied throughout the year or only during certain times, but after its use in different settings and with different time formulas, the results obtained could give an idea of how to take advantage of this platform. The advantage of having sub-systems in each class that measure the students’ mood and a central server that gathers the information of all these sub-systems is that it allows the extension of this system to more and more classrooms to cover the whole educational system if needed.

**Conclusions**

The platform gives an idea of how to take the students’ feelings and opinions into consideration for a specific lesson or subject: on the one hand, by making students be part of the system in deciding the way they would like to be taught, and on the other, by making their vote and expressions reach the person responsible for the system to understand their needs. This will help the pedagogical department to improve the teaching of lessons and content, and make the teacher feel more responsible in preparing his/her lessons (way of teaching, and lesson content).

It would be useful to add to the system, for each individual panel of students, new attributes in which they could ask questions, and make suggestions to the teacher or the pedagogic department about how they would like to improve some aspects of the lesson. It would also help to add different sub-systems for measuring moods, by changing the type of RFID tags used, from Active RFID to Passive RFID, so that each student can express his opinion using his own mobile device (some new mobile devices have an RFID reader) to have more privacy while voting.
The most important contribution of Moods to the work presented in this thesis is that student’s feedback is really important in order to know how students and teachers are doing in their regular classes. And this feedback is more real if it is given anonymously.

The complete title of the paper in which this platform was first presented is: “Monitoring Students Moods for the Detection of Weaknesses in Secondary Schools” (Fardoun, 2012-C).

5.1.2 Looking for Leaders

This section describes the following prototype: Looking for Leaders. It is a tool for participation, awareness and leadership within the educational systems of secondary education. Participation plays a vital role in the PRSN model (Section 5.2) and in BeingExample (Section 5.3), and the work exposed during this section has helped to guide the process.

On November 20th 2011, general elections were held in Spain. Online social networking experienced a great movement of information, promoting the vote for certain purposes, and that influence could be easily noticed in the elections. By analysing the results, it can be observed that in 2011 the party which obtained the majority in terms of representatives in the Congress of Deputies received 10,830,693 votes, while in 2008 the winning party did not obtain an absolute majority, even with a higher number of votes than the current winner of 2011 (they actually received a total of 11,289,335 votes but not an absolute majority). Regarding historical participation data for general elections, according to (Elections, 2014), the average percentage of Spanish participation in elections is 73%, which is far from countries such as Italy, Austria and Malta, which are above 90%. And the total average of participation in voting in the European community is below 50%.

The system proposed in this section would be applicable in areas (such as Spain) where participation rates are low, trying to teach the importance of voting and electing representatives from adolescence. A clear example of the importance of voting participation can be observed in the election for the position of dean, at the University of Castilla-La Mancha (UCLM), held in November 2011. In the second round of voting, the chosen candidate was elected by a small difference, less than 1%; the winner obtained 50.4% of the votes while the other received 49.6%. That was thanks to the students’ votes, because they understand the importance of voting in order to have a better future.

Since the electoral issue is not the main focus of this research, this data is used to show the need and importance of participation in voting in the election of leaders of different social systems around us, as well as learning the responsibility of the personal vote and the impact that it has on the environment of students.

Description

This section describes the system, its main features, its actors, and its implementation. The platform users can perform organizational activities, create and participate in the educational community events.

It is based on the performance of Online Social Networks, adding a number of extra features to support active participation by students in their educational system. It has been taken into account that users of this platform are minors, and therefore it was decided that in principle it should be an independent platform (per school) for the better management and control of the school.

One of the main functions of the tool is to enhance participation in the daily activities that take place in school. For instance: reading workshops, sports clubs and so on.

The platform considers the student as the principal user, but there are more roles within it. The system participants are:
• *Students* are the main users of the system. They create most of the flow of information and activities within the platform.

• *Teachers* and directors of the centre. They will be responsible for managing the platform, controlling the social interactions among students, and ensuring its proper use. One or more of these people will be administrator/s of the platform.

• Other school *staff*. If the aim is to encourage participation and leadership in the educational system, every player who is inside should be involved. This role has fewer responsibilities and therefore less functionality than teachers and directors.

In terms of system functionality, two groups are presented: functionalities related to Social Networks and functionalities related to the main objective of the platform: *look for leaders*.

**Functionalities of Social Networks**

• Communication is one of the most important parts of the platform. This will include: private messages, board of staff, general board of the whole school, and messages to administrators to report misuse.

• Picture use. On the Internet almost everything is visual, and it would be a mistake not to have image features on the platform. It will not have more importance than it has in other Social Networks.

• There is no friend list on this platform; this is the great difference in its functionality in contrast to other online Social Networks. The idea is not to promote a popularity contest on the platform, but to increase participation and leadership regardless of whether students have more or fewer friends within the school system.

• Events: Creating events in Social Networks is a key element of participation in actions and other situations, so it will also be a key part of the platform.

**Looking for Leaders Platform functionalities**

• Supervision. A group of teachers will be responsible for overseeing all student activities, thus taking the administrator’s role.

• Voting. Any activity, event information, or situation may be voted on. All participants who have not been disciplined for misuse may propose votes on the basis of the activities. Within the feedback there are two key buttons, “Agree” and “Not Agree” (Figure 5-5).

• The student votes “Agree” to give support to the presented proposal.

• On the other hand, if the student votes “Not Agree”, he or she will give reasons why, so the dissatisfaction of the user can be meaningful and constructive for the educational system.

• Values. Teachers can enhance the acquisition of certain values that are transverse to their own subjects by creating activities and / or events on the platform.

• Groups, organization of areas or group work will be key features on this platform; students can create their own interest groups for a given activity/s as they go along. Groups can be public or private. For the private ones, students must be invited to register for them, while in public groups all the users can join them. Teachers may enter both groups as participants or observers.

• Events, performances, and proposals, have states: Idea (initial state), working and willing (partially or completely). This information will remain in the system, so that teachers can evaluate the activities of the students’ participation and their success.

• The students’ representatives feature is discussed more extensively below, since it is one of the key points.
Students’ Representatives

The *Looking for Leaders* platform does not replace the current items or processes used in schools; it just gives them more support. Therefore, the representatives established by the education system, according to its internal rules, will remain. The features related to leadership are as follows:

- **Leadership by accumulation.** Each student may delegate his or her vote to become class representative to peers, either because they have similar ideas, or because the student likes their way of leading. Students who delegated their vote shall not vote until they revoke the delegation. For example, if a student is a voting delegate of three other students, his or her vote will count as four.

- **Representatives of the group.** All groups will include the following figures: the group representative/s and the rest of the students. A manager coordinates and represents the group actions, and this can be a student or, on some occasions, several students from the group. An example is depicted in Figure 5-6.

- **Voting proposals.** Everyone can open a voting form. If the proposal goes beyond 10% participation in its first four days from creation, it will remain active, otherwise it will be closed.

- **Academic timeline.** Students can view their actions with respect to the system as a timeline. This enables them to see the activities in which they participated or the ones that were successful and the ones that were not.

- **Proposals of change regarding system aspects.** Made by the students themselves, each centre may set a percentage of votes for a proposal that the school management may take into account. One possibility would be to evaluate the proposals which reach more than 50% of votes (agrees).

These features are designed to teach students the importance of voting for their representatives, and to engage them, by supporting their participation in the activities, actions and improvements in their environments. Furthermore, the students themselves will have the chance to find their position within the group and see if they have the ability to lead; contrary to other Social Networks based on popularity, *Looking for Leaders* tries to engage the students themselves to discover leadership through their own actions. There is a learning process while the students use the platform. Therefore they learn which actions work and which do not, basing this learning on their own personal attitudes and skills for leading a group of people.
Platform Implementation

Initially, the platform is based on two main entities or classes: Social User and Event. The Social User represents the default capabilities a user can exercise in an Online Social Network, such as log in, comments, etc. The Event is to be seen as anything subject to voting. Both classes will be specialized to add specific behaviour. Therefore, students, teachers or any other social actor interacting with the system will have their own specialization of Social User that represents the actor's capabilities. For example, the Teacher class will add supervision capabilities when extending Social User. In an analogous way, events such as activities or proposals that are created with voting perspectives will be a subclass of Event, which includes the general voting data.

Regarding the communication system implementation, it has the same features as any basic social network, while the new added features are the strong point for achieving the objectives of participation and the pursuit of leadership.

The Looking for Leaders platform features a client-server architecture to enable the social capabilities. The main business logic module functions as a Web server that includes the implementation for the features that have been explained above.

As can be seen in Figure 5-7, several user interface client specializations are considered. Web and Mobile interfaces have lately acquired great success and are the easiest to use for students and school staff. However, desktop or even console clients should also be taken into account for other kinds of tasks, be it administration, monitoring, or support, among others.
**Rules for using the platform**

With great power comes great responsibility. Therefore, for the proper functioning of the system and to prevent irresponsible or improper use by students, a set of rules is defined. There are three possible sanctions that can be imposed by the team of teachers responsible for the students who make use of the platform in an inappropriate manner:

- When a student loses the position of representative, he or she shall not be able to re-stand for this position in the system for a certain period of time.
- Temporary voting ban. The student shall not be able to participate in any of the voting proposals. It is advisable to take this measure with students who are using their vote unethically.
- Observer. In this case, the student adopts the role of observer, and he shall not use any of the system features. This would be the most restrictive measure.

Such sanctions are documented in the system, to prevent the possible misuse of it. In addition, each school has the ability to add its own rules, with respect to the system, in order to adjust it as much as possible to its projects, and promote the values they want in their students.

**Conclusions**

This section describes the following prototype: *Looking for Leaders*. It is a tool for participation, awareness and leadership within the educational systems of secondary education. It has allowed to study how certainly social skills such as *participation* and *leadership* may be look for or even enhance by using ICT platforms and it is taken into account when building the PRSN concept (Section 5.2) and BeingExample (Section 5.3), its instance for education.

The complete title of the paper in which this platform was first presented is: “Looking For Leaders: Reaching the Future Leaders in Education through Online Social Networks” (Fardoun, 2012-B).

**5.1.3 Looking for Examples**

The idea of the system presented in this section is to improve the leadership methodologies and processes in secondary schools by introducing Online Social Networks as a part of their system, and by offering services to the educational community (students, parents and teachers) for the construction of a school environment that allows the development of values, attitudes, socio-emotional skills, and ethical standards (Fardoun, 2012).

This platform aims to create a social life where all members of the educational environment participate, share and develop as much as possible. On the one hand, students will learn to be citizens, how to vote, and to be responsible for the improvements and changes of their own educative system; under the supervision of the management team of the centre and the school board. This methodology intends students to have responsibilities through their participation (voting, debate, leadership, etc.) in their own school system.

On the other hand, *Looking for Examples* is an improvement of *Looking for Leaders*, and it comes as a response to personal experience as a teacher. Its main improvement resides in adding a new type of leadership concept, not by calling some users leaders but by pointing to them as an example for one or several of their actions. Teachers have listened sentences such as: “I am tired of how society behaves; the acknowledgements are always for the same little group” or “I got tired of doing it when I realized that no one was interacting with me”. These thoughts support the need of new features in the platform *Looking for Leaders*, in order to give opportunities to every student. As this platform is not just for leaders, it is developed to serve
the whole educative community. There were many questions, but the main one was: How we can make everyone feel what leadership means? Its answer is: by using Looking for Examples.

The Platform

The process of improving Looking for Leaders, and the main changes made to it, are discussed below. The first step should be to propose a vote on the website of the system, where every user could vote ‘agree’ or ‘not agree’. Why propose a vote? One of the goals of this platform is to get the involvement of the students, so to follow the spirit of the platform the decision of change should be given to the students. An example of a possible vote is shown in Figure 5-8.

![Vote on the website of the system](image)

**Figure 5-8 Vote on the website of the system**

So after the vote, the next step should be define the change to improve Looking for Leaders, and this definition may be as follows:

The goal of Looking for Examples is to promote the possibility of young students being a good example for their peers. Experiences in education show that good actions and examples happen continuously in educative centres, but they are not rewarded. It happens with bad examples as well. But in this case, the research is not a sociological one, so it is not the author’s responsibility to judge whether the examples are good or bad. The aim, with this platform, is just to enhance the participation in the platform, and make the good examples more visible to the educative community. So, how to achieve this visibility? The answer is simply by adding new features to the online community.

Looking for Examples New Features

The new features were added and developed on the Looking for Leaders platform, by re-using the same code and maintaining all its functionalities. Table 5-2 shows the main features added to the system, and which all its users can use: administrators, students and teachers.

The Looking for Examples feature is presented, on the platform, with the functionality New proposal: where registered users can add a new Looking for Examples proposal. This proposal has to be accepted, first, by the system administrator Accept a new proposal feature. Once the proposal is accepted the rest of the users can vote on it, and the default time for voting is one week. After this week the vote is closed automatically (there is another possibility, namely the closing of a vote by the administrator before a week has passed). After this process, a list with the most voted-for proposals are rewarded in a weekly and monthly way (a diploma). Furthermore, other prizes could be added by the educational centres who use the system.
Table 5-2 Main features added to the system

<table>
<thead>
<tr>
<th>Features</th>
<th>Admin</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>New proposal</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Voting a proposal</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Accept a new proposal</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Check the results of a proposal</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Close a vote</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Check the accepted proposal list</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Check rewarded proposals</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Select a proposal as the month’s or week’s winner</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

1 Users cannot vote on a proposal if they are sanctioned.
2 The system is responsible for selecting the winners.

Changes in the System

In Figure 5-9 there is an example of a *Looking for Examples* proposal. A new button was added to the main menu of the website interface, named *Examples*. The vote with respect to a *Looking for Examples* proposal is the same that we had before for the vote in the prototype of *Looking for Leaders*.

Once the user accesses the Examples section, he has different subsections:

- Closed Proposals: Proposals that were ended.
- Active Proposals: This subsection contains the proposals whose voting process is still active.
- Rewarded Proposals: Once the voting for a proposal is closed and the week or the month ends, the proposal with more votes goes to this subsection, and a diploma is given to the person who proposed it.
- Adding a new proposal: Where users can add new *Looking for Examples* proposals.
- Proposal review: Only the administrators (teachers usually) of the system can access this subsection.

![Looking for Leaders]

**Figure 5-9 Looking for Examples proposal**
The general aspect of the platform architecture remains the same. The database has been changed to work with the data of the new features. The server schema (Figure 5-10) undergoes minor changes in the “Proposal” part, where a new type was added: Looking for Examples proposal.

![Server Schema](image)

**Figure 5-10 Server schema changes, where a new type was added: Looking for Examples proposal**

Some of the aspects of the system remain the same in order to properly maintain the platform’s functionality, such as the recommended rules for the system. There are three sanctions that can be imposed by the team of teachers responsible for the students who make use of the platform in an inappropriate manner: a student loses the position of representative, a temporary voting ban and the observer role. These were described in Section 5.1.2.

**Conclusions**

After improving Looking for Leaders students may be able to feel part of the community. Being part of the process of the improvement of their own educative system should improve their participation. Now the platform allows more kinds of leadership, trying to make students feel important inside their environment.

The complete title of the paper in which this platform was first presented is: “Being Example: A Different Kind Of Leadership, Looking for Exemplary Behaviors” (Romero, 2013). In this thesis it has been named Looking for Examples in order to avoid confusions with the platform presented in Section 5.3.

**Summary**

In this section the prototypes that have helped to identify initial concepts have been explained. The platform Looking for Leaders and its evolution into Looking for Examples are an important part of the foundations of the final platform, which is presented in Section 5.3. But first it was necessary to give a formal model for this new kind of systems that may improve our educational environments, so in the next section a formal definition for this kind of systems is given.

Some of the main characteristics that are included in the model presented in the next section are based on concepts proven by the prototypes presented in this section. Moods highlights the need for giving students the option of a more active role into their educational system, and this can be done through feedback and participation. On the other hand, Looking for Leaders shows how a social skill may be encouraged or just searched for with the help of an ICT platform. Finally, the last platform, Looking for Examples, on which there
is a transition from leaders to positive examples, shows how important it is that these skills supported by technology need to be as generic as possible in order to cover all students and not just the ones with a singular skill.

5.2 PRSN: Positive Reinforcement Social Network

Although most of the research conducted up to this point focused on education, it was intended to create as broad a concept/model as possible so that it might be applied to different environments.

Most of the time, humans interact with their environment trying to obtain some kind of "reward". That happens when something makes a positive impact on them. By taking advantage of this feature, human beings, or users, who perform actions that positively affect their environment will be "rewarded" through the proposed system.

The model proposed uses Web technologies, which currently are the most successful in the socialization of human beings through the Internet. In this section a possible definition is given for a novel type/concept of online social network (OSN) which has been called Positive Reinforcement Social Network (PRSN), and an initial proposal for its social and collaborative model is made. Finally, its implementation and architecture are described.

5.2.1 Definition

According to (Boyd-Ellison, 2007) a OSN (see Section 2.2) is a site which offers services based on Web technologies, and these services allow the users to build or create public or semi-public profiles within a relationship system, to have a list of users with a shared website connection, and to see and navigate the user's connections list, which has a shared connection with the user.

Thus, a Positive Reinforcement Social Network (PRSN) is an Online Social Network (OSN) in which users interact with each other and their environment, receiving a reward based on the type and number of actions performed/tracked through/by the system. In it, users may propose, implement and collaborate on actions that have a positive impact on themselves, the others and their environment.

Therefore, PRSNs have a number of added features with respect to existing Social Networks, controlling these good actions and their respective rewards. Adding rewards may be seen as gamification (Domínguez, 2013), and usually it has been used to increase user engagement on Web-based platforms. While gamification, within education, may increase initial motivation and improve scores in practical assignments, it may have a negative effect on written assessments. However, in this case only rewards have been used and not the rest of gamification concepts or elements.

Positive reinforcement consists in assigning rewards to certain types of actions. The two most important rewards are: a virtual currency (which will be backed by a real currency environment PRSN), and virtual points (these points do not need financial support). Users can accumulate and eventually exchange these rewards for real benefits.

An action is described as good if a reward is given by the system when users participate in, or perform, this action. As mentioned above, these rewards may vary depending on the institutions which have adopted this kind of systems, or depending on the administrators. Usually these rewards are related to the needs of the environment where the system is used.
Several models have been created to support this new concept, and these are presented in Section 5.2.2. The concept model helps to understand the concept from a visual perspective. The participation model helps to show how PRSN participation is intended to affect environment participation. Finally, the co-interactions model helps to show how some of the most important elements (rewards, events and interactions) of the system have to be implemented.

**PRSN Types**

Two types of PRSNs can be distinguished:

- Positive reinforcement through points that can be exchanged or through which the user can obtain some advantages.
- Positive reinforcement through points and money. In this case the users have the option of being rewarded economically when they perform, or assist in, certain actions. In this type, PRSNs have to take into account the issue of security more seriously than in the other case.

**Interaction in the PRSN**

User interactions (or actions) in PRSNs are similar to those of OSNs. Users also have the possibility of the interaction associated with positive actions, the "reward", and how to use or spend it. Therefore, the interaction will be conducted through the website, but there will be other possible scenarios of interaction.

A possible interaction scenario is the “events scenario”, which is organized by the PRSN users or administrators, and in which, at the end of the interaction, the organizers can identify the PRSN users who have participated in this action through the insertion of an electronic document of identity in electronic-readers. Once the user is identified, appropriate software might map the "reward" to the user's account.

By identifying the place where the action is performed through an email delivery, user name or an official document that identifies him, in this case the assignment of a "reward" is not automatic. The organizers should later enter the users’ or attendees’ data into the system. By having the option to give each participant a code, and enter it on the PRSN website (previously the user will have to log in), the system will keep an account of the good actions performed and give a "reward" to the user.

Other possible scenarios of interaction should be taken into account in which the user wants to take advantage of his accumulated points or spend part of their "virtual" money.

Some possible types of interaction related to this exchange might be:

- Exchange points for some kind of reward.
- Spend the "virtual" money on some kind of reward.
- Participate in an online or an offline event organized from the PRSN to obtain points or "virtual" money.
- When some positive action is performed, the environment recognizes that the user is performing this action and gives his reward (either points or "virtual" money).
- Obtain a benefit or advantage in exchange for points or "virtual" money of the PRSN platform (between two users of the PRSN).
5.2.2 PRSN Modelling

In the following paragraphs the social and collaborative model of PRSNs are described. The most important elements presented below are: the conceptual model, the visual model, the organizational structure, the participation model and the co-interaction diagrams. The social aspects of the PRSNs are defined by the conceptual model, the visual model, the participation model and the organizational structure. The collaborative aspects of the system are expressed in the co-interaction diagrams. It is important to highlight that the system has to be modelled by taking into account the diagram of entities presented in Figure 5-18.

Conceptual Model

In the conceptual model, which is shown in Figure 5-11, as can be seen there are two basic types of users: Participant and Entity. The administrator is not shown but he is in charge of setting up the environment and monitoring the correct use of the platform by these two other types of users. On the one hand, there is an entity that creates and manages the actions and rewards associated with them, and on the other hand you have the participants who perform and/or participate in such actions.

The model focuses on Action-Reward. The action is considered as a timely event or action that has a positive effect on the environment of the user or users who perform the action. Rewards are received by the participant who performs the action, as positive reinforcement for what he has done.

There are two possible types of rewards depending on whether you have funding behind an action or not. The points will serve to increase the ranking and with this increase in ranking the user will have certain advantages or possible awards. Regarding money, PRSNs will reward with that which is behind the real money that is stored in the entity that controls the platform, at a bank in a pay-pal account and so on. This "virtual" money may be spent by the user in different ways, depending on the final implementation of the platform.

Figure 5-11 PRSN conceptual model
Figure 5-12 shows the main elements of a generic PRSN, where the main elements involved are users, actions and rewards. The elements with an asterisk may or may not be implemented or used in PRSN instances. Users perform actions, obtaining their associated reward. Actions can be online actions (interactions) or real world actions (events). Regarding users, there are participants, administrators and entities, the latter having more features available than participants, but fewer than administrators. Finally, with regards to rewards, there are points obtained by actions performed by users, and if these actions are funded by an entity, the users receive currency, but this part is not a compulsory part of PRSNs. Furthermore, ranking is considered a reward, and is calculated depending on the rewards obtained (usually points), but may vary in instances of PRSNs.

In (Boyce, 2014) the authors adapted a participation model from the original work of (Roschelle, 2003). In the original model a person’s attention is divided into several attention planes, with a social plane where attention is on interpersonal interactions. The technological plane focuses on the technological device. It is important to highlight that (Roschelle, 2003) stated that the different planes available within the process can either facilitate or hinder multiple types of participation.
The model presented in (Boyce, 2014) was the main reference in creating the PRSN participation model shown in Figure 5-13. In the original model there was a technological plane (PRSN participation), a social plane (remains) and finally the nature participation plane. The last one has been replaced by the classroom participation plane. Therefore, PRSN participation should facilitate or interfere on the social and environment participation planes.

**Organizational Structure**

The organizational structure and actors shown in Table 5-3 have been identified in PRSNs. The development of this organizational structure has drawn on the work carried out in (Ruiz Penichet, 2007).

**Table 5-3 Organizational structure**

<table>
<thead>
<tr>
<th>Organizational Structure</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRSN Description</td>
<td></td>
</tr>
<tr>
<td>Conceptual Model (Figure 5-11)</td>
<td></td>
</tr>
<tr>
<td>Entities Diagram (Figure 5-18)</td>
<td></td>
</tr>
<tr>
<td>Groups</td>
<td>Administrators</td>
</tr>
<tr>
<td></td>
<td>Entities</td>
</tr>
<tr>
<td></td>
<td>Participants</td>
</tr>
<tr>
<td>Individuals</td>
<td>Super Administrator</td>
</tr>
<tr>
<td></td>
<td>Collaborating Entity</td>
</tr>
<tr>
<td></td>
<td>Entity</td>
</tr>
<tr>
<td></td>
<td>Participant</td>
</tr>
<tr>
<td>Rewards</td>
<td>Points</td>
</tr>
<tr>
<td></td>
<td>Currency</td>
</tr>
<tr>
<td></td>
<td>Ranking</td>
</tr>
<tr>
<td></td>
<td>Transactions</td>
</tr>
<tr>
<td>Actions</td>
<td>Online</td>
</tr>
<tr>
<td></td>
<td>Offline</td>
</tr>
<tr>
<td>Description</td>
<td>In this table are the main actors in the system and their possible groups. We also have agents in the system and two of the main points of the PRSNs, namely rewards (positive reinforcement) and the events through which users receive this reward.</td>
</tr>
</tbody>
</table>

There are three main actors in the system:

- **Super Administrator**, who is the creator of the PRSN and administrator with permissions to perform any modifications to the system configuration. This type of user has the option to change the role of some users and/or entities to directors/creators.

- **Collaborator Entity**. This entity will participate in creating and managing the PRSN in both online and offline actions or events, and needs a validation of the super administrator. One of the main actors in the system which will fund certain actions (motivated by social marketing).

- **Registered User or participant**, who is the PRSN’s basic user. Users cannot create or manage the actions proposed, but they can use the other functions.
Co-interactions Model

Below are the most important co-interactions diagrams of the system, which are based on TOUCHE (Ruiz Penichet, 2007). Figure 5-14 shows the co-interactions diagram of the PRSN’s events (or offline actions), which can be both online and offline, and participating in online events will be validated automatically by the system; however, in the offline events or actions the user participation is validated through an identification system (managed by the organization), which will have to let the system know about the user participation.

The reception of the reward by the user occurs in their system account. It was not taken into account in this diagram whether co-interactions are rewarded with money or points, as there is only reference to a generic reward.

Figure 5-14 Co-interactions diagram of events

Figure 5-15 Co-interactions diagram of rewards

Figure 5-15 shows the co-interactions diagram with respect to rewards. It illustrates how the entities and administrators are the ones who "inject" awards and benefits into the system. It can also be seen how the user uses his ranking and rewards for prizes and benefits in their environment. These prizes or benefits are previously introduced by the administrators or entities.

Finally, Figure 5-16 shows the co-interactions diagram with respect to interactions (online actions). It illustrates that administrators are the ones who set up the rewards related to user interactions. It can be seen how the participant obtains a reward if the interaction performed has one associated. There may be cases where there is not a reward associated to a specific type of interaction. Rewards must be set for one or more types of interactions.
5.2.3 Architecture and Implementation

This section describes the possible architecture and implementation of PRSNs.

Model-Based Development

The design of computer systems has evolved, not only in appearance but also in the way it is carried out. In a groupware application, as in any other system, the interface design is crucial, since in it lies much of the success of development. HCI has been an important area, and methods and techniques have emerged to facilitate design. A groupware application will have its own user interface, and these methods are applicable for its design. However, CSCW systems are systems with certain particularities and it is worth taking special care to obtain an interface design of higher quality and closer to user needs.

Architecture

The possible software and hardware architecture (schema) of a PRSN can be seen in Figure 5-17.
In this software architecture we can see the major stakeholders (user, administrator and entity, each of them having a number of associated features) and how they interact through the system, which could be implemented as a website and as a Web service, in order to have a positive impact on the environment. The system will also have a resource server where security will be important.

On the hardware side, for deployment it will be necessary to have the same components that are required for any website. Complexity will vary depending on how, where, number of users etc.

The implementation of the software should be directed towards modularity and system scalability, taking into account that a basic PRSN may have a number of separate functions in different modules, but different types of PRSN may require different features and therefore new modules. Leaving this possibility to add functionality opens the door to adapting to as many scenarios as the PRSNs could have.

The software architecture of the system can be divided into three layers: user interface layer, business or logic layer, and data access layer.

**Diagram of Entities**

Figure 5-18 shows the main users of the system: administrator, participant and entity. There is a reward system, whose main items are transactions, rewards (points and currency) and ranking (which is related to users). Finally, the main actions of the system may be offline (events) and online (interactions on the website), and these actions may have a reward associated with them.

![Diagram of entities](image)

**Figure 5-18 Diagram of entities**

The complete title of the paper in which this concept was first presented is: “Proposed model for social and collaborative social network of positive reinforcement” (Fardoun, 2012-F). It is the most important concept of the research presented in this thesis. The platform presented in the next section is based on this concept.
5.3 BeingExample Platform

BeingExample brings together some of the concepts and functionalities previously implemented on: Tweacher (Section 4.2); Moods, Looking for Leaders and Looking for Examples (Section 5.1); and PRSNs: Positive Reinforcement Social Networks (Section 5.2), see table below. The main thesis goal covered by all presented in this section is G5 To create a platform, based on the Online Social Network concept created (Section 5.3.1 and 5.3.2), which helps to measure (Section 5.3.3), analyse and improve (Section 5.4) and/or support students’ online social skills, motivation and academic outcomes.

<table>
<thead>
<tr>
<th>Platform</th>
<th>Objective/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tweacher</td>
<td>Microblogging site whose focus is on educational environments</td>
</tr>
<tr>
<td>Moods</td>
<td>A tool that allows teachers and administrators to measure the moods of the students and be able to compare these results with the academic ones</td>
</tr>
<tr>
<td>Looking for Leaders</td>
<td>A platform that supports and tries to encourage students to become leaders</td>
</tr>
<tr>
<td>Looking for Examples</td>
<td>Is an improvement of Looking for Leaders. There are people who do not yet have leadership skills but want to change things, and everyone can lead something by being a good example for the rest. This is what this platform supports</td>
</tr>
<tr>
<td>PRSN</td>
<td>Social network model in which individuals interact with each other and their environment, receiving a reward based on the type and number of actions done/tracked through/by the system</td>
</tr>
</tbody>
</table>

Before starting to describe the platform, some objectives and goals are presented:

- Its main goal is: to provide simple functionalities which will be able to yield powerful outcomes and impact positively on its environment.
- To generate positive environments by sharing positive examples.
- To increase participation; overall, when there are big groups of people, time does not let everyone speak or participate. BeingExample tries to give that participation option to everyone.
- To engage people in projects or groups, as members’ participation and importance increases when they feel more supported, and they are more engaged if they are an active part of what is happening.

There are many more objectives, but in some way they are related to those that have been explained above, or are not so important as to be mentioned here. Summarizing the objectives, BeingExample aims to improve the social environment of the users by following the PRSN model.

First a description of the platform is exposed, followed by the most important models that vary from the PRSN concept to BeingExample. Third measurements are presented (Section 5.3.3), followed by rewards in Section 5.3.4. Next architecture and implementation are described (Section 5.3.5). Finally main functionalities of the platform are presented in Section 5.3.6.

5.3.1 Description

BeingExample is a PRSN developed for educational environments. The platform structure is not optimized for classroom content management. It tries to improve the educational environment of its users by positive...
participation, examples, sharing, outcomes, groups, votes, etc. The functionalities of the platform will be discussed more deeply in Section 5.3.6.

BeingExample may thus be considered as a social media site, implemented and oriented to educational environments. Subject content will not be the focus, but sharing it will not be forbidden, but the platform structure is not optimized for classroom content management. This platform is not an LCMS; however, it will be measured and analysed in a similar way to the learning analytics of this type of systems (Section 5.3.3). It can be considered as a type of academic analytics (Campbell, 2007), and is close to, but not the same as, social learning analytics (Shum, 2012).

However, if content is not the key element of this experiment, what could be as important as content is in educational environments? The answer is social media interactions. To address this subject several educational environments have been taken into account and these will be described in Section 5.3.3.

Below I describe several scenarios in which the application can be used:

- Modelling class behaviours. The academic year is starting and Mrs. Stark wants to work on classroom rules during the first week. Therefore she decides to use a BeingExample group in order to do so. She is lucky and has five desktop computers in her class. The students create their accounts and join the group. Once created, Mrs. Stark allows comments, shared items and outcomes within her group. The first step, for the students, is to search the Internet for leaders, for good people, for exemplary behaviours and share this with the rest (Share Items). Once this is done, Mrs. Stark proposes questions (votes) about the main behaviour keys that are important or not, and the students answer them by agreeing, being neutral or not agreeing. Once voting has finished, the teacher creates the main rules of their classroom as outcomes, and the students that have participated can access the platform in the future. However, if a student misbehaves, the teacher could send him to the computer to review the shared items and the votes, and to work by himself again on why that rule is important for the classroom.

- Department Meetings. During the last academic year Mr. Mestre’s department peers complained about the waste of time that all the department meetings were. He looked for a tool that allowed him to be outcome oriented, and he also wanted to increase the level of participation and motivation of some peers that are usually less active than others. He will use the department group during each department meeting to let the group decide on their needs and how they are going to confront the academic challenges that the new academic year will bring.

- Training. Mrs. Lopez usually provides training to other teachers. She is an experienced science teacher and wants to have a tool to channel all the participation, and at the same time be able to share documents with the participants. So she is using BeingExample during her training sessions in order to allow the pro-active participation of the trainees, and to share electronic material in an easier way.

- As a single user to show your opinions and point out those who deserve them. Jose is a college freshman who has a lot of concerns. He believes in a better world, but when he watches the news or reads newspapers he is upset because there are a lot of bad examples for him and his friends. When Jose discovered BeingExample, he wanted to be able to share positive examples online and be able to vote if the examples shared by other users are good enough.

Those are the main scenarios in which BeingExample can be used, but each user will be able to find his/her own way to use it depending on their environment and needs.

For a better understanding of the focus of the platform, the Honeycomb model in (Kietzmann, 2011) has been used (see figure below), and it allows us to see a comparison between BeingExample, Foursquare, Facebook, YouTube and LinkedIn.
Kietzmann presented seven basic functional building blocks for social media: presence, relationships, reputation, groups, conversations, sharing and identity. Each of those blocks may be extremely important, important or not important on each social media site. In the BeingExample case the most important block was sharing, followed by groups, conversations, identity and reputation. On the other hand, the not important blocks are relationships and presence.
The most important elements or options that users can create on the site are examples and groups, which are described below.

*Examples* are the basic communication unit/item of the platform. The composition of one example is: description, results, external URL, hash tag and comments. All the examples are public and allow registered users’ comments.

The user may create an example in order to have as many agree votes as possible. The rest of the users vote agree, neutral or disagree. All the users can see the results of the example vote. In Figure 5-21 an example can be seen.

![Figure 5-21 Example](image)

*Groups* are more complex than examples. Groups are intended for having a meeting, being together or just communicating online. A groups can be public or private; if it is private it has a code (automatically generated by the platform) that the participants must introduce the first time that they enter the group.

Public groups allow anonymous participation (not commenting, just voting) if the creator marks that option, while private groups do not allow anonymous participation by default. The main parts of a group are the participants, questions and comments.

![Figure 5-22 Groups](image)
The optional parts of a group are outputs and shared items. In Figure 5-22 a group can be seen which allows shared items but does not allow outcomes. It has three questions, and the creator allows the participants to see the results, and comments are allowed as well.

Although examples and groups have been mentioned, some of the functionalities are explained in more depth in Section 5.3.6. A summary of the functionalities of these two elements is shown below:

Table 5-5 Examples and groups comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>Example</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moods Vote</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sharing Options</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Hashtag</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Description or/and Title</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>External URL</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Comments</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Anonymous Participation</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Questions</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Shared Items</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Outcomes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Privacy options</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

1 In questions.
2 Not allowed in private groups.

As Table 5-5 shows, the examples have fewer features than the groups; as was mentioned above, examples are less complex.

5.3.2 BeingExample Models

In this section the PRSN part of the platform is discussed. One of the objectives that led the platform to implement PRSN is to generate a positive environment by sharing positive examples and the reward associated with students’ participation in the process.

Figure 5-23 BeingExample conceptual model
First of all, the conceptual model of BeingExample based on the PRSN model is shown in Figure 5-23. In the diagram we can see the main actors of the platform: Leader and Participant. A Participant becomes the Leader of a group or of an example when he creates them. Some elements that have not yet been implemented can also be seen, and these elements will be important in, and for, the future of BeingExample (they appear in grey and with an asterisk).

In the next figure we can see the participation model of BeingExample, which has been adapted from the PRSN participation model (presented above). The main changes are that the environment is the learning environment and environment participation is replaced by classroom participation.

![Figure 5-24 BeingExample participation model](image)

Co-interactions diagrams for examples and groups have been created. In Figure 5-25 the examples’ co-interaction diagram is shown. The Leader, by creating an example, obtains connections (with the participants that were not connected with him before). He improves his ranking and receives BEcoins. The participants do not receive BEcoins for participating, although they do obtain the connection with the creator of the example, and they also improve their ranking.

![Figure 5-25 Co-interactions diagram of rewards](image)

The groups’ co-interactions diagram is very similar to the examples’ one. It is necessary to add two extra elements inside the Groups element: Documents and Questions. Documents may also be considered as a reward for the participants of the group, as others can share them, but the system does not track documents as rewards.
5.3.3 Measurements

After Tweacher was presented in Chapter 4, the need to analyse and measure users’ interactions through the platform arose. Learning Analytics has been the focus of several studies in the last few years. It is the measurement, analysis, collection of data about students or learners and their environments, for purposes of optimization and understanding. Therefore, learning analytics helps to measure and understand part of the ICT impact on educational environments. It is just part of the solution as not every item of ICT technology has analytics implemented, and measuring its impact is more complicated. Although learning analytics was not one of the starting points of this research, a point came when a review of what has been done in the field was needed. Furthermore, adding analytics to the platform will help to measure the achievement of the Thesis and the chapter goals.

Learning Analytics

Academic analytics was presented in (Campbell, 2007), in which the process is divided into five steps. Capturing data from the digital platform is the first step, followed by reporting data to key individuals. The third is predicting student success based on key predictors, and the fourth is acting, in which the instructors and students take actions based on these predictions. Lastly comes refining, in which information is collected and evaluated to improve the model.

Taking advantage of big data and learning analytics by electronic transaction processing rather than manual processing is highlighted in (Picciano, 2012). This paper was published in 2012 and explains the evolution, both present and future, of learning analytics in American education environments. Although big data and analytics are not the magic pill for every problem in educational systems, it is remarked that they can be involved in the solving process or support the decisions or final solutions. Furthermore, learning analytics helps to understand how data should be measured in this proposal in order to be able to predict future academic outcomes.

One line of research into educational analytics is digital textbooks, as was the focus in (Junco, 2015), in which digital textbook analytics is the term used and presented as a new method of collecting data generated by students. In this case digital textbook metrics are used. An advantage of this method is that data can be collected automatically and used for the prediction of outcomes. In (Young, 2013) it is pointed out that interactivity and feedback have been included by publishers in their new generation of textbooks or digital textbooks in order to adapt their content to the new needs of educational environments. Sometimes data collected electronically by these digital platforms or software is even fed automatically into LCMS.

Predicting academic performance (in online courses) is the focus in (Iglesias-pradas, 2012), in which prediction is based on learning analytics in a virtual learning environment (VLE). The main difference between this study and the one proposed in this chapter is that interactions measured by Iglesias are related to the course content, whereas what is worked with in the experimental research conducted here is not based on the subject content, but on transversal aspects related to the students’ academic life (past, present and future). The types of interactions by users when using a VLE can be analysed in three ways: based on the agent involved in the learning process, where there are three types, namely student-student interactions, student-teacher interactions and student-content interactions; based on the frequency of use, from most used, and moderately used to rarely used; and the last one based on the participation mode, either active or passive. Their results showed that the interactions that have a major effect on students’ academic performance are: interactions they have with their peers, interactions related to evaluating students and interactions involving active participation.
Again learning analytics is explored in (Joksimović, 2015), in which the authors highlight the importance of interactions in online learning settings. However, they claim that extending current understanding and use of these interactions is needed, as they are more complex than they appear to be. Their findings showed that while the quantity of student-content interactions was negatively associated with final grades, the time spent on student-system interactions had a positive effect on learning outcomes. It is highlighted that promoting strategies and guiding these interactions in online and distance learning settings may be necessary to improve learning outcomes.

Social learning analytics is the title of (Shum, 2012), in which the authors obtain a fusion of learning analytics and the social part of our environments. Three challenges are mentioned by the authors: (1) implementing analytics related to ethical integrity; (2) online social learning is emerging and it is not stable at the moment; (3) understanding different types of social learning analytics. The last challenge is tackled in the same paper by proposing a taxonomy of five types of social learning analytics: network analysis, discourse analysis, content analysis, dispositions analysis and context analysis.

**Communication, Participation, Initiative and Leadership**

After reviewing learning analytics, it is necessary to look for a way to implement all this in the platform. Therefore, it is time to set measures by taking into account educational systems and at the same time the main interactions performed by the users when using BeingExample.

First of all, the skills required by different educative systems were analysed and from them those which were close or related to social media were chosen. Communication (C), initiative (I) and participation (P) are the categories into which the skills listed in the following table may fall, in many cases more than one. There were more skills in each of the educational levels analysed but just the ones related to these three elements are in the table.

**Table 5-6 Social skills by educational level**

<table>
<thead>
<tr>
<th>Educational level</th>
<th>Basic Skills</th>
</tr>
</thead>
</table>
| 21st Century Skills (United States) | • Thinking critically and making judgments. (C, P)  
• Creativity and entrepreneurial thinking (C, P, I)  
• Communicating and collaborating. (C, P, I)  
• Making innovative use of knowledge (I) |
| University of Castilla-La Mancha (Spain) | • ICT skills. (C, P, I)  
• Digital processing skills. (P, I)  
• Groupwork skills. (C, P)  
• Interpersonal skills. (C, P)  
• Critical thinking. (I)  
• Leadership skills. (C, P, I)  
• Initiative skills and entrepreneurship spirit. (C, P, I) |
| European Recommendation for K-12 environments (Europe and Spain) | • Digital Skills. (C, P, I)  
• Social and civic skills. (C, P, I)  
• Initiative and entrepreneurship spirit. (C, P, I) |
| Vocational Studies (Spain) | • Information processing and digital skills. (C, P, I)  
• Social and citizenship skills. (C, P, I)  
• Efficient communication, respecting autonomy and competences of other people who are part of their work environment. (C) |
Again the question arises: if content is not the key element of this experiment, what could be as important as content is in educational environments? To answer this question several educational environments have been taken into account. Communication, initiative and participation have been chosen as measurements after analysing the social skills officially required by the European government in their recommendation on key competences for lifelong learning (Skills Europe, 2015), the unofficial yet accepted trend in social skills called 21st century skills (Skills 21st Century, 2015) in the United States, the Spanish vocational studies law (Skills Vocational Studies, 2015), and finally the basic skills required by the University of Castilla-La Mancha (Skills UCLM, 2015). Besides these three elements there are skills that are more closely related to social media interactions and social media functionalities, but these may be easily categorized into these three.

Regarding online data, the system tracks elements such as: (1) \( V \) number of votes (positive, negative or neutral); (2) \( C \) number of comments made; (3) \( G_{\text{In}} \) number of groups in which the user is a participant; (4) \( L \) number of logins; (5) \( I \) number of shared items; (6) \( E \) number of examples created; (7) \( G \) number of groups created; (8) \( Q \) number of questions created; (9) \( C_{\text{n}} \) connections created with other users. Online data may be collected by groups and/or by student/teacher (individuals). The purpose, formula, interpretation, scale and type of these measures can be seen in the following table.

**Table 5-7 BeingExample basic measures specification**

<table>
<thead>
<tr>
<th>Name</th>
<th>Purpose</th>
<th>Formula</th>
<th>Interpretation</th>
<th>Scale</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Votes (V)</td>
<td>How many times has a user voted?</td>
<td>( X = V ) ( V = ) number of votes</td>
<td>( X &gt;= 0 )</td>
<td>Natural numbers</td>
<td>( V = ) Counter</td>
</tr>
<tr>
<td>Comments (C)</td>
<td>How many times has a user made a comment?</td>
<td>( X = C ) ( C = ) number of comments</td>
<td>( X &gt;= 0 )</td>
<td>Natural numbers</td>
<td>( C = ) Counter</td>
</tr>
<tr>
<td>Groups in (GIn)</td>
<td>In how many groups is the user a participant?</td>
<td>( X = G_{\text{In}} ) ( G_{\text{In}} = ) number of groups in which the user is a participant</td>
<td>( X &gt;= 0 )</td>
<td>Natural numbers</td>
<td>( G_{\text{In}} = ) Counter</td>
</tr>
<tr>
<td>Logins (L)</td>
<td>How many times has the user logged into the system?</td>
<td>( X = L ) ( L = ) number of logins</td>
<td>( X &gt;= 1 )</td>
<td>Natural numbers</td>
<td>( L = ) Counter</td>
</tr>
<tr>
<td>Shared items (I)</td>
<td>How many items (documents or URLs) has the user shared?</td>
<td>( X = I ) ( I = ) number of items shared by the user</td>
<td>( X &gt;= 0 )</td>
<td>Natural numbers</td>
<td>( I = ) Counter</td>
</tr>
<tr>
<td>Examples (E)</td>
<td>How many examples has the user created?</td>
<td>( X = E ) ( E = ) number of examples created by the user</td>
<td>( X &gt;= 0 )</td>
<td>Natural numbers</td>
<td>( E = ) Counter</td>
</tr>
<tr>
<td>Groups (G)</td>
<td>How many groups has the user created?</td>
<td>( X = G ) ( G = ) number of groups created by the user</td>
<td>( X &gt;= 0 )</td>
<td>Natural numbers</td>
<td>( G = ) Counter</td>
</tr>
<tr>
<td>Questions (Q)</td>
<td>How many questions has the user created?</td>
<td>( X = Q ) ( Q = ) number of questions created by the user</td>
<td>( X &gt;= 0 )</td>
<td>Natural numbers</td>
<td>( Q = ) Counter</td>
</tr>
<tr>
<td>Connections (Cn)</td>
<td>How many connections does the user have?</td>
<td>( X = C_{\text{n}} ) ( C_{\text{n}} = ) number of connections of the user</td>
<td>( X &gt;= 0 )</td>
<td>Natural numbers</td>
<td>( C_{\text{n}} = ) Counter</td>
</tr>
</tbody>
</table>
Initial online measurements, based on data that can be collected by the platform, can be seen in the next figure:

![Diagram](image)

**Figure 5-26 BeingExample indicators of use**

Leadership indicators are based on the elements that other users create or produce by interacting with the examples or groups created by other users. There are three leadership indicators that have been taken into account and which can be seen in the next figure:

\[
\text{Punctual Leadership (i)} = \text{Maximum number of elements in a single group or example}
\]

\[
\text{Global Avg. Leadership (i)} = \frac{\text{Total number of elements or participations received}}{\text{Total num. Examples + Total num Groups}}
\]

\[
\text{Total Leadership (i)} = \text{Total number of elements or participations received}
\]

**Figure 5-27 BeingExample indicators of leadership**

In the next table a specification of the metrics shown in the previous two figures is presented. Their purpose, formula, interpretation, scale and type of measure are the characteristics presented:

**Table 5-8 BeingExample extended measures specification**

<table>
<thead>
<tr>
<th>Name</th>
<th>Purpose</th>
<th>Formula</th>
<th>Interpretation</th>
<th>Scale</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication (Com)</td>
<td>How many times has a user performed a communication interaction?</td>
<td>( X = C + Q )</td>
<td>( X \geq 0 )</td>
<td>Natural numbers</td>
<td>C = Counter, Q = Counter, L = Counter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( C = \text{number of comments} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( Q = \text{number of questions} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( L = \text{number of logins} )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Positive Reinforcement Social Networks

<table>
<thead>
<tr>
<th>Participation (Par)</th>
<th>How many times has a user performed a participation interaction?</th>
<th>( X = \text{Com} + \text{V} + \text{GIn} + \text{I} )</th>
<th>( X \geq 0 )</th>
<th>Natural numbers</th>
<th>Com = Measure ( \text{Com} = \text{number of interactions related with communication} )</th>
<th>V = Counter ( \text{V} = \text{number of votes} )</th>
<th>GIn = Counter ( \text{GIn} = \text{number of groups in which the user is a participant} )</th>
<th>I = Counter ( \text{I} = \text{number of items shared by the user} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiative (Ini)</td>
<td>How many times has a user performed an initiative interaction?</td>
<td>( X = \text{Par} + \text{E} + \text{G} )</td>
<td>( X \geq 0 )</td>
<td>Natural numbers</td>
<td>Par = Measure ( \text{Par} = \text{number of interactions related with participation} )</td>
<td>E = Counter ( \text{E} = \text{number of examples created by the user} )</td>
<td>G = Counter ( \text{G} = \text{number of groups created by the user} )</td>
<td></td>
</tr>
<tr>
<td>Punctual Leadership (PL)</td>
<td>How many interactions have received the most popular element shared by the user?</td>
<td>( X = \text{Pr} )</td>
<td>( X \geq 0 )</td>
<td>Natural numbers</td>
<td>Pr = Counter ( \text{Pr} = \text{number of participations received by the individual element} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global Avg. Leadership (GL)</td>
<td>What is the average of interactions received by the examples and groups created by the user?</td>
<td>( X = \text{TPr} / (\text{E} + \text{G}) )</td>
<td>( X \geq 0 )</td>
<td>Ratio</td>
<td>TPr = Counter ( \text{TPr} = \text{total number of participations received} )</td>
<td>E = Counter ( \text{E} = \text{number of examples created by the user} )</td>
<td>G = Counter ( \text{G} = \text{number of groups created by the user} )</td>
<td></td>
</tr>
<tr>
<td>Total Leadership (TL)</td>
<td>How many interactions have received all the examples and groups created by the user?</td>
<td>( X = \text{TPr} )</td>
<td>( X \geq 0 )</td>
<td>Natural numbers</td>
<td>TPr = Counter ( \text{TPr} = \text{total number of participations received} )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This data may be used by the teachers whose students are using the platform in order to improve weak points or to have a general view of the group and their interactions with respect to data from other groups.

### 5.3.4 Rewards

Rewards are an important element of PRSNs, in the following paragraphs BeingExample rewards are described. As can be seen in Table 5-9, BeingExample actions are compared with Twitter and Facebook actions, and the corresponding reward associated to each of the elements that are tracked by the system is shown. Each one of the interactions tracked by the system has been classified into communication or participation or initiative.

In the next table it may be seen how the main functionalities of BeingExample are categorized and compared with the functionalities of other social media sites as important as Facebook and Twitter. Furthermore, as the PRSN model dictates, each functionality is given a numeric reward in BEcoins.

As can be seen in the table below the main focus of the rewards is on the Initiative items, as it is initiative that pushes participation and communication. For the experimental study described in the next section, these rewards have been used.
Table 5-9 Rewards and functionalities comparison

<table>
<thead>
<tr>
<th>Measurement</th>
<th>BE Actions</th>
<th>BE Rewards</th>
<th>Facebook Actions</th>
<th>Twitter Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>Login (L)</td>
<td>None</td>
<td>Login</td>
<td>Login</td>
</tr>
<tr>
<td></td>
<td>Comment (C)</td>
<td>1*</td>
<td>Comment</td>
<td>Reply</td>
</tr>
<tr>
<td></td>
<td>Create a Question (Q)</td>
<td>None</td>
<td>Create a pool</td>
<td>Create a pool</td>
</tr>
<tr>
<td></td>
<td>Automatic Connection (Cn)</td>
<td>None</td>
<td>Ask for friendship</td>
<td>Private Message</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>Vote (V)</td>
<td>1*</td>
<td>Likes</td>
<td>Like / Favourite</td>
</tr>
<tr>
<td></td>
<td>Items Shared (I)</td>
<td>1*</td>
<td>Share Info</td>
<td>Re-Tweet</td>
</tr>
<tr>
<td></td>
<td>Groups In (GIn)</td>
<td>1*</td>
<td>Groups In</td>
<td>Lists In</td>
</tr>
<tr>
<td>Initiative</td>
<td>Create an Example (E)</td>
<td>2</td>
<td>Create a Post</td>
<td>Create a Tweet</td>
</tr>
<tr>
<td></td>
<td>Create a Group (G)</td>
<td>3</td>
<td>Create a Group/Page</td>
<td>Create a List</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* If that interaction creates a connection the user receives one BEcoin
**BeingExample Rewards are given in BEcoins, and these may be exchanged for extra points in class.

Connections are created automatically when users participate in groups or examples, or others participate in theirs. Figure 5-28 shows an example of how a user sees his connections, which are displayed in the top right part of the users’ home page. The rest of the users cannot access others’ connections or see their BEcoins.

When a group or an example is deleted the connection with the user/s could be lost. Therefore, connections are considered a reward by the system and they may disappear when the interaction or action which created it is deleted.

BEcoins or BeinExampleCoins are the points that a user has earned via participation (most of them due to example or group creation). At the moment they are used as part of the ranking, but in the future the plan is for them to be used for monthly and yearly prizes or even in object exchanges as the reward points in supermarkets. BEcoins are the main reward of the system.

It is very important for the users not to delete their examples or groups because they and the users that had participated will lose some BEcoins. Figure 5-28 shows an example of how a user sees his BEcoins.

Figure 5-28 Examples, groups, connections and BEcoins counter

All the actions performed by the users help to improve their platform ranking. At the moment the platform is not yet well established (it does not have many users or monetary incomes) so it is not possible to give prizes to those users. But with time, and if its growth allows, this ranking will be used to reward those who deserve it. The ranking is based on the total number of BEcoins obtained; if a BEcoin is spent it does not affect the ranking, as it is not what you have that is taken into account, but what you have received.
5.3.5 Architecture and Implementation

This section describes the main features of BeingExample regarding its architecture and implementation.

Organizational Structure

BeingExample’s organizational structure is described below, and the actors are shown in Table 5-10. The development of this organizational structure was based on the work carried out in (Szekely, 1996).

<table>
<thead>
<tr>
<th>Table 5-10 BeingExample organizational structure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Individuals</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Examples</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Groups</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Rewards</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Description</strong></td>
</tr>
</tbody>
</table>

Here are the main actors in the system:

- **Administrator**: an administrator with permission to perform any modifications to the system configuration. This type of user has the option to delete or edit comments, examples, groups, users, etc.

- **Entity**: an entity that will participate in creating rewards to be exchanged for BEcoins (motivated by social marketing). It is not supported yet by the online system (BeingExample, 2014).

- Registered user, or **participant**: they may create groups or examples in which they and others can participate.

- **Anonymous user**: they may perform some actions such as read examples, or public group content, vote, but they cannot comment or create their own examples or groups.
Diagram of Entities

In BeingExample the following sub-systems can be found:

- **Login**: this is in charge of managing the login and the user register. It is necessary to be registered in order to begin to use the application.

- **User**: this is in charge of managing the personal information of the users, and it gives the users the option of changing or updating their information. It also manages the user connections with the help of the Reward system.

- **Reward system**: this handles all the elements related to rewards: ranking, transactions, BEcoins and connections. It is important for it to function well as incorrect functioning or use of it by participants or administrators may imply a wrong use of the positive reinforcement.

- **Examples**: this handles the examples. The users have the option of creating a new example or consulting the ones that have been created. All the examples are public.

- **Groups**: this is the biggest sub-system, because groups are one of the main parts of BeingExample. All users who participate in the group will be able to visualize the participants, the outcomes, shared items and comments. There are configuration options that allow the creator to deactivate outcomes, or shared items, or view results or anonymous participation. Another option that is handled by this sub-system is private groups, which it does by using a code that has to be introduced at least once by the users who want to participate in private groups.

Data Model

The data model includes all the database tables necessary for the first version of the platform and their corresponding relations. The tables are the following:

- **Users**: this contains id (unique user identification number), username, name, email, password, membership, URL, city and country. One user can have none or several examples.
• **Examples**: this contains id (unique user identification number), user_id (creator), title, hashtag, description, URL, imgURL and timestamps.

• **Groups**: this contains id (unique user identification number), user_id (creator), title, hashtag, description and code. The next are Booleans to control creator choices isActive, results, anonymous, comments, sharings and outcomes. One user can have none or several groups.

• **Comments**: this contains id (unique user identification number), user_id (creator), post_id (where the comment is), content and timestamps. One group can have none or several comments. One example can have none or several comments.

• **Questions**: this contains id (unique user identification number), user_id (creator), group_id (where it belongs), content, URL and timestamps. One group can have none or several questions.

• **Documents**: this contains id (unique user identification number), user_id (creator), group_id (where it belongs), content, title, type (outcome or shared item), URL and timestamps. One group can have none or several documents.

• **UserParticipations**: this contains id (unique user identification number), user_id (participant), group_id and timestamps. This is used for private groups; once the user has introduced the code the data is inserted in this table and the code will not be required any more.

• **Connections**: this contains id (unique user identification number), user_id, user_connected_id and timestamps.

• **Participations**: this contains id (unique user identification number), user_id (participant), group_id, question_id, vote and timestamps.

• **EParticipations**: this contains id (unique user identification number), user_id (participant), example_id, vote and timestamps.

**Architecture**

The architecture of the application has a client/server model and is shown in Figure 5-30.

For the proper functioning of the platform a Web server and a database are necessary. In this case both servers can be on the same machine. The Web server is in charge of solving the Web requests besides interpreting the code for generating the Web pages.

![Figure 5-30 BeingExample architecture](image-url)
An SMTP server is necessary as well due to reputation issues, as if a new SMTP server is created, its reputation (Resnick, 2000) will depend on the IP, and as a new website and IP it comes with a reputation that is not very good. Therefore, an external server has been the option taken. This server is from a business which provides SMTP servers to other businesses or individuals and your account starts with an acceptable email reputation.

The system has three types of users (entities are not yet supported by the platform), as many as there are user’s roles in the application: administrator, user and entity. These users can log into the system through the Internet, and their browser will send requests to the server, and the server will connect to the database when necessary.

Laravel (Laravel, 2014) has been used in development. Laravel is a free, open-source PHP Web application framework, designed for the development of MVC Web applications. Laravel is released under the MIT license. The database technology used is MySQL (MySQL, 2014).

Why Laravel? Laravel is built on top of several Symfony components, giving your application a good foundation of well-tested and reliable code.

Furthermore, Laravel is accessible, and provides powerful tools for large, robust applications. A good inversion of control container, expressive migration system, and tightly integrated unit testing support give the tools needed to build any Web application.

5.3.6 Functionality

In this section the question “What can I do with BeingExample?” is answered. Some of the functionalities have already been discussed above, but here some of them will be presented and explained in greater depth.

When a registered user logs into the system he obtains the User’s Home page (Figure 5-31). On this page, examples and groups from other users will be shown. He has the options of creating an example or creating a group.

A counter for the main elements that a user can have on the platform is situated in the top right part of the home page (Figure 5-31). These elements are:

- **Examples**: how many examples this user has created.
- **Groups**: how many groups this user has created.
- **Connections**: how many users are connected to the user through participation.
- **BEcoins**: Number of BEcoins that the user has.

![Figure 5-31 User’s home](image)
The main menu of the website (top part of Figure 5-31), besides Home, has notifications, the group edit profile and logout (administration access only for administrators). My examples and my groups are sections where the user can consult or edit the examples and groups that he leads or has led, check results and check their status. The user’s examples and groups can be edited or deleted from the home page or the individual page of that element (group or example).

The public page of a user, which can be accessed via “http://beingexample.com/username”, is very similar to the home page of a user, but it does not have the create options, or access to the user connections or BEcoins. While the number of connections is shown, the number of BEcoins remains private, just for the user. The user’s connections cannot be navigated by anyone but the user himself.

As mentioned above, there are two principal items: examples and groups. Examples are so simple that it will not be necessary to look at their functionality in greater depth (already described in Section 5.3.1). The functionality of groups is examined in greater depth below.

![Create a Group](image)

**Figure 5-32 Anonymous participation**

When a user is creating a new group he has to fill in three important fields: group title, hashtag and description. Besides this information there are several options to decide on, and these options are explained below and can be seen in Figure 5-32:

- Active or Closed group: by default set to active, but if the user deactivates this checkbox the group will be created as closed and will not allow users to participate unless the creator activates the group.
- Public or Private group: by default set to private, but if it is public all users will be able to participate in the group. On the other hand, if it is private, they will need to insert the group code to be able to access it.
- Allow user to see results: sometimes the creator will not want the results to be displayed, or he may prefer to display results at the end of the group.
- Allow Anonymous participation (private groups do not allow anonymous participation): as its name says, it allows anonymous participation in the case of the group being public.
- Allow comments: having this option checked allows registered users to comment in the group.
• Allow sharing documents: having this option checked allows registered users to share documents in the group.

• Include outcomes: having this option checked allows registered users to create outcomes (mostly documents or decisions) in the group.

The rest of the functionalities of the groups were explained above in Section 5.3.1.

It is important to highlight the similarities and differences between example and group questions. Both allow users to vote, and both have the option of a URL. But questions belong to a group and examples are not part of anything else, they are by themselves. Furthermore, examples have an image and comments, and the users have online social network sharing buttons.

Communication

Private messages are not implemented. The only ways of communication between users are comments and participation. In this first version of BeingExample the idea is for the users to increase public participation, private participation is not a goal. Anyway, users have email and generic OSNs for private communication matters.

Participation

Participation is one of the key elements of the platform. Users can participate in examples or in groups. Participation in groups is more complex than participation in examples. By participating users obtain connections and they improve their ranking if they are registered users.

When a positive impact is intended, the more users using the platform, the better for their users’ environments. Therefore, an important functionality was to allow the participation of anonymous users. It has risks such as possible manipulation in voting, but this is assumable by the platform, because here it is not about winning but about improving. The anonymous participation in examples is implemented on the index page of the platform and on every individual user page, where his/her examples may be read and voted on.

The Online Platform

The platform has been online since July 11th, 2014 (BeingExample, 2014). When the reader checks the online platform, it will be possible to see some changes. These changes may have come about due to several circumstances. BeingExample is intended to be a living tool and to adapt to the final users. It is important to highlight that (BeingExample, 2014) has been implemented following these lines of research, but its ownership is not related to the research, the University or the High Schools where it was tested. The owners of the website came to an agreement to provide all the data related to the experimental studies (presented in Section 5.4), and to implement PRSN functionalities as described in this section, but they maintain ownership of the platform.

There have been several studies into the psychological meaning of words, as in (Tausczik, 2010). There has been research on Facebook about these psychological meanings of words and how they can affect the users who are exposed to them, such as:

“The spread of emotion via Facebook” (Kramer, 2012) and “Experimental evidence of massive-scale emotional contagion through Social Networks” (Kramer, 2014), which is a research paper for which they conducted a massive experiment on Facebook (689,003 users). The authors claim that emotions can be transferred to others via emotional contagion. This happens without direct interaction, just by being exposed
to others users’ content. It clearly supports this platform in one of its objectives, namely to generate a positive environment by sharing positive examples.

Some newspapers complain about how Facebook “manipulates its users’ feelings” (eldiario, 2014), and in this case the journalist claims that only LinkedIn has references to research in its terms of use.

For these reasons a Terms of Research part has been included in the terms of service of the platform. This paragraph has been included: “As this platform is a product of research, in the future there will be research conducted on this website, but do not worry, it will not affect your use of BeingExample and all the results will be anonymous, your name will not appear anywhere.”

Table 5-11 Comparing functionalities, commercial platforms versus these research platforms

<table>
<thead>
<tr>
<th></th>
<th>BE</th>
<th>L.L.</th>
<th>Moods</th>
<th>Tweacher</th>
<th>Edmodo</th>
<th>Facebook</th>
<th>Twitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Voting</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Leadership Functionalities (*)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Connections</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No (*)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sharing Documents</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No (*)</td>
<td>No (*)</td>
</tr>
<tr>
<td>Monitoring Options</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Rankings Options</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Academic Oriented</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Friends</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Private Messages</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (*)</td>
<td>Yes (*)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 5-11 shows a comparison of the most important platforms, prototypes and commercial platforms mentioned in this thesis. From the beginning: BE: BeingExample (Section 5.3); L.L: Looking for Leaders (Section 5.1.2); Moods (Section 5.1.1); Twea: Tweacher (Section 4.2); Edm: Edmodo; FB: Facebook and TW: Twitter.

As can be seen in the table above, most functionalities analysed are in BeingExample, except for friends and private messages. These two were not implemented on purpose to avoid distractions.

BeingExample, which is a PRSN oriented to education, has been created and presented. Therefore, it can be said that (G5), to create a platform, based on the Online Social Networks concept created, which helps to measure, analyse and improve and/or support students’ online social skills, motivation and academic outcomes has been partially accomplished. Once the platform is ready, it will be time to test it within a real environment (Section 5.4), and this experiment will help to completely accomplish G5.

5.4 Experimental Study: Analysing the Impact of BeingExample

A final experiment modelled for testing BeingExample will be presented in this section. An eight week experimental study to determine how BeingExample affects a real educational environment has been conducted. It may be considered a long term experiment, as it was carried out over eight weeks of an academic year, with the first and last weeks being preparation and ending weeks, while the other six were when the students participated in the experiment and data was collected. Besides these weeks, classroom data was collected by the teacher before and after this period, so in total it was a semester-long experiment.

This section has helped to accomplished the following thesis goals: G5: To create a platform, based on the Online Social Network concept created, which helps to measure, analyse and improve and/or support students’ online social
skills, motivation and academic outcomes. And G6: To perform experimental research to validate and extract data from the platform and the new Online Social Networks concept.

First of all the experimental study purpose is described, and then questions and hypotheses are formulated. Then the method is explained, followed by the results. Finally, a discussion about the experiment concludes the section.

5.4.1 Purpose

Almost every path started in life has a purpose, and once the platform BeingExample had been created, it was time to test how its use affects educational systems. Therefore, the purpose of this study is to answer research questions and prove the initial hypotheses of this experimental study, which are listed below.

Although the main purpose is to answer the research questions and validate the hypotheses related to these research questions, the experiment starts by trying to collect as much data as possible in order to be able to obtain other results that may be hidden at first sight. In addition, these questions and hypotheses are related with this chapter’s goals and this thesis’ goals and hypotheses (Table 5-12).

- **Q1.** Is there a relation between students' grades and BeingExample use? Those who use the platform and those who do not. External validation.
- **Q2.** What effect/relation does the use of BeingExample have for educational purposes on/with students' classroom participation or other skills?
- **Q3.** Among those who use the platform, how is a proper use of the platform related to academic outcomes? Inner validation.

Below are the hypotheses related to these questions:

- **ER.H1.** (Q1) Is there a relation between academic results obtained by students and the use of BeingExample?
- **ER.H3.** (Q2) Does proper and constant use of BeingExample have an effect on students' participation or social skills used within regular classes?
- **ER.H2.** (Q3) Can academic outcomes be predicted by the use of the BeingExample measurements?

These are the questions and hypotheses that have guided BeingExample tests. In the following table the relations between the thesis hypotheses, goals, chapter goals and experimental research hypotheses are shown.

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Goals</th>
<th>Chapter 5 Goals</th>
<th>ER Hypotheses</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>G1, G2, G3, G4, G5 and G6</td>
<td>PSR.G1</td>
<td>ER.H1</td>
</tr>
<tr>
<td>H2</td>
<td>G3, G4, G5 and G6</td>
<td>PSR.G2, PSR.G3 and PSR.G4</td>
<td>ER.H2 and ER.H3</td>
</tr>
<tr>
<td>H3</td>
<td>G3, G4, G5 and G6</td>
<td>PSR.G2 and PSR.G3</td>
<td>ER.H2 and ER.H3</td>
</tr>
</tbody>
</table>

5.4.2 Method

The method used for testing BeingExample and answering the research questions is explained below. Procedure, Sample, Timeline, Tasks and Activities, and Data Collection, in this order, are presented in the following paragraphs.
Procedure

The design of the experimental study was based on (Lazar, 2010). The main characteristics of the experiment are: it is based on hypotheses; the dependent variables are quantitatively measured; it uses statistical significance tests; and it is replicable. Regarding variables, the independent variable is the use or not of the BeingExample platform. On the other hand, there are two main dependent variables which are easy to measure: academic performance and classroom participation. Regarding the design of the experiment, it is worth highlighting that it was a basic design as it has one independent variable, and it was a between-groups experiment, as with-in group design was not possible.

In order to answer and validate the hypotheses and questions listed above, an experimental study of eight weeks was conducted. The first and last weeks, called week 0 and week 7, were used for specific purposes and were not taken into account for the results. This was because week 0 was used for an initial survey (all students) and training (students who had not used BeingExample before), while week 7 was used for final surveys (experimental group) and exams. The final survey was only completed by the experimental group as it is similar to the initial one and its purpose is to measure changes produced because of BeingExample use. Weeks 1 to 6 were the main part of the experiment. During these weeks several activities were undertaken.

A Mathematics teacher and his 72 students took part in the study. The students were divided into two groups, which will be explained in the Sample section. Online data (from BeingExample) and offline data from daily procedures in class were collected methodically. Offline data was collected in order to validate the hypotheses ER.H1 and ER.H2. On the other hand, online data helped to work with all the experimental questions and hypotheses.

During each class, the students forming part of the experimental group were given 10 to 15 minutes each to work on the online platform (classes were 90 minutes long), and they had a main activity to perform each week, as for example week 4 was college oriented. Students were given two sheets to stick in their journals and keep track of their online activity. One of them was to monitor their initiative, participation, communication and leadership, while the other was a roadmap with the six main goals, one per week of the experiment, and on this document they were asked to write down the highlights of their activity on the platform.

The lifecycle of the experiment was as follows:

- (1) Identify research hypotheses.
- (2) Specify the design of the study.
- (3) Run a pilot study to test the design, the system, and the study instruments (week 0).
- (4) Run the actual data collection sessions (week 1 to week 7).
- (5) And finally report the results (Sections 5.4.3, 5.4.4 and 5.4.5).

At the end of the experiment an analysis of the data was carried out and its results are presented in Section 5.4.4, and discussed in Section 5.4.6.

Sample

For the experiment there were two different homogeneous groups. The experimental group N=48 with three different classes and the control group N=24 with another three different classes. It was conducted during the spring semester with a K-12 mathematics subject. The students’ ages ranged from 14 to 18 years.
Within the experimental group there are two groups, group one with \(N=26\) and group two with \(N=22\). This division is due to these three groups having mathematics classes in different periods. The total number of students in the experimental group is \(N=48\).

Before starting the experimental research all the students were given the same activities and academic tools. The total number of students in the control group is \(N=24\).

**Table 5-13 Sections of the sample group**

<table>
<thead>
<tr>
<th>Names</th>
<th>Group</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section one</td>
<td>Experimental</td>
<td>26</td>
</tr>
<tr>
<td>Period 1A Geometry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section two</td>
<td>Experimental</td>
<td>22</td>
</tr>
<tr>
<td>Period 3A Geometry</td>
<td>Control</td>
<td>24</td>
</tr>
<tr>
<td>Section three</td>
<td>Control</td>
<td>24</td>
</tr>
<tr>
<td>Period 7A Geometry</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

After the general data shown in the table above, in Table 5-14 we can see more data about each one of the classes: sex, age range, average age, how many students are 9th grade students (freshmen, first year at the High School), 10th grade, 11th grade or 12th grade (senior year, last year at the High School). This data gives a more complete idea about each group.

**Table 5-14 Sample group data**

<table>
<thead>
<tr>
<th>Group</th>
<th>Students</th>
<th>Women</th>
<th>ELL Students</th>
<th>TSI Ready</th>
<th>Age</th>
<th>Age Avg.</th>
<th>9th</th>
<th>10th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>48</td>
<td>52%</td>
<td>60%</td>
<td>15%</td>
<td>15-17</td>
<td>15.6</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>Control</td>
<td>24</td>
<td>25%</td>
<td>63%</td>
<td>17%</td>
<td>14-17</td>
<td>15.8</td>
<td>2</td>
<td>22</td>
</tr>
</tbody>
</table>

More relevant information to take into account about the sample is that in the educational system where the experiment was conducted there are students with special situations such as:

- Some subjects such as Algebra I, Geometry, Algebra II etc. can be taken before the academic year that they are normally taken if the student is good enough at Mathematics. This leads to groups with a wide age range, from 14 to 18.

- There are many students who come from Mexico, and some of them struggle with the language (it does not affect Mathematics as much as other subjects), so some of them are placed in a grade below the one corresponding to their age in order to allow them to improve their English with content that they should already know. This affects the age range within the groups as well.

- At the High School where the experiment took place, students may have started “Early College”. These are students that have already taken or passed College tests for Mathematics and English and who may be taking Dual credit classes (credit that counts for the High School and for some colleges) at the same time that they take their regular classes. This will produce groups that have students with college classes mixed with students that do not yet have college classes.

Measures were taken to avoid the *Hawthorne effect* (Adair, 1984). Thus, students were not told that an experiment was taking place, although the teacher knew about the experiment as he had to track extra student data, such as classroom participation and academic performance based on multiple choice exams to avoid subjectivity. In order to avoid them thinking or knowing about the study, the teacher told all the groups that the project would first be undertaken by two groups and later by the last group due to website workload.
Timeline

The experimental research took place during the fourth, fifth and sixth weeks of the academic year 2014-15. The three main stages of the experimental research on BeingExample were Pre-use, During-use and Post-use.

- **Pre-use** stage: from the second week of January until the second week of March. During this stage academic offline data was collected.
- **During-use** stage: from the third week of March until the last week of April. BeingExample was used by the experimental group and its online data interactions were collected. Academic data was collected as well.
- **Post-use** stage: from the first week of May until the last week of May. During this stage academic offline data was collected.

The second stage (During-use) consisted of a period of 8 weeks of using BeingExample. The first and last week, called week 0 and week 7, were used for specific purposes and have not been taken into account for the online data results. The period of study was from March 16th (week 0) to May 10th (week 7). Week 0 was used for an initial survey (all students) and training while week 7 was used for final surveys (experimental group) and exams. The final survey was only completed by the experimental group as it was similar to the initial one and its purpose was to measure changes produced through BeingExample use. Weeks 1 to 6 were the core of the experiment (when online data was collected).

Each week, students in the experimental group were asked to work with BeingExample, with a new main activity for each week; for example, week 4 was devoted to college orientation, and the week 5 activity was on creativity. The system tracked students’ online social interaction data and presented the data as BEcoins won by the student, but not in terms of Communication, Participation or Initiative. A roadmap document was given to the students with the six main goals of the use of BeingExample, one per week. They were asked to make a note of the highlights of their activity on the platform.

The control group did not use the platform. Both groups had regular Mathematics classes with no difference in the activities undertaken. BEcoins were exchanged for extra points by students (in the class where the platform was used). The control group was asked to bring the teacher digital material connected with the class or academic life to obtain extra points. In order to have similar possibilities, one group used BeingExample and the other did not. These extra points were not taken into account for academic outcome data.

In the table below a summary of the most important tasks and activities performed during the experimental research are listed.

<table>
<thead>
<tr>
<th>Week</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Initial survey (all students)</td>
</tr>
<tr>
<td>March 16 - 22</td>
<td>Initial BeingExample training (experimental group)</td>
</tr>
<tr>
<td>1</td>
<td>Group oriented week</td>
</tr>
<tr>
<td>March 23 – 29</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Example oriented week</td>
</tr>
<tr>
<td>Mar. 30 – Ap. 5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Hobbies oriented week</td>
</tr>
<tr>
<td>April 6 – 12</td>
<td>Exam number one</td>
</tr>
<tr>
<td></td>
<td>Report card due April 10th</td>
</tr>
</tbody>
</table>
Lastly, classroom data was collected after the period of use of BeingExample (post-use). Online data and offline data from daily procedures in class were collected methodically. Offline data, such as test results and classroom participation were collected by the teacher.

Tasks and Activities

Below the most important activities and/or tasks carried out before, during and after the experimental research, are explained in detail.

In the week before starting the experimental research (named week 0), the students in the experimental group received one and a half hours of training in using the BeingExample platform. During this training, students must complete the following actions: edit their profile; join the class group; create three examples; vote on 10 peers’ examples; create a group with a purpose and create three questions on it; join three groups created by peers; share 3 items in their groups or peers’ groups; make 10 comments and evaluate themselves (see figure below).

<table>
<thead>
<tr>
<th>Levels</th>
<th>Participation</th>
<th>Communication</th>
<th>Initiation</th>
<th>Leadership</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Have you voted?</td>
<td>Have you made comments?</td>
<td>Have you created a group?</td>
<td>Has your group 0 to 3 participants?</td>
</tr>
<tr>
<td>2</td>
<td>Have you become a group participant?</td>
<td>Have you answered questions?</td>
<td>Have you created questions?</td>
<td>Has your group 3 to 5 participants?</td>
</tr>
<tr>
<td>3</td>
<td>Have you shared documents [in a group own by other user]?</td>
<td>Have you created new questions if needed?</td>
<td>Have you shared documents on more than three groups?</td>
<td>Has your group 10 or more participants?</td>
</tr>
</tbody>
</table>

Figure 5-33 Students self-evaluation

Among their weekly activities, students have to keep track of their use of the platform with two documents, as mentioned above. One of these activities was to track their communication, participation,
initiative and leadership levels with a document similar to the one shown in the figure above. Students then have to write down the highlights of each week on the document that includes a roadmap (see figure below) with the goal for each week.

Regarding exams, all the students had to sit three exams in different weeks in order to help answer the experimental research questions one and two. These exams were multiple choice exams, in order to avoid any subjective grading.

Figure 5-34 Experiment roadmap for students

The initial surveys were completed during week 0, directly before the training. Both groups, namely the experimental and control groups, completed them. Some of the questions asked were: (1) Age; (2) Gender; (3) Do you like new technologies?; (4) Right now your self-motivation is …; (5) Do you study at home?; (6) Are you taking dual credit classes?; (7) Do people get the message when you talk or ask them?; (8) Are you an active participator? etc.

The final survey (week 7) was completed by the experimental group only to obtain data about BeingExample use and whether any of the answers to the questions in the initial survey had changed due to the use of the platform, and some of the initial questions were removed. Some new questions were added: (1) Did you like using BeingExample?; (2) Would you like to use IT tools that may help you to improve participation, initiative, communication or leadership?; (3) Would you recommend BeingExample to your friends or teachers?; (4) Have you improved your online social skills during this project? etc. The most noteworthy results of both surveys are presented and discussed in Sections 5.4.5 and 5.4.6. Both surveys were carried out by using an online form that has to be completed by the students (anonymously).

Data Collection

There are two important data collection sources. The first one is the teaching-learning process that takes place in the class, which may be considered as “offline data” or “real world data”. The second one is all the data collected through the monitoring and tracking tools provided by BeingExample, mostly information about the interactions of the students with the platform and between them.

Some of the most important offline data collected for analysis was: (1) students’ exam grades; (2) extra points from students’ participation; (3) students’ attendance and late arrivals; (4) seating chart per group.

On the other hand, online data was also collected, including such elements as: (1)(V) number of votes (positive, negative or neutral); (2)(C) number of comments made; (3) (GIn) number of groups in which the user is a participant; (4)(L) number of logins; (5)(I) number of shared items; (6)(E) number of examples created; (7)(G) number of groups created; (8)(Q) number of questions created; (9)(Gn) connections created.
with other users. All these data helped to create formulas for measuring participation, initiative, communication and leadership (Section 5.3.3). These formulas will be presented in Section 5.4.4.

Online data was collected by group and by student, and an example of both can be seen in the following figure:

An example of classroom participation data collection is shown below. In the process, seven measurements were taken per group: the first three were taken before starting the experiment, two more during the experiment, and the last two after finishing it.

With regards to offline measurements, which are related to ER.H3, there are no special formulas or measurements. Once all the data is collected it will be analysed by looking for patterns or evidence about how the use of BeingExample affects daily procedures in the classroom.

Statistics will play an important role when analysing the results, and the most important measurements taken on the data will be: (1) measures of dispersion: standard deviation and range; (2) measures of central

Figure 5-35 Example of online data collection

Figure 5-36 Example of classroom data collection
tendency: mode, median and mean. The experimental group data and the control group data will be statistically analysed by using nested ANOVA and multiple linear regressions.

5.4.3 Results

First of the academic outcomes data is discussed. Followed by Communication, Participation and Initiative data are analysed through BeingExample data and it is presented. Much more data than that shown was collected, but only a summary of the most important and relevant information is presented.

Academic Outcomes Data

In this case only the exam grades were collected, and multiple choice exams were used in order to be as objective as possible and avoid subjectivity. The table below shows the previous means before the experimental was conducted, and those during and post are the grades of the exams taken during and after the experiment.

<table>
<thead>
<tr>
<th>Data</th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>Diff.</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>1 (1A)</td>
<td>64.90</td>
<td>27.50</td>
<td>76.90</td>
<td>20.73</td>
</tr>
<tr>
<td>2 (3A)</td>
<td>66.35</td>
<td>19.90</td>
<td>81.90</td>
<td>17.50</td>
</tr>
<tr>
<td>3 (7A)</td>
<td>66.40</td>
<td>25.10</td>
<td>71.70</td>
<td>20.13</td>
</tr>
<tr>
<td>Overall</td>
<td>65.90</td>
<td>24.20</td>
<td>76.80</td>
<td>19.5</td>
</tr>
</tbody>
</table>

Classroom participation was manually tracked by the teacher in his teacher's book and later digitalized to an Excel document in order to be processed and analysed. In this case only the positive actions or participations have been taken into account.

<table>
<thead>
<tr>
<th>Section</th>
<th>Pre-Experiment (9W)</th>
<th>Experiment (6W)</th>
<th>Post-Experiment (5W)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>1 (1A)</td>
<td>3.72</td>
<td>2.63</td>
<td>2.88</td>
<td>2.22</td>
</tr>
<tr>
<td>2 (3A)</td>
<td>4.05</td>
<td>3.82</td>
<td>3.82</td>
<td>2.54</td>
</tr>
<tr>
<td>3 (7A)</td>
<td>4.04</td>
<td>1.95</td>
<td>2.59</td>
<td>1.66</td>
</tr>
<tr>
<td>Overall</td>
<td>3.94</td>
<td>2.35</td>
<td>3.10</td>
<td>2.14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section</th>
<th>Pre-Experiment (9W)</th>
<th>Experiment (6W)</th>
<th>Post-Experiment (5W)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Diff.</td>
<td>Mean</td>
<td>Diff.</td>
</tr>
<tr>
<td>1 (1A)</td>
<td>0.41</td>
<td>+0.07</td>
<td>0.48</td>
<td>+0.01</td>
</tr>
<tr>
<td>2 (3A)</td>
<td>0.45</td>
<td>+0.19</td>
<td>0.43</td>
<td>+0.04</td>
</tr>
<tr>
<td>3 (7A)</td>
<td>0.45</td>
<td>-0.02</td>
<td>0.43</td>
<td>+0.04</td>
</tr>
<tr>
<td>Overall</td>
<td>0.44</td>
<td>+0.08</td>
<td>0.47</td>
<td>+0.07</td>
</tr>
</tbody>
</table>

In the two tables above classroom participation data can be seen. Both tables have data from different periods of time: before the experiment (Pre-experiment), during the experiment (Experiment) and finally data collected once the experiment had ended (Post-Experiment).
The figure below shows the evolution of the classroom participation for each group, both experimental and control. It is interesting to see how at the beginning the weekly participation average per student was similar in the two groups, and the evolution during and after the experiment.

![Classroom participation pre, during and post experiment](image)

**Figure 5-37 Classroom participation pre, during and post experiment**

**Communication, Participation and Initiative through Being Example Data**

Communication, participation and initiative were the three measures taken into account, and these were tracked during the experiment. The mean scores per student are shown in the following table.

<table>
<thead>
<tr>
<th>Section</th>
<th>Communication</th>
<th>Participation</th>
<th>Initiative</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>SD</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>1 (1A)</td>
<td>10.48</td>
<td>56.74</td>
<td>69.22</td>
<td>26</td>
</tr>
<tr>
<td>2 (3A)</td>
<td>15.05</td>
<td>96.73</td>
<td>112.77</td>
<td>22</td>
</tr>
<tr>
<td>Overall</td>
<td>12.77</td>
<td>76.74</td>
<td>91.00</td>
<td>48</td>
</tr>
</tbody>
</table>

The next figure shows the total number of interactions performed via the platform by students from the experimental group. These interactions were related to, or included in, the indicators Communication, Participation and Initiative.

![Total number of interactions (per week)](image)

**Figure 5-38 Total number of interactions (per week)**
In week 2 and week 5 the figures are lower, which is probably due to them being High School testing weeks, while on the other hand the high level of participation during week 6 may be due to the fact that it was the last week of the project and students wanted to share the information that they had not had time to share before.

Regarding the leadership data, both total leadership and average leadership have been taken into account (formulas presented in Section 5.3.3), and the results by group can be seen in the following table. It is important to highlight that subject content leaders may be seen as the ones expected to have better scores, but in this case most of the information shared was not related to subject content. Thus results in this area are not predictable, one way or another, and these results may be interesting as a starting point for leadership studies in social media integrated in educational centres.

<table>
<thead>
<tr>
<th>Group</th>
<th>Grade</th>
<th>Elements</th>
<th>L (Avg.)</th>
<th>L (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>&gt;= 90</td>
<td>25.00</td>
<td>1.48</td>
<td>38.50</td>
</tr>
<tr>
<td></td>
<td>90 &gt; x &gt;= 70</td>
<td>15.92</td>
<td>2.53</td>
<td>34.46</td>
</tr>
<tr>
<td></td>
<td>&lt; 70</td>
<td>7.80</td>
<td>1.09</td>
<td>11.40</td>
</tr>
<tr>
<td></td>
<td>Students Avg.</td>
<td>14.33</td>
<td>1.84</td>
<td>26.52</td>
</tr>
<tr>
<td>3A</td>
<td>&gt;= 90</td>
<td>29.67</td>
<td>2.32</td>
<td>68.67</td>
</tr>
<tr>
<td></td>
<td>90 &gt; x &gt;= 70</td>
<td>18.33</td>
<td>2.62</td>
<td>18.07</td>
</tr>
<tr>
<td></td>
<td>&lt; 70</td>
<td>9.00</td>
<td>4.19</td>
<td>31.50</td>
</tr>
<tr>
<td></td>
<td>Students Avg.</td>
<td>18.18</td>
<td>2.86</td>
<td>27.41</td>
</tr>
</tbody>
</table>

In the next two figures data from the table above is shown. Firstly, all the elements created by the students and the total leadership data that is related to these items is presented. After that global average leadership is displayed in the following figure.

Regarding total leadership, as it is an accumulative measure, usually those who create more elements are the ones who have a higher value. However, it can be seen that in group 3A the students who scored below 70 have more total leadership than those who are between 90 and 70.

![Figure 5-39 Total leadership and elements created (students grouped by grades)](image)

On the other hand, average leadership depends on how many interactions are received by an element created, so it penalizes those who create a lot of content that is not interesting for their peers. As can be seen in the figure below, both the groups analysed, namely 1A and 3A, showed different results.
While in 1A the group with a better score in average leadership are those who score between 70 and 90, in 3A the average leaders are the ones who are below 70.

As mentioned above, leadership data analysis stops here as it is difficult to make connections with academic outcomes, although it will be very useful to have this initial data for comparison with data collected in future experiments.

### 5.4.4 Statistical Analysis

First ANOVA (nested) analysis is presented, this analysis helped to know if the improvement showed by the experimental group (Section 5.4.3) is significant. After it, linear regression analysis are presented, these analysis have helped to found a prediction model for academic performance and classroom participation, this prediction model is based on Communication, Participation and Initiative (Section 5.3.4).

In order to evaluate the data collected during the experiment, in some cases it was not enough to see the growth or output differences. Therefore, to validate some of the results obtained, ANOVA (nested) was used in order to answer research question number one.

#### Table 5-21 Academic outcomes summary

<table>
<thead>
<tr>
<th>Data</th>
<th>Milestone</th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Academic Performance</td>
<td>Pre</td>
<td>65.67</td>
<td>16.17</td>
</tr>
<tr>
<td></td>
<td>During</td>
<td>79.99</td>
<td>10.68</td>
</tr>
<tr>
<td></td>
<td>Post¹</td>
<td>62.51</td>
<td>19.76</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>69.36</td>
<td>17.55</td>
</tr>
<tr>
<td>Classroom Participation</td>
<td>Pre</td>
<td>0.46</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>During</td>
<td>0.58</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>0.78</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>0.60</td>
<td>0.44</td>
</tr>
</tbody>
</table>

¹Final Exam Grades (all second semester content was included).

ANOVA (nested) analyses were conducted for each one of the rows in the Table 5-21. The results from theses analyses are shown above: first academic performance data, and then the classroom participation results.
difference between the experimental and control group was the usage (experimental) or not (control) of BeingExample (Section 5.3).

In this case, for ANOVA the dependent variable was the exam grade in the Geometry class. Another possible measure was High School GPA, but it was not possible to access all the students’ information, and self-reported GPA may not be as reliable as multiple choice exams. ANOVA analysis of the academic performance data is shown below. Furthermore, the system was only used by the Geometry teacher and GPA data is from all the classes taken from the beginning of High School, so it was decided to only take the Geometry exams into account.

Academic performance data collected before the experiment had $F (1, 70) = 0.000029$, $P = 0.99$. It can be concluded that there is not a significant difference between the two groups before starting to use the platform. Grades collected during use of BeingExample yielded $F (1, 70) = 6.25$ and $P = 0.015$. As $P \leq 0.05$ it can be affirmed that there is a significant difference between the grades of the experimental group and the control one. After use of the platform (three weeks afterwards), the final exam of the semester was taken by the students, and ANOVA showed $F (1, 70) = 3.37$, $P = 0.07$; this is very close to 0.05 but in this case it is not enough. Finally, compiling the grades from all three phases (pre, during and post), ANOVA was run again and yielded $F (1, 70) = 3.93$, $P = 0.049$, so it is proven again that there is a significant difference between the groups.

On the other hand, classroom participation data collected before the experiment had $F (1, 70) = 0.23$, $P = 0.63$, so there was not a pre-existing difference between the groups. During use of BeingExample, the data collected was analysed with the following results $F(1, 70) = 4.19$, $P = 0.045$, so there is a significant difference in this case. After use of the platform the data obtained gave $F (1, 70) = 4.15$, $P = 0.046$, so again there is a significant difference. Ending with all classroom participation data collected resulted in $F (1, 70) = 3.36$, $P = 0.068$, which is close to the significant difference, but in this case there is not one.

Once it was statistically proven that there is a relation between BeingExample use and academic outcomes, the next step was to work with the patterns related to experimental study question number three. Several models are proposed and two dependent variables are involved: academic performance and classroom participation. Each model may have one or more explanatory variables or predictors. Multiple linear regression analysis was also used in order to validate the formulas presented above.

Multiple linear regression analyses were conducted to determine whether the three formulas and their components could predict students’ performance and class participation. Regression analysis is used as it is the statistical process which helps to estimate relationships among variables. Therefore, this process will help to validate, change or discard the initial formulas proposed.

Several initial formulas were proposed, and these formulas are composed of students’ interactions tracked by the platform. These formulas are intended to predict students’ participation and performance. There are 3 initial formulas:

\[
(1) \ \text{Communication} = \text{Comments} + \text{Questions} \\
(2) \ \text{Participation} = \text{Comments} + \text{Votes} + \text{GroupsIn} + \text{Items} \\
(3) \ \text{Initiative} = \text{Participation} + \text{Examples} + \text{Groups}
\]

Communication, Participation and Initiative are the most important measurements, and are based on the items tracked by the system: \(V\) number of votes; \(C\) number of comments made; \(GIn\) number of groups
in which the user is a participant; (I) number of shared items; (E) number of examples created; (G) number of groups created; and (Q) number of questions created.

To obtain the value of Communication the number of comments and questions made by the user is taken into account, as both interactions may be considered as interactions used for communication purposes. For Participation four elements are used: first the result of Communication plus the number of votes cast, groups in which the user is a participator, and finally the items shared by this user. Communication has been included in Participation because it may be considered as being included within it. Finally, Initiative tries to give a global result and includes Participation (which included Communication), plus examples created, plus groups created.

Table 5-22 Academic outcomes and PRSN measurements, linear regression data

<table>
<thead>
<tr>
<th>Item Analysed</th>
<th>Academic Performance</th>
<th>Classroom Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef.</td>
<td>β</td>
</tr>
<tr>
<td>(1) Ini, (2) Part and (4) Comm***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>66.28</td>
<td>3.48</td>
</tr>
<tr>
<td>Communication (Com)</td>
<td>3.28</td>
<td>1.14</td>
</tr>
<tr>
<td>Participation (Par)</td>
<td>-2.62</td>
<td>1.27</td>
</tr>
<tr>
<td>Initiative (Ini)</td>
<td>2.57</td>
<td>1.15</td>
</tr>
<tr>
<td>(1) Ini, (2) Part and (3) Comm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>71.51</td>
<td>3.01</td>
</tr>
<tr>
<td>Communication (Com)</td>
<td>0.35</td>
<td>0.21</td>
</tr>
<tr>
<td>Participation (Par)</td>
<td>-0.50</td>
<td>0.22</td>
</tr>
<tr>
<td>Initiative (Ini)</td>
<td>0.51</td>
<td>0.20</td>
</tr>
<tr>
<td>Individual Items Tracked</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>53.89</td>
<td>5.22</td>
</tr>
<tr>
<td>Votes (V)</td>
<td>-0.04</td>
<td>0.05</td>
</tr>
<tr>
<td>Comments (C)</td>
<td>0.20</td>
<td>0.22</td>
</tr>
<tr>
<td>Groups In (Gln)</td>
<td>-1.23</td>
<td>1.32</td>
</tr>
<tr>
<td>Logins (L)</td>
<td>1.66</td>
<td>0.46</td>
</tr>
<tr>
<td>Items (I)</td>
<td>-1.18</td>
<td>1.20</td>
</tr>
<tr>
<td>Examples (E)</td>
<td>0.43</td>
<td>0.19</td>
</tr>
<tr>
<td>Groups (G)</td>
<td>1.58</td>
<td>2.14</td>
</tr>
<tr>
<td>Questions (Q)</td>
<td>0.72</td>
<td>0.59</td>
</tr>
<tr>
<td>Connections (Cn)</td>
<td>0.26</td>
<td>0.22</td>
</tr>
</tbody>
</table>

1 β = Beta, the standardized regression coefficient.

* p ≤ .01
** p > .05
*** (4) Communication = Comments + Questions + Logins, Login is included in order to calculate communication

Table 5-22 contains the most important data generated from the multiple linear regression analysis. The three indicators (Communication, Participation and Initiative) are put together in order to be able to predict the students’ outcomes. However, once this step is taken, with the initial model based on the three basic measures proposed above, it is found that the coefficient related to communication has P = .108, which means the results in this case are not statistically significant. This led the research towards trying to integrate something else into the model in order to obtain a significant difference. Therefore, as Login was not included previously, and as it has a good P when the items tracked are analysed individually and all together,
the decision was taken to include it. Login was seen initially as something not active enough to be part of the initial measures, and hence it was included in the communication formula as it is not a sufficiently pro-active interaction to be included in participation or initiative.

Finally, after several attempts to obtain a model in which the probabilities were significant, Login was added as follows:

\[4\text{ Communication} = \text{Comments} + \text{Questions} + \text{Logins}\]

This change affects the other two indicators, namely Participation and Initiative, as Communication data is part of both indicators. On the other hand, Connections was the only item tracked by the platform to be left out. Connections are created automatically when users interact with each other, so they do not have the possibility of asking for a connection, rejecting it or accepting it. For example, connections are generated automatically by other interactions, such as group participation or example participation.

Of the three analyses carried out for each dependent variable the only one in which all the independent variable coefficients had a significant probability was the prediction model in which login was added to communication. The other two approaches did not have these good results, and as a consequence these two may be used to predict data from this experimental group but will not be able to be used with other groups of students.

Regression analysis where human beings take part has \(R^2\) results that are not as good as when data does not come from a human source, as humans are less predictable. From the \(R^2\) values observed in Table 5-23 it may be deduced that these prediction models are good enough. Nevertheless, as might have been expected, the values for the model in which individual items were taken into account are more precise than the others. Moreover, the formula with the new communication (number of logins included) has better values than the one without it. Finally, it is important to highlight that the model performs better for classroom participation.

<table>
<thead>
<tr>
<th>Table 5-23 Regression parameters of each model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prediction Model</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>(1) Ini, (2) Part and (4) Comm *</td>
</tr>
<tr>
<td>(1) Ini, (2) Part and (3) Comm</td>
</tr>
<tr>
<td>Individual Items Tracked</td>
</tr>
</tbody>
</table>

\(^1\) S = Standard regression error

*(4) Com = C + Q + L, Login is included in order to calculate communication

To summarize, ANOVA was used to answer experimental research questions number one and two, while multiple linear regression was the one chosen for the validation of the prediction models, so it will help to answer research question number three.

### 5.4.5 Students’ Surveys

First pre-experiment surveys’ data is presented. Anonymous surveys were conducted on all the groups involved in this case study. The most relevant data is presented below, but before that the questions (seventeen) are listed:

- Do you like new technologies? Answer from 1(min.) to 5 (max.).
• How good are you with computers? Answer from 1(min.) to 5 (max.).
• Right now your self-motivation is… Answer from 1(min.) to 5 (max.).
• Do you study at home? Answer always, sometimes or never.
• How many hours do you study at home weekly? Answer a number from 0 to 10.
• Do you stay after 3:40 for athletics, band or tutoring? Answer always, sometimes or never.
• Are you taking (or have you taken) Dual Credit classes (college classes)? Answer yes or no. Dual credit classes are the ones that give students High School credit and college credit at the same time. If they pass the class and its exam, sometimes they may obtain High School credit, but if they do not pass the final exam they do not receive college credit.
• Have you passed your math TSI already? Answer yes or no. The math TSI test is the college level test that allows students to take dual credit classes related to math, science and engineering.
• Would you like to pass your math TSI? Answer yes or no.
• Do people get the message when you talk or ask them? Answer yes, sometimes or no.
• Do people follow you when you create or organize something? Answer yes, sometimes or no.
• In the groups I am part of usually I start things… Answer yes, sometimes or no.
• Are you an active participator? Answer yes, sometimes or no.
• Would you like to become or to be a good communicator? Answer from 1(min.) to 5 (max.).
• Would you like to become or to be an initiator? Answer from 1(min.) to 5 (max.).
• Would you like to become or to be an active participator? Answer from 1(min.) to 5 (max.).
• Would you like to become or to be a leader? Answer from 1(min.) to 5 (max.).

Some of the data collected during these initial surveys will be discussed when the data from the final survey is discussed in order to compare data and analyse the changes. The rest is presented in Table 5-24.

Questions such as: Do you like new technologies?, How good are you with computers?, And right now your self-motivation is… were collected from both groups of students, without a significant difference between groups. On the other hand, interesting data regarding the questions: Would you like to become or to be … a good communicator?, an initiator?, an active participator?, or a leader? is shown by the data in the table below. Leadership is the main preference, followed by communicator, participator and initiator.

<table>
<thead>
<tr>
<th>Table 5-24 Students’ initial survey answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question</td>
</tr>
<tr>
<td>Do You like new technologies?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>How good are You with computers?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Right now Your self-motivation is…</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Would You like to become a good communicator?</td>
</tr>
<tr>
<td>Would You like to become an active participator?</td>
</tr>
</tbody>
</table>
Would You like to become an initiator?  
E  1.6%  14.1%  34.4%  28.1%  21.9%

Would You like to become a leader?  
E  7.8%  7.8%  20.3%  20.3%  45.3%

<table>
<thead>
<tr>
<th>Question</th>
<th>Group</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have You passed your math TSI already?</td>
<td>E</td>
<td>14.1%</td>
<td>85.9%</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>15.6%</td>
<td>84.4%</td>
</tr>
<tr>
<td></td>
<td>Dif.</td>
<td>-1.5%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Would You like to pass your math TSI?</td>
<td>E</td>
<td>89.1%</td>
<td>10.9%</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>87.5%</td>
<td>12.5%</td>
</tr>
<tr>
<td></td>
<td>Dif.</td>
<td>1.6%</td>
<td>-1.6%</td>
</tr>
</tbody>
</table>

E means experimental group and C control group. Dif. means the difference between their percentages.

Finally, academic interest and performance to see and compare the experimental group with the control group may be shown by the following questions: Have you passed your math TSI already?, and Would you like to pass your math TSI? Here again, there are no significant differences between groups.

**Final Surveys (Post-Experiment)**

Anonymous surveys were conducted with the groups that were part of the experimental group, and in this case the control group did not participate. Some questions are the same as in the initial survey in order to be able to compare the results and analyse possible changes due to the experimental process. The most noteworthy data is given below.

Some of the questions asked in these questionnaires were:

- Right now your self-motivation is… Answer from 1 (min.) to 5 (max.).
- Did you like the BeingExample project? Answer from 1 (min.) to 5 (max.). BeingExample project was the name given to all the activities shown in this section.
- Would you like to use IT tools that may help you improve participation, initiative, communication or leadership? Answer from 1 (min.) to 5 (max.).
- Would you recommend BeingExample to your friends or teachers? Answer from 1 (min.) to 5 (max.).
- Have you improved your online social skills during this project? Answer from 1 (min.) to 5 (max.).
- Name three of your peers that you think have lead by using BeingExample … Open ended question.
- Give your informal opinion about the project, at least two lines… Open ended question.
- Do people get the message when you talk or ask them? Answer yes, sometimes or no.
- Do people follow you when you create or organize something? Answer yes, sometimes or no.
- In the groups you are part of do you usually start things… Answer yes, sometimes or no.
- Are you an active participator? Answer yes, sometimes or no.
- Would you like to become or to be a good communicator? Answer yes, sometimes or no.
- Would you like to become or to be an initiator? Answer yes, sometimes or no.
- Would you like to become or to be an active participator? Answer yes, sometimes or no.
- Would you like to become or to be a leader? Answer yes, sometimes or no.

The following table shows a comparison of the questions answered in the initial surveys and the answers to the final one.
Table 5-25 Students' perceptions about their social skills before and after the experiment

<table>
<thead>
<tr>
<th>Question</th>
<th>Milestone</th>
<th>Yes</th>
<th>Sometimes</th>
<th>No</th>
<th>somehow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are You an active participator?</td>
<td>Pre</td>
<td>56.3%</td>
<td>43.7%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>73.7%</td>
<td>21.1%</td>
<td>5.2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dif.</td>
<td>+17.4%</td>
<td>-22.6%</td>
<td>+5.2%</td>
<td></td>
</tr>
<tr>
<td>Usually, do You start things within your social groups?</td>
<td>Pre</td>
<td>34.4%</td>
<td>57.8%</td>
<td>7.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>52.6%</td>
<td>36.8%</td>
<td>10.6%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dif.</td>
<td>+18.2%</td>
<td>-21.0%</td>
<td>+2.8%</td>
<td></td>
</tr>
<tr>
<td>Usually, do people get your messages?</td>
<td>Pre</td>
<td>34.4%</td>
<td>62.5%</td>
<td>3.1%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>42.1%</td>
<td>52.7%</td>
<td>5.2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dif.</td>
<td>+7.7%</td>
<td>-9.8%</td>
<td>+2.1%</td>
<td></td>
</tr>
<tr>
<td>Do people follow you?</td>
<td>Pre</td>
<td>28.1%</td>
<td>57.8%</td>
<td>14.1%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>50.0%</td>
<td>47.4%</td>
<td>2.6%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dif.</td>
<td>+21.9%</td>
<td>-10.4%</td>
<td>-11.5%</td>
<td></td>
</tr>
<tr>
<td>Would you like to become an active participator?</td>
<td>Pre</td>
<td>56.2%</td>
<td>43.8%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>73.7%</td>
<td>21.1%</td>
<td>5.2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dif.</td>
<td>+17.5%</td>
<td>-22.7%</td>
<td>+5.2%</td>
<td></td>
</tr>
<tr>
<td>Would you like to become a leader?</td>
<td>Pre</td>
<td>65.5%</td>
<td>28.2%</td>
<td>6.3%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>73.7%</td>
<td>21.1%</td>
<td>5.2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dif.</td>
<td>+8.2%</td>
<td>-7.1%</td>
<td>-1.1%</td>
<td></td>
</tr>
<tr>
<td>Is your self-motivation good right now?</td>
<td>Pre</td>
<td>64.0%</td>
<td>29.7%</td>
<td>6.3%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>78.9%</td>
<td>18.4%</td>
<td>2.7%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dif.</td>
<td>+14.9%</td>
<td>-11.3%</td>
<td>-3.6%</td>
<td></td>
</tr>
<tr>
<td>Did You like the BeingExample project?</td>
<td>Post¹</td>
<td>57.9%</td>
<td>36.9%</td>
<td>5.2%</td>
<td></td>
</tr>
<tr>
<td>Would You recommend BeingExample to your friends or teachers?</td>
<td>Post¹</td>
<td>65.8%</td>
<td>29.0%</td>
<td>5.2%</td>
<td></td>
</tr>
<tr>
<td>Have You improved your online social skills during this project?</td>
<td>Post¹</td>
<td>71.0%</td>
<td>29.0%</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

¹These questions were only asked in the final survey

Regarding what skills students want to acquire in the future or whether they want to become participators, initiators, communicators or leaders, the two skills with different percentages when comparing them with the initial survey are leadership and participation, which can be seen in the above table as well. The questions asked were: Would you like to become or to be a good communicator?, And would you like to become or to be an active participator? It could be interpreted that students realized that active participation and leadership are key points in collaborative IT tools used in class or that the BeingExample platform awakes students’ interest in social skills such as active participation and leadership.

The self-motivation question is an important one, and it helped to compare the initial self-motivation and the final one. As can be seen in the table above, there is an improvement in self-motivation at the end of the process.

In the last three questions it can be seen whether students liked the project and if they would recommend the experience to other students and/or teachers. The students feel that they have improved their online social skills during the project, with 71% answering yes.
After all the results have been presented, it is time to answer the experimental research questions and discuss the results. This will be done in the following section.

5.4.6 Discussion

The main findings and a discussion of the results analysis of this study are presented below. Firstly, in the following paragraphs the results related to the experiment’s questions and hypotheses are presented and analysed. This is followed by the limitations of this analysis and then this section concludes with the final remarks about this experiment.

Q1. Is there a relation between students’ grades and BeingExample use?

The academic performance data (Section 5.4.3) collected before the experiment gave $F (1, 70) = 0.000029$, $P = 0.99$. It can be concluded that there is not a significant difference between the two groups before starting to use the platform. The grades collected during use of BeingExample yielded $F (1, 70) = 6.25$ and $P = 0.015$. As $P \leq 0.05$ it can be affirmed that there is a significant difference between the grades of the experimental group and the control one. After using the platform (three weeks afterwards) the final exam of the semester was taken by the students, and ANOVA shows $F (1, 70) = 3.37$, $P = 0.07$; this is very close to 0.05 but in this case it is not enough. Finally, compiling the grades from all three stages (pre, during and post), ANOVA was run again, yielding $F (1, 70) = 3.93$, $P = 0.049$, so it is proven again that there is a significant difference between the groups.

During the usage stage ANOVA gave positive results, and students from the experimental group had better geometry grades than students from the control group. In the post-usage stage the ANOVA results showed that there was not a significant difference. On the other hand, when all the data from the three stages was put together and analysed, it showed that there was a significant difference between the groups.

Therefore, this question can be answered as follows: Yes, there is a positive relation between PRSN usage and students’ academic performance during usage of the platform, but it may change when the platform is not used in class.

Q2. What effect/relation has the use of BeingExample for educational purposes on/with students’ classroom participation or other skills?

Classroom Participation data collected before the experiment gave $F (1, 70) = 0.23$, $P = 0.63$, so there was not a pre-existing difference between the groups. During the use of BeingExample the data collected was analysed with the following results: $F (1, 70) = 4.19$, $P = 0.045$, so there is a significant difference in this case. After using the platform the data obtained yielded $F (1, 70) = 4.15$, $P = 0.046$, so again there is a significant difference. Ending with all the classroom participation data collected results in $F (1, 70) = 3.36$, $P = 0.068$, which is close to the significant difference, but in this case there is not one.

A possible answer to the question is: Yes, there is a positive relation between PRSN usage and students’ classroom participation during usage of the platform, but it may change when the platform is not used in class.

When the “during usage” stage ended with positive classroom participation results, the students from the experimental group had improved their participation. There was also a significant difference between the control and the experimental groups. The after usage data shows that there is a significant difference between the groups. However, when all the classroom participation data was put together there was not a significant difference between the groups, which may be due to the data from the pre-usage stage.
Q3. Among those who use the platform, how is a proper use of the platform related to academic outcomes?

To answer this question positively a method to predict students’ outcomes by using PRSN data was needed. However, this method could only be used for this experimental group data, which means that it could not be used to predict other groups’ data. Or as would be the case if the statistical analysis showed statistical significance, it could be used to predict future students’ outcomes regardless of whether they belonged to this experimental group or not.

The prediction models based on the data shown in the above section are presented below. These prediction models are based on the three measures proposed at the beginning: communication (plus login), participation and initiative.

A prediction model for academic performance data and another one for classroom participation may be concluded from the data shown in Section 5.4.4:

\[(1) \text{Academic Performance} = 3.48 + 1.14 \cdot \text{Communication} + 1.27 \cdot \text{Participation} + 1.15 \cdot \text{Initiative} \quad (*) \]
\[(2) \text{Classroom Participation} = 2.41 + 0.79 \cdot \text{Communication} + 0.88 \cdot \text{Participation} + 0.80 \cdot \text{Initiative} \quad (*) \]
\[(*) \text{The Communication formula used is (4), the one with the number of logins included} \]

Standard coefficients were taken for the two formulas shown above, and in both cases the three parameters have a similar influence on the final result. For example, the coefficients in the academic performance formula are: 1.14, 1.15 and 1.27. Nevertheless, the one that shows a bigger positive influence in both cases is participation.

It can be concluded that during use of BeingExample by students there are significant positive effects on academic performance and classroom participation. However, after this usage it is not completely certain that the effects will remain; in this study, after using the platform, classroom participation continued with a significant difference. On the other hand, academic performance did not show this significant difference, which may be due to the data from this stage being taken from a final exam (which included the whole semester’s content), so if it were taken from regular exams it may continue with a significant difference. In the two cases in which there was not a significant difference P is close to 0.05, which may mean that a longer exposure to the platform may cause the significant difference that is the desired result.

The second part of the question can be answered partially by data from the final surveys (5.4.5). After the experiment there is an improvement in the positive answers to every question. Furthermore, for every question there is a reduction in the number of students who answer sometimes or somehow, so students who had doubts about their social perceptions may be helped by the use of PRSNs. Moreover, the positive intention of becoming an active participator or a leader increases after the experiment. Therefore, it can be concluded that BeingExample usage has a positive impact on students’ perceptions of their own social skills or at least on some of them such as communication, initiative, participation and leadership.

Limitations

Due to privacy issues, it was not possible to have students’ background data in order to analyse it and correlate their online and offline data to their home environment. In order to compensate for this and to have more data, anonymous surveys were carried out at the beginning and at the end of the experiment.
Regarding the sample, initially the number of students who were participating was $N = 140$, of which 67 were part of the experimental group and 73 were part of the control group. There were six different sections, and the problem was that they have different Mathematics subjects, with different exams. Moreover, analysing the control and the experimental group of Algebra 2 revealed that they were not as homogeneous as the Geometry ones. Therefore, the Geometry groups were the ones selected for the final experiment. Finally, this was a modest sample size, and future research should try to include larger samples.

Furthermore, the tool was tested by one teacher who was teaching Mathematics, so it would be good for future studies to have at least five teachers involved and different areas covered.

At the end of the experiment the control group did not take part in the final survey, and data about their self-motivation would have been useful in order to compare their evolution and the experimental group’s evolution.

In this case a twenty week process was involved, from pre-experiment data collection to the last exam taken by the students. The process almost covered a full semester, but it would have been better to conduct a year-long experiment, or even a two-year-long experiment with the same students in order to obtain more precise data about how PRSNs may affect educational processes in long-term situations, as this study may be considered short-term.

**Final Remarks**

The main objective of PRSNs is to improve their users’ environments. In this particular case BeingExample was used with several purposes in mind, but the main one was to improve the academic environment of the students involved. Regarding educative environments, there are many parts that may be improved; in this case the focus was on three of them: classroom motivation, classroom participation and academic performance.

This study provides experimental evidence that using PRSNs in educational environments can increase students’ participation in class and improve their academic performance as well. Previous research focused on students at university while this study was carried out with secondary education students. As PRSNs may be considered social media, this study supports and extends the positive impact results of social media (Fardoun, 2012 D; R. Junco, 2011 A; Junco, 2012 B; Russo, 2009) to High School students. As there are more university faculties involved in research activities, social media or ICT studies applied to educational environments are usually focused on students of eighteen and older. This study reaches similar conclusions to studies performed with university students, although in this case High School students were the focus.

There is also experimental evidence that students’ academic outcomes can be predicted by using PRSN data generated by the students themselves. It will help both students and teachers to take measures before it is too late. Teachers may analyse the data in order to try to motivate or follow closely those students who have low participation levels on the platform, as it has been shown before that those with low levels of participation are usually the ones who do not pass the subject. This may be done by using the tracking notes of the teacher, but in this case with the platform the teacher does not have to do the calculations, it is the platform that points out who these students are.

It will be interesting for future works to check whether inducing or trying to increase use, on the part of those students who show low online participation, implies an improvement in their academic performance and classroom participation.
As there is a continuous growth in the use of ICT by students and teachers, it is hoped that this study will help them to decide between different technological options, or even to try to implement similar functionalities to those which have worked and to avoid those which do not help students’ academic outputs.

Is social media an efficient and effective software solution for the K-12 education classroom? Yes, but with limitations. Although all the experimental study research questions have been answered positively, as said by (Tess, 2013), there is a lot of work to do before having a final answer. Moreover, it may be concluded that with the appropriate conditions and features, social media may help to improve educational processes and be used as a tool in education.

5.5 Conclusions

As mentioned above, the goals of this chapter were related to the G4, G5 and G6 thesis objectives. However, these latter goals will be discussed in the conclusion of the thesis, and in the following paragraphs the chapter objectives will be the focus.

To achieve these goals the first step taken was the proposal of several prototypes (Section 5.1). This was followed by a theoretical proposal combining rewards, positive reinforcement and OSNs (Section 5.2). However, there is no contribution if that new concept is not proved (Sections 5.3 and 5.4). Now is the time to review the initial goals of this chapter.

The main goals of this chapter were:

- **PSR.G1.** To discover patterns between social skills shown/tracked by using ICT platforms and academic outcomes obtained by students.
- **PSR.G2.** To have a positive effect on students’ academic outcomes. This is becoming more and more difficult with all the external stimulation that they are being subjected to, in the form of entertainment, the Internet, marketing, etc.
- **PSR.G3.** To increase students’ participation, initiative/leadership and collaboration through the use of technology.
- **PSR.G4.** To find positive and committed leaders or students with initiative, who could contribute positively to their communities.

PSR.G1 was achieved, as a positive relation between the use of BeingExample and academic outcomes was found. Moreover, as this relation was positive it covers PSR.G2 as well.

On the other hand, it can be said that PSR.G3 has only been partially achieved, because classroom participation improved, but as there was no previous data regarding initiative, leadership and collaboration, that part cannot be affirmed, although it can be said that for the next time there will be initial data about initiative, collaboration and leadership. This points out a weak point of our educative systems, namely that skills as important as the ones mentioned above are not being properly considered.

Regarding PSR.G4, finding positive and committed leaders was not properly accomplished. This research attempted to fill a gap whose magnitude is such that a lot more work is needed first. There is not enough evidence to say that leaders were found, only future work will say if this is possible. Leadership has been one of the weak points in the experimental study presented in this chapter.

Finally, the thesis hypotheses, this chapter supports H1 Students’ online social interactions play a significant role on information systems used in educational environments, H2 ICT impact on educational environments should be monitored and analysed and H3 It is possible to use new technologies, specifically Online Social Networks, to improve academic outcomes.
In this chapter it is first presented the conclusions and a summary of the most relevant contributions of this research. After that, it is discussed the possible lines of future work that can lead to new directions for related research and development. Finally, the set of publications that are related to this thesis are presented.

6.1 Conclusions

The purpose of this thesis is to use online social skills to measure, analyse and improve academic outcomes by using Positive Reinforcement Social Networks (PRSNs). In order to achieve such purpose, several hypotheses and goals were set at the beginning of the research, and the research work was guided by them. Within the following paragraphs the main conclusions are presented.

First of all, a general consideration of the initial research hypotheses is presented.

**Hypothesis 1 (H1):** Students’ online social interactions should play a significant role on information systems used in educational environments.

This research has proven that online social interactions can play an important role in education. Rather than claiming the negative effects of social networks among young people, this thesis shows how to take advantage of OSN to improve academic outcomes. PRSNs concept in general, and BeingExample in particular, can be used to promote a proper of OSN in education.
Hypothesis 2 (H2): ICT impact on educational environments should be monitored and analysed.

Regarding H2, this research has shown the importance of monitoring and analyzing ICT in education in general, and online social interactions in particular. This work presents a set of measurements to allow teachers to monitor and analyze online social interactions in educational environments.

Hypothesis 3 (H3): It is possible to use new technologies, specifically Online Social Networks, to improve academic outcomes.

Finally, this research has proven that it is possible to employ an OSN, the PRSN platform named BeingExample, to improve academic outcomes.

The following paragraphs go over the goals presented in Section 1.3.

As a first result, namely to study and analyse the impact of ICT on education (goal G1), was achieved. The research work that supports each one of the initial hypotheses is presented and analysed. In addition, connections between social ICT and education are found and taken into account.

An interesting question that arose and which can now be answered is: are social skills less important than academic performance, motivation, engagement etc.? It cannot be affirmed which one is most important; however, it may be assured that online social skills are related to academic outcomes.

Once the first goal was achieved it was the turn of (G2), namely to carry out field studies to obtain a better vision of educational environments. Long-term fieldwork from 2009 until 2012 was conducted, and in this students were the main actors, and several educative centres participated (secondary education, K-12). This was followed by an extensive analysis of ICT platforms in educational environments in three different countries: Spain, Guatemala and the United States. Again this study of the ICT platforms was conducted on secondary education systems from 2009 to 2015. As Moodle was not the main platform used in any of them, another tool used in the Texan system was used for a case study: AgileMind. A question that arose in this chapter and which can now can be answered is: could the teacher's labour be aided by facilitating tools for monitoring and measuring different aspects related to academic environments? And the answer is that it can.

While these field studies were being conducted, a first platform was created: Tweacher, presented in Chapter 4. Tweacher was intended to address (G3), namely to develop early prototypes to obtain initial results in education, and it was a good initial approach and a starting point for the achievement of G4, G5 and G6. Tweacher was designed to improve Edmodo features by bringing them into a social media environment. However, the final results were similar to those obtained by using Edmodo and there was nothing particularly new. It can be said that Tweacher laid the first stone of the building assembled in Chapter 5.

Chapter 5, Positive Social Reinforcement in Educational Environments, presents the most noteworthy outcomes of this research. After Tweacher, although positive results were obtained, new approaches to generate innovation were needed. It was then when two prototypes were created and tested: Moods and Looking for Leaders. The second one even had a second version.

These prototypes, whose focus was to achieve (G4), namely to create a new Online Social Networks concept which helps to measure, analyse and improve and/or support students’ social skills, motivation and academic outcomes, were not enough, so a model in which the impact of ICT could be influenced and controlled was needed, and this is when the PRSN model was created. A PRSN is a social network in which individuals interact with each other and their environment, receiving a reward based on the type and number of actions performed/tracked through/by the system. In it, users may propose, implement and collaborate on actions and/or events that have a positive impact on themselves, the others and their environment.
A conceptual model for PRSN was proposed in which the main elements and their relations are described. A participation model for this type of environments is proposed in which PRSN participation facilitates, or interferes with, social participation and the environmental participation (where this PRSN is being used). Furthermore, co-interactions diagrams were created for three of the most important elements, namely rewards, online interactions and events.

The platform created using the PRSN model, namely BeingExample, is the one which achieves G5, which was to create a platform, based on the Online Social Networks concept created, which helps to measure, analyse and improve and/or support students' online social skills, motivation and academic outcomes. It measures, helps to analyse and improves academic outcomes. In addition, it is based on all this measurement, analysis and improvement in online social skills measures: Communication, Participation and Initiative. These three were chosen after research performed in different educative environments in Europe and the United States.

After the platform and its measurements were set, an experimental study was conducted to see how PRSNs (BeingExample) affect academic performance and classroom participation (G6 – to perform experimental research to validate and extract data from the platform and the new Online Social Networks concept). One teacher and his 72 students participated with positive outcomes. The three research questions asked at the beginning of the study have been answered positively (Section 5.4). A prediction model based on the measures proposed above was created, one for classroom participation and the other for academic performance.

During the experimental study three main research questions were answered:

- **Is there a relation between students’ grades and BeingExample use?** This question can be answered as follows: yes, there is a positive relation between PRSN usage and students’ academic performance during the usage of the platform, but it may change when the platform is not used in class.

- **What effect/relation has the use of BeingExample for educational purposes on/with students’ classroom participation or other skills?** There is a positive relation between PRSN usage and students’ classroom participation during the usage of the platform, but it may vary when the platform is not used in class.

- **Among those who use the platform, how is a proper use of the platform related to academic outcomes?** There is a relation in the form of a prediction model based on multiple linear regression. This model can be used to predict students’ outcomes by using PRSN data.

Furthermore, there is experimental evidence that students’ academic outcomes can be predicted by using PRSN data generated by the students. This will help the students themselves, and their teachers, to take measures before it is too late. Although the first prediction models have been presented, in the future data collected from other students may help to improve these models or even to create an alternative one.

The results suggest that PRSNs can be used to improve classroom participation and academic performance, and so they should be tried in other subjects, but the one used in the experiment, namely Mathematics, is not precisely the most loved by the students. The period of time of BeingExample usage is important as it was proven that the improvements remain during its use, but may vary when it is not used. Furthermore, academic outcomes can be predicted in advance in order to be able to warn students or (preferably) teachers.

It can be said that communication between students and communication between students and the teacher improved. This is not new, as there are several studies that show this communication improvement when social media are used for academic purposes. Use of the platform also encouraged cooperation among students.

Students’ perceptions of their social skills or desired improvements vary with the use of the platform, but there are improvements in all the questions (anonymous surveys) with regards to positive answers.
Is social media an efficient and effective software solution for the K-12 education classroom? Yes, but with limitations (mentioned in Section 5.4.6). Although the research questions have been answered positively, there is a lot of work to do before reaching a final answer (Tess, 2013). Moreover, it may be concluded that with the appropriate conditions and features, social media may help to improve educational processes and be used as a tool in education.

Given the facts presented in Chapter 5, it can be concluded that PRSN use improves, and could be used to predict, students’ classroom participation and performance. Therefore, as PRSNs may be considered social media, social media improves secondary education (K-12) environments if used properly and meaningfully. Regarding the thesis’ goals, these facts cover G4, G5 and G6, and give a positive answer to H1, H2 and H3.

A summary of the most important prototypes, models and platforms created during the research can be seen in Table 6-1.

<table>
<thead>
<tr>
<th>Platform</th>
<th>Objective/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tweacher</td>
<td>Microblogging site whose focus is on educational environments</td>
</tr>
<tr>
<td>Moods</td>
<td>A tool that allows teachers and administrators to measure the moods of the students and be able to compare these results with the academic ones</td>
</tr>
<tr>
<td>Looking for Leaders</td>
<td>A platform that supports and tries to encourage students to become leaders</td>
</tr>
<tr>
<td>Looking for Examples</td>
<td>Is an improvement of Looking for Leaders, there are people who do not yet have leadership skills but want to change things, everyone can lead something by being a good example for the rest. This is what this platform supports</td>
</tr>
<tr>
<td>PRSN</td>
<td>Social network model in which individuals interact with each other and their environment receiving a reward based on the type and number of actions performed/tracked through/by the system</td>
</tr>
<tr>
<td>BeingExample</td>
<td>Is a PRSN whose functionalities were adapted for use in educational environments</td>
</tr>
</tbody>
</table>

6.2 Future Work

This thesis has contributed to bridging the gap between ICT and its social use within the classroom. As it was proven that ICT has an impact on the classroom, and as social media are one of the main tools used on the Internet by users everywhere, including students, is important to keep bridging this gap.

Once the effect on academic outcomes has been proved, it is desirable to give teachers analysis resources, and to enable them to configure and create their own rules inside the PRSNs in order to improve the weaknesses of their students. In order to give this capability to teachers it is necessary to keep improving the BeingExample platform indicators of use and its administration panels and characteristics. Furthermore, it will be useful to allow teachers to detect students who may have a low performance in order to help them. It will also help to detect high performance students in order to give them opportunities to learn and improve by themselves.

It will be interesting for future work to check whether inducing, or trying to obtain, more use, on the part of those students who show low online participation, implies an improvement in their academic
performance and classroom participation. On the other hand, a long-term experiment (one or two years) will be able to show whether results are maintained over time or if there are changes when students use PRSNs for a long period of time.

Although the first prediction models have been presented (Chapter 5), in the future data collected from other students may help to improve these models or even to create an alternative one. The prediction model for academic performance needs improvement, as their results are not ideal. A possible approach to this improvement is to use response surface (Khuri, 2010), structural equation modelling will be taken into account as well (Savalei, 2010). Another possible way to analyse students’ interactions on BeingExample may be similar to the one presented in (Joksimović, 2015). In this case a possible future analysis and/or prediction model of academic outcomes could be to sort the interactions into three different groups: student-system, student-student and student-teacher.

As it is known that LCMS are the systems that are most used within education, a good approach would be to integrate PRSN models within one of those systems. Besides applying the prediction model and measurements to LCMSs, the interactions will be interesting and with an unpredictable result, as LCMSs are based on subject content, while BeingExample’s focus is on information related to the future and academic life but not necessarily related to the subject for which the system is being used.

Applying a similar kind of measurement to that described in Sections 5.3 and 5.4 to Twitter will be a huge challenge. But as seen in Section 5.3.4, most of functionalities that are present in Twitter are included in BeingExample.

Leadership has had the least satisfactory results. It was one of the main goals of Chapter 5 to look for leaders and students with initiative (PSR.G4); however, it was not possible to establish a clear pattern between this online leadership measure and academic outcomes. Although the first steps have been taken regarding leadership within PRSNs, more work on this is needed. Another question that could not be answered during this research appeared in Chapter 3: how could it be possible to use ICT in places where the Internet has not arrived?

Finally, and once it has been statistically proved that BeingExample usage has an impact on students’ classroom participation and students’ academic performance, further research needs to be done in order to establish other connections or reasons for this improvement. There are many questions without an answer yet, and some of the most important ones are:

- Will there be similar results if the content shared and worked on using BeingExample is only related to the subject whose teacher is using the platform with his students?
- Can a teacher further improve the results by paying attention to other BeingExample indicators than the ones used during the research (communication, participation and initiative)?
- Is there an individual pattern between academic performance and student BeingExample interactions or/and indicators?
- Is there an individual pattern between classroom participation and student BeingExample interactions or/and indicators?
- Should the weights in future prediction models and in rewards be changed? They may be the key to obtaining better linear functions to predict future students’ academic outcomes.
- Are there better approaches, than the one presented, to predict academic outcomes?
- Which elements of the system were responsible for increasing academic performance?
Summarizing, there are a lot of questions without a clear answer yet. It will take time to answer them all. However, due to the rapid change in this kind of technologies, what is valid now may change in a few years. Bridging the social ICT gap in education will not be an easy task.

6.3 Publications

The publications produced during the research process of this thesis are listed in this section. These contributions have been published in international and national conferences and in some journals.

International Journals


Book Chapters


International Conferences


National Conferences


Other Contributions


Participation in a research project: CENIT: “mIO! Tecnologías para prestar servicios en Movilidad en el Futuro Universo Inteligente” (CENIT 2008-1019-MIO).
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